Introduction to 'Contra-Boolean' Thinking --

Benefits of a 'Contra-Boolean' Method for Past Reconstruction and for Future 'Pre-Construction'.

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<u>ABSTRACT</u>. A simple new algebra has recently been discovered, one that, in crucial ways, is a 'contrary supplement' to the Boolean arithmetic and algebra that, for example, grounds our present-day digital computers, as well as much of our ordinary, every day thinking.

This text introduces this 'contra-Boolean' algebra, and exemplifies its use in model building for several representative domains.

The math that grounds our digital age, and much of our ordinary thinking, falls short in modeling both the maximal domain, our universe as a whole, and the many sub-domains within it, that are <u>deeply</u> dynamical. Such domains are <u>deeply</u> dynamical in that they change themselves, but not just by adding quantitatively more [or less] of the kinds of things that were already extant in the past. Such domains change themselves by creating *new <u>kinds</u>* of things. They continually give birth to such new kinds from within themselves, from out of their *old <u>kinds</u>* of things.

In this text, we outline the new method of modeling that can better capture this <u>deeper</u> dynamism of the past-to-present of such domains, and can also induce 'pre-constructions' of their futures.

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1

A Sketch of the Original Boolean Algebra. Boole's Model of the "Class" Humanity.

Boolean algebra, in its later, amended forms, has turned out to be a remarkably effective engineering tool for digital circuitry design¹. It is so by virtue of its capability to model the digital logic -- the "Off On", or "**O**1", logic -- of the electronic circuitry of our today-ubiquitous digital computers.

But George Boole, whose name is given to that "**O****1**" arithmetic, and algebra, and who invented the original form of Boolean algebra, had a different objective in mind than that of modeling the logic of computing machines. Such, of course, barely yet existed in his time and clime.

George Boole aimed to model human "mental operations"² via his new algebraic ideographical language.

As is so often the case, insight as to aims can be gained, we hold, in this case also, by going back to the root. We do this, here, by leaving behind the amended, later versions of Boole's creation, and by going back to its original sources. There we ask: How faithfully does Boole's own "Boolean" algebra achieve his aim -- to provide a mathematical model of the human thinking process?

We find this original source mainly in two works by Boole -- in his 1847 book <u>The Mathematical Analysis of</u> <u>Logic</u>: Being an Essay towards a Calculus of Deductive Reasoning [hereinafter referred to as <u>MAL</u>]³, and in his 1854 book <u>The Laws Of Thought</u> on which are Founded the Mathematical Theories of Logic and Probabilities [hereinafter referred to as <u>LOT</u>]⁴.

For Boole's algebra⁵, **1** denotes the "Universe", the class of all existing things [for whatever "Universe" we are "discoursing" about], and **0** represents "Nothing", the class containing no things. If **x** stands for any class of things, (1 - x) denotes the "negation", or complement, of class **x**; the class of all things *except* for the **x** kind of things. Per Boole, a product such as **r**•**a**, or **ra**, means that the class **r** extracts/"elects", from out of class **a**, all individuals of kind **r**. Equivalently, as **ar**, that class **a** extracts/"elects", from out of class **r**, all individuals of kind **a**.

[Note to readers: Skip the next paragraph, without losing the main argument, if algebra has not been a fluent language for you]. A working sample of Boole's original algebra in action is the following⁶. Take as given, and assume, as premise, the definition [`=`] "human beings = rational **a**nimals", or, as re-expressed in the algebraic language of Boole's ideography, **h** = r.a. Therein, 'r-a' means your mind's "[s]election", out of class a, the class of all animals, of all of those animals which are also <u>r</u>ational beings. Then, let **r**•**a** bring into your mind, per this definition, the class **h**, of all **h**uman beings. The equation-definition asserts an inextricable 'inter-mutual' involvement of the classes named "human beings", "rational beings", and "animals", in and with one another. Suppose that you wish to solve that definitional equation algebraically, thus under its own definitional constraints, to obtain a logical equation defining "rational [beings]" alone/in-general. This means, given the 'inter-involvement' of classes **h**, **r**, and **a**, asserted by the original definitional, or 'premissing', equation -- that the "logical division" of class **a** from out of class r.a, does not eliminate class a from that 'inter-involvement'. Instead, this "logical quotient", (r.a)/a, defines class **r** alone, no longer encumbered, as it was in **r**•**a**, by **a**. This means defining **r** exclusively in terms of all combinations of the other two classes involved in it per that premise equation -- in terms of **h** and **a**, yes, but also in terms of their Boolean "negations", (1 - h) and (1 - a), respectively. Each of the four resulting combinations will bear a different coefficient, or "weight", specifying how prominently its content figures in the constitution of **r**. So, $h/a = r \cdot a/a = r$. Next, apply Boole's special "development" algorithm, for calculating these "weights". The weights hail from all four possible "fractional" combinations of **0** and **1**. Boole uses this algorithm for "decoding" the otherwise "encrypted", and, indeed, cryptic, meanings of "logical fractions" like **h/a**. It is a rich algorithm, but we will not detail it herein. In this example, this algorithm accomplishes an "abstracting", or extracting, from out of the "human" content of $\mathbf{h} = \mathbf{r} \cdot \mathbf{a}$, the "animal" content, leaving only the "rational" content on the Right-Hand Side [RHS] of our definition-equation --

$r = h/a = (1/1) \cdot a \cdot h + (0/1) \cdot a \cdot (1-h) + (0/0) \cdot (1-a) \cdot (1-h) + (1/0) \cdot (1-a) \cdot h.$

This means, per Boole's standard interpretation of such logic-equations, that the "logical volume" of the class of **r**_ational beings consists of that of *all* [1/1 = 1] **a**_nimals that are **h**_umans, plus that of *no* [0/1 = 0] **a**_nimals that are *not* **h**_umans, plus that of an indefinite remainder [none, *some*, or all] of beings that are *neither* **a**_nimals *nor* **h**_umans*, and, lastly, plus the logical volume of *no possible* members of the "impossible class" ["impossible" since 1/0 "=" infinity, the "impossible" value: $(\infty) \cdot (1 - a) \cdot h$ "=" 0], the class of non-**a**_nimals who are **h**_uman. The "logical volume" of this class, $(1 - a) \cdot h$, must be so beyond-infinitesimal that even when multiplied by infinity itself, it still has no "logical volume". This class, of [**r**_ational] **h**_umans who are *not* **a**_nimals, is *impossible* under the 'definitional'/'assumptional', equation, **h** = **ra**, with which we began.

*[Did the -- very Christian -- Mr. Boole have in mind, here, angels? Could this term also connote, in a far-future present, android robots?].

Original Boolean Algebra as an Algebraic Model of Human Mental Operations: A Critique from Within.

All of such applications "descend" from what Boole calls the "fundamental law of thought", or "law of duality". He expresses this "law" as " $\mathbf{x}^2 = \mathbf{x}$ ". That "law" holds, arithmetically, for **0** and **1**: $\mathbf{0}^2 = \mathbf{0}$; $\mathbf{1}^2 = \mathbf{1}$. For Boole, his algebra for modeling human "mental operations" is an algebra of "election" operations -- of "elector" operators. Under that interpretation, **X** denotes a "class" of individual things. Boole names these individuals "**X**"s, individuals which, each and all, share the same quality that the name of class **X** expresses. For example, **X** might stand for the class of all white birds. Then X would stand for any of the members of that class. Indeed, in that particular case, we might denote the class by **w**, and any of its individual members by **W**. The Boolean "fundamental law" equation is $x^2 = x \cdot x = x$. It is therefore interpreted, by Boole, as describing, for any possible class of all of the things of a given kind, \mathbf{x} , the "mental operation", of forming that class, \mathbf{x} , in mind, and of then operating upon ["multiplying"] that class, X, by that self-same class, X, itself. This means that class X extracts, selects, or "elects" all of the Xs, all of the kind \mathbf{x} individuals, from out of the class \mathbf{x} itself. This, per Boole, yields only \mathbf{x} . The \mathbf{x} class, which "contains" only X_s -- and so "elects" the <u>entire</u> content of class \mathbf{x} , and thereby yields a "new" class that "contains" all of the **X**s that are in present existence -- yields the same "old" class **X** itself all over again. Thus, $x^2 = x(x)$ in 'Boolean' means the "self-<u>intersection</u>" of class x. The 'elector" operator, class x, extracts, from out its self-same operand, i.e., from out of the class **x** itself, again, a *perfect copy* of that operator, and of that operand and of that class, \mathbf{X} , again. Try biotic evolution using a reproduction process that yields only *perfect copies* of parental DNA! However, biotic evolution is not a process of human thought. It is a process of biotic Nature, presently "external", and largely also "prior", to human thought.

But how well does Boole's algebra -- if we are to take Boole seriously, as framing a mathematical model of human "mental operations" -- model *actual* human "mental operations"? Can we find a better, more realistic such model?

To be fair to Boole, we must note that he was not proposing to base his science of logic, and its laws, upon exhaustive empirical observation of individual specimens of human thought. His laws of thought were, primarily, for him, a *normative* matter. For him, reflection upon even a *single* specimen of *right* reasoning should suffice to establish the laws of thought.⁷ Boole holds that the "laws" of non-mental, "external", physical nature, are "laws" that can <u>never</u> be violated. On the contrary, he holds that the laws of human thought are violable, and are violated, in practice, recurrently.⁸ However, Boole also holds that human thought is often logically *correct* -- often instances his "laws" of thought. But could there be aspects of *correct* human thought -- *not* of *erroneous* thought, but of useful, creative, productive, progressing, valid human thought -- that Boole's "laws" of thought fail to capture?

Boole's "fundamental law of thought", or "law of duality", $\mathbf{x}(\mathbf{x}) = \mathbf{x}^2 = \mathbf{x}$, is suggestive of our mental process of *reflecting* upon a category, \mathbf{x} , with \mathbf{x} itself, in the sense of a "<u>self</u>-reflection", which might also be denoted ' $\mathbf{x}(\mathbf{x})$ '. Part of this process occurs when we hold a class, \mathbf{x} , in current mind, in current attention. That is the part denoted by ' $\mathbf{x}(\underline{})$ '. We may then also "reflect upon" that class, \mathbf{x} . We may use that present-mind copy to recall, or to call up, from memory, that class as we have held it in mind in the past. That past copy the part denoted by ' $\underline{(\mathbf{x})}$ '. We may then compare that remembered past copy to our present, front-of-mind copy, ' $\mathbf{x}(\underline{})$ '. Or, we may mentally confront a past, externalized, objectified, written-down account of that class, \mathbf{x} , presently in front of us, e.g., on paper, and also denoted by ' $\underline{(\mathbf{x})}$ ', with what we hold presently in mind as that class, \mathbf{x} , denoted by ' $\mathbf{x}(\underline{})$ '. For Boole's "law", the two versions of that class, ' $\mathbf{x}(\underline{})$ ' and ' $\underline{(\mathbf{x})}$ ', are, in either case, always supposedly <u>absolutely</u> identical to one another, to the last jot & tittle --

Boolean "fundamental law of [formal-logical] thought", with **x** spanning the **2** Boolean values, "Nothing"[**0**], and "Universe" [**1**], and with the sign '⇒' signifying the phrase "formally implies" --

 $x^2 = x$ [e.g., $1^2 = 1 \& 0^2 = 0$]; $\Rightarrow x - x^2 = 0$: in-mind "*class*" x, "*mentally operating*" *upon class* x itself, *yields* nothing but class x again. Boole's algebra offers only a *simple reproduction* of ideas, forever, always already, "cut and dried"; offers only gain-less repetition of the presumed "known"; of the currently conventional.

I see that Boole's "fundamental law" is leaving out something *important*; something, well, *fundamental*, about human thought! I see this via my direct experience of my own "mental operations", when I think that I am thinking at my best. I see this via my indirect experience of the thought processes -- of the "mental operations" -- of other humans, when I think that they are thinking at their best, e.g., in face-to-face, creative, innovating dialogue. The total dimension of 'implicitude', of initially tacit presuppositions, of 'elaborability', for idea-objects categories, and of yet-to-be actualized potentiality *for changes in kind*, for physical-objects categories, is missing in Boole's model.

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Human ideation is discursive. Its categories do not often build to their full richness and complexity by a single leap.

Suppose that one thinks of the domain, of everything that is real, as the "all", via the category of "Being". One may then quickly notice that this category, of all things that exist, leaves unmentioned its implicit counter-category, the category of "Nothing". "Nothing" is the category for things which do not presently exist, but which once existed. Or, for those things that never have existed, but that we expect will exist in the future. Or for imagined, impossible things; for things that, we hold, have never existed, do not now exist, & never can/never will exist. And one may notice that both of these thoughts, which share a "statical" quality, even when held in mind together, leave out more dynamical categories. Fore example, they leave out of the category of "Becoming", even if only as that of the transit between the earlier two, as the movement from "Nothing" to "Being", or "commencing Being", complemented by the movement from "Being" [back] to "Nothing", or "ceasing Being", respectively.

Or, when one considers the idea "number", one may think of the "counts", I, II, III,.... But one may soon notice that this thought leaves out that of the "no counts" number, 0. That first thought, and even its second, 'counter-thought', also both leave out the thought of the coordination of number(s) 0 with numbers I, II, III, etc., to form numerals like 10, 202, 302, and so on.

Or, suppose that one thinks of the category of 'pre-/sub-atomic particles' as constituting all of the matter in the universe. One may soon notice that this category, of matter organized only up to the level of organization of, e.g., electrons, protons, & neutrons, leaves out the higher level of organization which we call atoms. It also leaves out the category of "first generation"/"main-sequence" stars. They are the starry "pressure-cookers", that cook up 'pre-/sub-atomic particles' -- [electrons,] protons and neutrons -- turning them into atomic nuclei and into atoms, e.g., into Helium, not to mention the category of molecules.

Two party dialogue, or even multi-party 'multi-logue', presents similar phenomena. One party to the 'multilogue' posits a hypothesis as to the nature of the current state of affairs of the group, or as to the solution of a group issue regarding which the group has convened, perhaps, to discuss, or even to solve. Another party, or even the same party, is then provoked, by the deficiencies of that initial statement, to posit a counter-statement. Then, next, either the initial positing party, the first speaker, or the counter-positing, second speaker, or even a third speaker, notices a potentially gainful unification of the first statement with the second statement, and states that combination. If one or more members of the group perceives deficiency in that third statement, further counter-posits, followed by their 'unifying posits', may accrue. Suppose that, eventually, a 'unifying posit' is pronounced that is met only by silence, or by universal acclaim, within that group. Then a *final* 'unifying posit', for this group, for this while, has been achieved. The discussion ceases. An 'inter-mutually' satisfying state of affairs statement, problem definition, and/or solution, has been achieved, to the satisfaction of this group, for this juncture.

Or, suppose that one engages a solitary kind of thought process. Suppose further that this leads, again, to the kind of three-plus-category categorial progressions that we have cited above. That solitary process of thought may be felt to be a kind of "intra-dual self-dialogue" that one carries on, even if in outward silenced, with, & within, one's self.⁹

Real human thought tends to develop via an <u>elaboration</u> of a starting category. It develops via a progression of further categories, as we recurrently notice the deficiency, the incompleteness, the inadequacy of the categor(y)(ies) that we have so far evoked. If we are to comprehensively and exhaustively present, comprehend, &/or explain, the complex domain about which we are thinking, or speaking, such step-by-step categorial elaboration is requisite.

When we write, similar phenomena of thought appear. We hold our theme, and/or our purpose, for the piece of writing in question, in mind. We confront our draft with that mentally-held theme, and/or purpose. We may therefore edit that draft. We may improve it, relative to that theme and/or to that purpose, if its inadequacies, vis-à-vis our intension, have thereby become externally visible to us, and/or "tangible" for us, by means of their objectification in writing, e.g., on paper, or on screen.

There is an old German word which seems to me to well-describe the "mental operation" involved in these examples of actual human thought: «aufheben». This word still, to this very day, keeps a perfectly clear concrete operations meaning. But this word has also achieved an extraordinary philosophical career¹⁰. Its concrete meaning applies, say, when you pick up a pebble from off of the ground, and lift it up to the level of your eyes. In general, this word means to *change* [to *negate*] the *position* of a thing, while also, concurrently *conserving* the core reality of that thing. It means to "negate" the former position of that thing, in the sense of also *elevating* that thing to a higher level.

Foundation <u>Encyclopedia Dialectica</u> [F.<u>E</u>.D.], **21**MAY**2016**.

That word also describes, metaphorically, what happens in a well-working thought-process, in a well-functioning dialogue, and in a progressive process of writing and self-editing. The first-posited thought, or proposition, or draft, is critiqued, by its author, in a way which posits a supplement -- a supplementary category, a counter-example, an omitted other -- that is left out, or left implicit only, in that first posit. This critique explicitly adds, to the first-posited category, a second, new category, as a supplement and corrective. That second category is constituted by lifting up the first category to a higher level of inclusion, while still also including the original positive utility of the first category. Thus, the "sum", or 'qualitative superposition', of the two categories enhances our description or explanation of the domain being thought. The first "class", \underline{X} , gives way to, or itself catalyzes, the irruption of an «aufheben» of itself, of \underline{X} : ' \underline{X} «aufheben» \underline{X} ', a *self*-«aufheben» of class \underline{X} . This gives us back class \underline{X} again, yes, but also adds, into explicitude, something new -- a new class, category, thought, proposition, or an improved draft. This "new" category may have been implicit in, and/or presupposed by, class \underline{X} all along. However, that inclusion may not have been clearly noticed as such until further such 'self-«aufheben» self-reflexion' ensued.

Positive Fruition of Our Internal Critique: A 'Contra-Boolean' Model for 'Deep Dynamics'.

So let's pose a generic supplement to Boole's "fundamental law of thought". Indeed, let's pose an «aufheben» of that "fundamental law". This will thus be a 'contra-Boolean basic "law" of [«aufheben»] thought'. Category $\underline{\mathbf{x}}$, self-acting, will net-yield a new category, ' $\mathbf{\Box} \underline{\mathbf{x}}$ ', but one also thus derived from $\underline{\mathbf{x}}$. Given that ' $\underline{\mathbf{m}}$ ' and ' $\mathbf{\Box}$ ' denote generalizations of '+' and ' $\mathbf{-}$ ', respectively, this new "law", written in the 'contra-Boolean' algebraic language that we have named $\mathbf{\Omega}$, is, for $\underline{\mathbf{x}}$ in $\mathbf{\Omega}$, as follows: $\underline{\mathbf{x}}[\underline{\mathbf{x}}] = \underline{\mathbf{x}}^2$, such that $\underline{\mathbf{x}}^2 \stackrel{1}{\neq} \underline{\mathbf{x}}$ --

$\underline{\mathbf{x}}^2 = \underline{\mathbf{x}} \blacksquare \square \underline{\mathbf{x}}, \text{ or } \underline{\mathbf{x}}^2 \boxminus \underline{\mathbf{x}} = \square \underline{\mathbf{x}},$ e.g., $\prod_{w}^2 = \prod_{w} \blacksquare \square_{\mathbf{1}2w}, \qquad \prod_{w} \ddagger \square_{\mathbf{2}w}, \qquad \text{for all } \mathbf{w} \text{ in } \mathbf{W}, \text{ such that } \mathbf{W} = \{\mathbf{0}, \mathbf{1}, \mathbf{2}, \mathbf{3}, \dots\}.$

<u>Note</u>: The stylized "delta" operator ideogram, \Box ", used above, denotes a qualitative, or <u>kind</u>-of-thing, incrementation operator, in the <u>generic</u> context of «aufheben» modeling. We underscore symbols, like **x**, to denote their '<u>contra</u>-Boolean' operatorial character. The ideogram ' \ddagger ' denotes a qualitative, <u>kind</u>-of-thing inequality relation between two symbols, e.g., <u>apples</u> \ddagger <u>oranges</u>, for a LHS symbol which is <u>neither</u> greater

than, <u>nor</u> equal to, <u>nor</u> less than its RHS symbol. We denote, by \mathbf{W} , the number-set, of the "<u>Whole</u>" numbers, $\mathbf{W} = \{0, 1, 2, 3, ...\}$. The symbols involving variants of the letter 'q' are 'kind of thing qualifiers', standing for what we will call, instead of "classes", "categories" [thereby evoking an ancient philosophical tradition that begins at least as early as Plato and Aristotle]¹¹. They do so by denoting/applying the "quality" which is shared by, and which thus defines, all of the individual things that inhere in that category. *Each such "qualifier" category*-

symbol, operating upon itself, or upon other such "qualifiers", functions as an «aufheben» operator. The stylized 'q' symbol, ', denotes such

'qualifiers' in the <u>generic</u> context of our 'contra-Boolean' modeling. In general, the symbols for that context exhibit a "<u>rectangular</u>" motif. In the specific context of our <u>synchronic</u> models, presenting *present* content in *systematic* order, the corresponding symbols exhibit a <u>curvaceous</u> motif. In that of our <u>diachronic</u> models, representing *past-to*-present content, in *chronological*, *historical* order, they exhibit an <u>angular</u> motif.

Note how our 'contra-Boolean' "law" «aufheben»-conserves, *in part*, the form of the original, Boolean, "law" -- $\mathbf{x}^2 = \mathbf{x} \blacksquare \dots$ -- while it also «aufheben»-surpasses /elevates it. It negates the Boolean "law", but *not* in *all* ways, leaving abstract nothing. On the contrary, it negates the Boolean "law" in particular ways only, in ways which aim at [a]mending the deficiencies of the Boolean "law", but without "throwing the baby out with the bath water" --

 $\mathbf{x}^2 = \dots \blacksquare \Box \mathbf{x}$. We need not rely only on external examples of the greater efficacy of the [in]equations above as descriptions of the fundamental pattern of human thought, vis-a-vis Boole's $\mathbf{x}^2 = \mathbf{x}$. An example, internal to Boole's original algebra, falsifies the Boolean "fundamental law", while instancing the 'contra-Boolean' description. [Note: The stylized "delta" operator ideogram, ' \mathbf{A} ', used below, denotes the qualitative, or <u>kind</u>-of-thing, incrementation operator for the

<u>synchronic</u> context of «aufheben» modeling.]. The Q "law" of «aufheben» thought, interpreted for the <u>synchronic</u> context, namely

 $\mathbf{x}^2 = \mathbf{x} \bigoplus \Delta \mathbf{x}$, such that $\mathbf{x}^2 \neq \mathbf{x}$, thus describes an <u>expanded reproduction of ideas</u>. It also better describes the <u>actual</u>

<u>history</u> of Boole's algebra -- including of **Boole**'s own thought-processes, or "mental operations", in developing it -- than does the "fundamental law of thought" per Boole's algebra itself, $\mathbf{x}^2 = \mathbf{x}$. Boole "self-critiqued" the core content of his algebra, as he had first <u>presented</u> it, in his 1847 book <u>The Mathematical Analysis of Logic</u> [MAL], so that its content, in his ~ sevenyears-later, 1854 book <u>The Laws Of Thought</u> [LOT] was deeply altered. In particular, he massively amended his "<u>fundamental</u> law of thought". What change, for Boole's algebra of thought, could be <u>more</u>, well, fundamental? The former "law", $\mathbf{x}^n = \mathbf{x}$ for <u>all</u> **n** in **N** [<u>MAL</u>, p. 17], became <u>just</u> $\mathbf{x}^2 = \mathbf{x}$ [<u>LOT</u>, p. 49; see also footnote, p. 50, and body, pp. 50-51]. Perhaps the *Boolean* "mental operation" of "self-Election", $\mathbf{x}(\mathbf{x}) = \mathbf{x}\mathbf{x} = \mathbf{x}^2$, <u>should</u> encompass the update/correction/revision of such an \mathbf{x} . This might be because <u>past</u> \mathbf{x} , as recalled from memory, or as earlier written out, e.g., on paper, falls short of \mathbf{x} as <u>presently held in mind</u>; e.g., is an inferior version of, or is an obsolete prototype of, \mathbf{x} as <u>presently held in mind</u>. If so, then Boole's model of thought falls short. It falls short even of well-describing his own thought in the <u>history</u> of his own development of his own algebra of thought. Suppose that we use \mathbf{E}_1 to denote a Boolean class for the original, '1847 version', of Boole's 'Elector algebra'. Then we have $\mathbf{E}_1(\mathbf{E}_1) = \mathbf{E}_1\mathbf{E}_1 = \mathbf{E}_1^2 = \mathbf{E}_1$, which does <u>not</u> describe Boole's algebra's <u>actual history</u>. That history is better described, instead, by the emergence of a new, **Boolean** [<u>unit</u>] class [<u>LOT</u>, p. 28] --

$$\underline{\mathbf{E}}_1 \underbrace{\langle \underline{\mathbf{E}}_1 \rangle}_{\mathbf{1}} = \underline{\mathbf{E}}_1^2 = \underline{\mathbf{E}}_1 \bigoplus \underbrace{\langle \underline{\mathbf{E}}_1 \rangle}_{\mathbf{1}} \vdash \underline{\mathbf{E}}_1 \xrightarrow{\oplus} \underline{\mathbf{E}}_2, \text{ such that } \underline{\mathbf{E}}_1 \xrightarrow{\oplus} \underbrace{\mathbb{E}}_{\mathbf{1}}^1, \text{ and } \underline{\mathbf{E}}_2 \xrightarrow{\oplus} \underbrace{\mathbb{E}}_{\mathbf{1}}^1$$

[Note: The sign ' \blacktriangleright \equiv ' signs solution assertion. The stylized "delta" operator symbol, ' \diamondsuit ', denotes the qualitative, or <u>kind</u>-of-thing, incrementation operator for the <u>diachronic</u> context of «aufheben» modeling. The symbol ' \vdash ' signs the *mutual* assignment, or *mutual* interpretation, of the symbol(s) to its right and to its left, for that context. The sign ' $-\bigoplus$ ' denotes 'oppositional addition', the superpositioning of qualitative contraries, for that context]. Thus, the very ''<u>self evidence</u>'' of Boole's algebra itself -- the <u>evidence</u> of the <u>actual</u> cognitive psychohistory of Boole's own thought itself -- falsifies its claimed "fundamental law of thought", as such. The <u>unit</u> of \underline{E}_2 is, in a

very <u>special</u> way, '*meta-element-ic*' in *relation* to the <u>units</u> of $\underline{\mathbf{E}}_1$: the $\underline{\mathbf{E}}_1$ "law's" <u>multiplicity</u> of <u>elements</u>, signed via the set -- { $[\mathbf{x}^n = \mathbf{x}] } \equiv$ { $[\mathbf{x}^1 = \mathbf{x}], [\mathbf{x}^2 = \mathbf{x}], [\mathbf{x}^3 = \mathbf{x}], \dots$ } -- consolidates into the $\underline{\mathbf{E}}_2$ "law's" unit class <u>single element</u> $[\mathbf{x}^2 = \mathbf{x}]$. This is so even though $[\mathbf{x}^2 = \mathbf{x}]$ is already contained in { $[\mathbf{x}^n = \mathbf{x}]$ }. It is so because, in $\underline{\mathbf{E}}_1$, element $[\mathbf{x}^2 = \mathbf{x}]$ is just another case of $\mathbf{n} > \mathbf{1}$, no different from all of the rest. It thus also does **not** hold the same meaning that it later acquires, e.g., as containing/implying the **unique** Boolean-algebraic version of the classical *law of <u>non-contradiction</u>*: $\mathbf{x}(\mathbf{1} - \mathbf{x}) = \mathbf{0}$. The latter Boolean logic-equation asserts that, when class \mathbf{x} extracts/"elects" all of the kind \mathbf{x} individuals from out of the class of the <u>not-x</u> kind, $(\mathbf{1} - \mathbf{x})$, it extracts <u>no</u> things at all, as signed by "empty zero", **0**. It asserts that the common content, or "intersection", of class \mathbf{x} and/with its "opposite"/complementary class, class $(\mathbf{1} - \mathbf{x})$, is "Nothing" [see <u>LOT</u>, pp. 49-51].

Our model [in]equation, for the generic fundamental pattern of human thought, **x**² **‡ x**, keeps very close to Boole's [revised]

"fundamental law", $\mathbf{x}^2 = \mathbf{x}$, in that ours too is an equation of second degree. Our equation too falls short of capturing, even at this level of abstraction/genericity, part of what we noted, above, about human thought processes, in our critique of original Boolean algebra as an apt model thereof. Human thought need not stop with posit and/vs. counter-posit. It may progress further, beyond that apparent impasse, to *at least* a third category, which combines, and reconciles/unifies, the prior two.

Therefore, perhaps we should amend our "fundamental rule of 'contra-Boolean', «aufheben» thinking" to --

$$\mathbf{x}^{3} \notin \mathbf{x}; \ \mathbf{x}^{3} = \mathbf{x} \boxplus \square \mathbf{x} \boxplus \square \mathbf{x}; \mathbf{x} \vdash \square \mathbb{C}_{1}^{3} = \mathbb{C}_{1} \boxplus \mathbb{C}_{2} \boxplus \mathbb{C}_{3}^{3}$$

There is, as the above-stated revised rule would suggest, a third algebra of logic, in our categorial progression presentation of such algebras of logic. It combines hybridizes our 'contra-Boolean' logic-algebra, \underline{Q} , with

Boole's logic-algebra, <u>E</u>. That is, if we denote Boole's "algebra of <u>E</u>lector operators" by <u>E</u>, then the 3rd-degree, "double self-critique" of that system of logic-algebra yields no longer just a double sum, but, instead, a triple sum --



But we have our hands full, already, explicating just Q as contrary supplement to \mathbf{E} . So we won't be addressing the nature of the \mathbf{v} be addressing of this, introductory, essay. [Note: In the expression above, the sign ' \mathbf{e} ' signs the *general* operator of the «aufheben» self-negation, or of the [immanent,]self-critique, of its operand, in the *specific* form of the operator \mathbf{E} . The sign ' $\mathbf{F} \equiv$ ' stands for solution-assertion. The sign ' $\mathbf{E} = \mathbf{O}$ ' stands for the *mutual* assignment/*mutual* interpretation, of the symbol(s) to its right and left, for the synchronic context [curvaceous motif], in relation to the generic context [rectangular motif]].

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In this light, it is interesting to see what another mathematician who, like George Boole, applied himself to the development of a mathematics of logic -- by name, Charles Saunders Peirce -- had to say about what he called, and what Boole also called, "trichotomy"¹²:

[&]quot;The first is that whose being is simply in itself, not referring to anything nor lying behind anything. The second is that which is what it is by force of something to which it is second. The third is that which is what it is owing to things between which it mediates and which it brings into relation to each other."

The Four Key Rules of Our 'Contra-Boolean' Method.

We have found a way to capture, algebraically, the pattern, identified above, of actual and well-functioning, but 'contra-Boolean', human processes of thought. We do so with only the following 4 rules, for our <u>generic</u>, \mathbf{Q} "«aufheben» arithmetic". The <u>generic</u>ity of these 4 rules undergirds both the <u>synchronic</u> and the <u>diachronic</u> modeling applications/interpretations of this arithmetic and its algebra. In stating the 4 rules below, we use the symbol ' \forall ' to replace the phrase "for All", the symbol ' $\boldsymbol{\epsilon}$ ' to replace the phrase "is an $\boldsymbol{\epsilon}$ lement of", ' $\boldsymbol{\Xi}$ ' to sign a generalized addition operation, ' $\boldsymbol{\Xi}$ ' to sign a generalized subtraction operation, ' $\boldsymbol{\epsilon}$ ' to assert a relation of <u>quantitative inequality</u>, ' $\boldsymbol{\epsilon}$ ' to assert a relation of <u>qual</u>itative <u>inequality</u>, ' $\boldsymbol{\Rightarrow}$ ' to replace the phrase "formally implies", \boldsymbol{W} to denote the number-space, or number-set, of the "<u>Whole</u>" numbers, $\boldsymbol{W} \equiv \{0, 1, 2, 3, ...\}$, \mathbf{Q} to denote the space, or set -- one of '<u>ordinal</u> categorial <u>qualifiers</u>' [subsuming \boldsymbol{W}] -- of this rules-system, \mathbf{Q} , for "«aufheben» arithmetic", and sign ' \boldsymbol{F} ' to assert each rule as holding the formal-logical truth-value ' \mathbf{T} ', for "<u>T</u>rue":

- Q1. <u>Additions</u> of likes, of <u>NON</u>-distinct \bigcirc categorial gualifier' summands, sum to a <u>single</u> copy of that \bigcirc gualifier'. [or: **I** [\forall w \in W][\bigcirc **I** \bigcirc **I**
 - [rule of *idempotent* addition of likes / category qualitative uniqueness / categories' unquantifiability].
- **Q2**. <u>Additions</u> of <u>un</u>likes, of <u>distinct</u> **Q** 'categorial <u>qualifiers</u>', do <u>not reduce</u> to <u>any single</u> **Q** 'qualifier'.

 $[\text{or:} \blacksquare [\forall i, j, k \in [W \boxminus \{0\}]][[j \ \ k] \Rightarrow [\bigcirc_{j} \blacksquare \bigcirc_{k} \ \ k \ \bigcirc_{i}]].$

[rule of <u>IR</u>reducibility of categorial <u>qual</u>itative differences / of categories' sums <u>non</u>-amalgamation].

Q3. <u>Additions</u> of pairs of wQ 'categorial Qualifier' summands are <u>commutative</u>.

$$[or: \blacksquare [\forall j, k \in W][\square_j \blacksquare \square_k = \square_k \blacksquare \square_j].$$

[rule of the *additive commutativity of Q elements].*

Q4. <u>Multiplications</u> of pairs of wQ 'categorial <u>qualifier</u>' factors, <u>distinct</u> or <u>not</u>, are equal to their multiplicand factor, plus that unique Q 'categorial <u>qualifier</u>' whose subscript is the sum of the subscripts of the factors pair.

$$[\text{or:} \blacksquare [\forall j, k \in W][\square_j \boxtimes \square_k = \square_k \blacksquare \square_{j+k}].$$

[note how subscript 'k' is *conserved <u>doubly</u>*, in <u>both</u> terms of the product]. [rule of 'the <u>double</u>-conservation «aufheben» product rule' for categorial <u>qualifiers' multiplication</u>].

These four rules, taken together, define the kernel of a method of, of a system of, 'algebraic algorithmic heuristics'¹³ -- one whose efficacy we shall demonstrate, via the examples presented below, in the Appendices. It is an unprecedented method for new hypothesis discovery, for present knowledge organization, for well-ordered knowledge presentation, for knowledge representation condensation, for past history reconstruction, and for conjectural future history prediction, which, in this context, we term 'pre-construction'. Such categorial 'pre-construction' is based on expectations of future categorial 'meta-unit-ization', and hybridization, which are well-founded "inductively", i.e., in human experience to-date.

The continuing progressions of algebraic category-symbols, that this Q 'algebraic algorithmic heuristic method' generates, may also be modeled via a movement -- a lurching, "stop-and-go" movement -- through a series of disjunct Boolean spaces *of ever increasing dimensionality*.¹⁴

'Contra-Boolean' Method & 'Boolean Analytical Geometry'.

The arithmetics that undergird algebras, and those algebras' geometries -- mathematical <u>ideographies</u>, and their images in corresponding mathematical <u>pictographies</u> -- go hand-in-hand, in a mutually-clarifying 'ideo-symbiosis'*. You may recall from high school an example of this 'ideo-symbiosis': classic 2^+ -D algebra and its Cartesian-coordinates "analytical geometry".

However, the case of original Boolean algebra may seem to belong to the nadir of this 'ideo-symbiosis'. With only two values, thus two "points", **0** [or **0/1**], and **1** [or **1/1**], officially allowed as measures of the contents of classes, *Boolean* geometry would appear to be *minimal* geometry. However, despite this paucity and sparsity of "points", 'Boolean analytical geometry' is, we find, still a source of insights, into Boolean algebra itself, and, especially, into its 'supplementary contrary', the $\[mathbb{Q}\]$ algebra,

and *its* "analytical geometry". The 'Boolean analytical <u>geometry</u>' of $\mathbf{E} = \{0/1, 0/0, 1/1, 1/0, \}$, a <u>geometry</u> which

corresponds to original Boolean <u>arithmetic</u>, can be envisioned via a single, linear, closed, one-dimensional unit interval linesegment, **[0, 1]**, representing the Boolean "Universe", in which the boundaries of that unit interval line-segment, **0** and **1**, are explicit, and emphasized. However, the interior of that unit interval is only implicit, and is thus indicated by ellipsis dots, rather than by a solid line, in the depiction below --



Also above, the Boolean "indefinite value", 0/0, spans the entire one-dimensional "Universe" of this single unit-interval space/unit-length line-segment -- "none, *some*, or all" of it. The 4th, the "impossible", Boolean value, 1/0, i.e., ∞ , resides outside that one-dimensional "Universe", i.e., resides nowhere. The 0/1 or 0 point represents the empty "origin" of that 1-D Boolean space. In light of this depiction of the "geometry" of the original Boolean algebra, we can also depict the "analytical geometry" of the 'contrary-supplementary counter-example' to <u>E</u>, namely, that of the <u>Q</u>, «aufheben» algebra. It depicts as an

'«aufheben» meta-unitization' of the single unit[-length line-segment]s of the separate Boolean "Universes [of_discourse]", LE



Each unit-length line-segment depicted above intends a "solid", <u>a</u>tomic, "<u>un</u>cuttable" <u>unit</u>[y], oriented in a different [orthogonal] direction. Each represents a '<u>sub</u>-"Universe" of the multi-kind "Universe" that they together constitute. The vector-like sums of these unit-length segments are "diagonals" [beyond the **3**rd segment, '*hyper*-diagonals'], except for the **1**st segment, which we term a '*hypo*-diagonal'. [For 'tomic', explicitly *fractional* parts of these 'sub-universe' dimensions/segments, recourse to \bigcirc or \bigcirc is requisite, i.e., to higher «aufheben» algebras, subsuming

fractions, from the "*Rationals*", \mathbf{Q} , or subsuming "*irrationals*", from the "**R**eals", **R**]. Thus, each "kind of thing" category that is generated, in models using this analytical-geometrical metaphor, gets its own dimension, a dimension which sprouts, from non-existence, from out of the \mathbf{q}_0 "origin", into full, unit-length existence, at the right time, $\boldsymbol{\tau}$ [or in the right presentational **S**tep, **S**], i.e., in the right *order*.

^{*}See Charles Musès, Explorations in mathematics, Impact of Science on Society, 27:1 (1977), p. 68, UNESCO [special issue on frontiers of science].

Two 'Contra-Boolean' Models of the Category "Humanity": <u>Diachronic & Synchronic</u>.

We want to heighten your feeling for the differences, in quality, between the category of original Boolean algebra, $\mathbf{w} \stackrel{\mathbf{E}}{=}$, and that of our 'contra-Boolean algebra', $\mathbf{w} \stackrel{\mathbf{E}}{=}^2 \bigoplus \mathbf{w} \stackrel{\mathbf{E}}{=}^1 = \mathbf{w} \stackrel{\mathbf{Q}}{=} [using `\bigoplus' to denote 'generalized subtraction' in the synchronic context of «aufheben» modeling]. Let us therefore directly juxtapose Boole's model of humanity -- his logical equation definition of the "class" of humans -- with our two <math>\mathbf{Q}$, 'contra-Boolean' models for category 'humanity', one for its diachronic context, and the other for its synchronic context.

Boole's model [using = to denote 'definitional equality', and '

"human beings \equiv rational <u>a</u>nimals", or, in the language of Boole's original algebra --

h = ra

-- stands versus, in the language of our 'contra-Boolean' algebra, two models, one diachronic, one synchronic --

1. A <u>diachronic</u> model, of the <u>genesis</u> of the reality "humanity" from our immediate predecessor reality, $\underline{\ell}$ --

$\underline{\ell}^2 \diamondsuit \underline{\ell}^1 = \bigtriangleup \underline{\ell} \vdash = \underline{h}$

[wherein $\underline{\ell}$ denotes the category of, e.g., "socia $\underline{\ell}$ anima $\underline{\ell}$ s", & \bigcirc 'generalized subtraction' in the <u>diachronic</u> context of «aufheben» modeling] -- and, using ' $\underline{\partial}$ ' to denote the operation of taking an indefinite *finite <u>part</u>* / fraction/fragment of the <u>whole</u> meaning of a category/**q**uality --

2. A <u>synchronic</u> model, of the constitution of [sub-]domain 'humanity' as it exists presently, today* --

$$\frac{1}{\sqrt{\frac{1}{2}}} \underbrace{H}^{n} = \underline{h} \oplus \underline{\partial} \widehat{\mathfrak{g}}_{hr} \oplus \underline{\partial} \widehat{\mathfrak{g}}_{ha} \oplus \dots \oplus \underline{\partial} \widehat{\mathfrak{g}}_{hm} \oplus \dots \oplus \underline{\partial} \widehat{\mathfrak{g}}_{hp} \oplus \dots \oplus \underline{\partial} \widehat{\mathfrak{g}}_{h\ell \text{bepmar}}$$

The <u>diachronic</u> 'contra-Boolean' <u>h</u>umanity-model, $\underline{\ell}^2 \Leftrightarrow \underline{\ell} = \underline{h}$, is intended to describe the core units of the <u>h</u>umanity category, e.g., in their "nascent state", as they were when they had just emerged from out of their immediate predecessor units, those of category $\underline{\ell}$, just before any interactions at all could have even begun, among the units of <u>h</u>umanity itself, and among all of their predecessor units, <u>immediate</u> and "<u>mediate</u>".

This $\underline{\ell}^2 \bigoplus \underline{\ell} = \underline{\mathbf{h}}$ diachronic model* also flows from our hypothesis that it was the self-growing population, and the self-growing physical-spatial concentration, of diverse anima<u> ℓ </u>-socia<u> ℓ </u> species units, that led to inter-species alliances. Also for that to happen, these anima<u> ℓ </u>-socia<u> ℓ </u> species units had to include, we hold, at least one socia<u> ℓ </u> species unit that responded to Darwinian "selective pressures" for greater neuro-cognitive capacities, e.g., in terms of 'proto-<u> ℓ </u> anguage' processing, in terms of social interactions remembering / score-keeping, etc.

For '<u>proto-humanity</u>', such inter-species alliances must have begun, we hold, with a 'social proto-human[oid]s' bands/social wolves' packs alliance, in 'symbiotic co-hunting/co-foraging/co-scavenging units'. These then, we hold, accrued further, and developed, 'protractedly', into humans-led, meta-social meta-social meta-social plant", species two-way, "mutual domestication" of modern humans and of multiple social animal, and "social plant", species -- what we call "social symbiogenesis", and "social endosymbiosis" [for more about this, see end note 20].

The <u>synchronic</u> 'contra-Boolean' <u>h</u>umanity-model, as expressed above, defines present-day <u>h</u>umanity as the "additive combination", or 'qualitative superposition', of <u>h</u>umanity's core reality, category <u>h</u> itself, with the so-far partial [] fruitions -- at least "locally" -- of <u>h</u>umanity's interactions / appropriations / conversions, with / from / of [*finite* parts of], all of the other "kinds of things" categories that are even <u>possibly</u> co-existing with <u>h</u>umanit(y)(ies) in our present cosmological epoch.

The '*d*' operations signify the taking of only a '*finitary* qualitative fraction', or a *finite* "partial", of the meanings of their whole operand qualitysymbols, or category-symbols, upon which they operate. They are involved, in this <u>synchronic</u> model, because, in our present epoch, per this model, that the actualities to which these interaction terms refer, we hold, are not yet fully formed. Those actualities have, so far, we hold, only ever been, at most -- at least in our cosmological locale -- but partially possible/actualized/complete, extant, and evident/manifest, to-date.



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General Recipe for Solving 'Contra-Boolean', Heuristic, "Purely"-Qualitative Mathematical Models.

The 'First Times Last Nets Next' Recipe.

There is an extremely simple recipe, or "algorithm", to generate the terms of a given 'contra-Boolean' model, in a term-by-term manner. This recipe generates the algebraic [i.e., the initially-unknown] categories of that model, category-symbol-byconsecutive-next-category-symbol. Thereby, you may also then solve that model's equation term-by-term, category-by-category, one term -- one category-symbol, at a time. We have named that procedure the 'First Times Last Nets Next Recipe'.¹⁵

Start with the starter category, whose explicit meaning must be already known to you. Since this first term is both the first term and the last term, at this stage, multiply it by itself, i.e., "first times last", "first times first", "last times last" -- all equivalent at this stage. That multiplication will generate 2 category-symbols/terms, regenerating the first category-symbol/term, & also explicitly positing its "delta" term for the first time in this use of this recipe. Solve that second, "delta", category-symbol, by means of a category of your knowledge, whose units inhere in the domain that this model models, using 'connotational entailment'*, and, e.g., the fundamental «aufheben» principle, of 'meta-unit-ization'**. Then multiply that second categorysymbol/term, which is now the *last* term for this new stage, by the first category-symbol/term. Add the resulting two terms back to the 2-term sum that you already had. That will <u>net-generate</u> a new, third "algebraic <u>unknown</u>" category-symbol/term, to be solved using the same principles as before. Assign, to any 'algebraic unknown' category-symbol that you do not recognize as connoting part of the "kinds of things" content of the domain that you are modeling, the 'qualitative full zero' value, '**•**', or • (*), as the context determines, so as to indicate that this category-symbol/term is an "inoperative" term, to the best of your knowledge, for the domain that you are modeling. Once the third category-symbol -- the new "last" category-symbol -- is solved, then, once again, multiply that new, third, "last" category-symbol by the "first", starter, category-symbol, again. Add the result back to the earlier sum of 3 category-symbols, net-yielding 4 category-symbols. Then solve for that new, 4th category-symbol. And so on, continuing to multiply the latest stage's "last" category-symbol by the first, starter category-symbol, until the latest resulting repeat-subscript symbol cannot be solved for any "kind of things", known-to-you, that is part of the content of the domain that you are modeling. There halt: the model has there, to your knowledge, exhausted the present content of its domain.

There is an auxiliary rule, a "rule of interpretation", needed to resolve cases of multiple occurrences of the same subscript epithet in a given category-symbol, as generated by this recipe. Suppose that a double occurrence, i.e., a repeat occurrence, of a subscripted character arises. If so, then replace it with the single character that was determined to be the solution for that repeatcharacter-pair in one or more of the previously-solved category-symbol/term cases. If that substitution leads to yet/still another repeat occurring subscript epithet, then again substitute the previously-solved single-character solution. Continue to do so, until only single-occurrences of subscript characters remain for the category-symbol in question. Suppose the repeat-character-pair subscript for this category-symbol has not occurred previously in this solutions-progression. If so, then solve for this new subscript character-pair using, e.g., 'connotational entailment'*, and the basic «aufheben» principle of 'meta-unit-ization'**. Substitute the resulting, new single-character subscript solution for that repeat-character-occurrence subscript. Suppose that no such single-character subscript solution for that new repeat-character-pair can be found, to your knowledge of the domain. If so, then halt there, at that point. Your solution is complete for your knowledge of the to-present development of the domain that you are modeling [and even, perhaps, for expectations that you may have regarding the future development of this domain].

^{*}By 'connotational entailment', we mean the implications that flow, intuitively, from the meaning, known to you, of the starter category, as well as from the known-to-you meaning of the domain being modeled as a whole, to each successive, model-generated, e.g., first times last nets next recipe-generated, initially "algebraic", i.e., initially "meaning-unknown", category-symbol. This flow of meaning can help you to "solve for" each category-symbol generated. I.e., it can help you to convert that symbol, from an unknown-to-you, to a known-to-you, meaning; to "solve" the meaning of that new symbol, per your knowledge of the domain being modeled. Such 'connotational inferences' also flow intuitively and cumulatively, from each so "solved" symbol, to each of its successor symbols, each also an initially algebraic/unknown, model-generated, recipe-generated category-symbol. This flow of connotations may help you, in turn, to "solve" for each of them as well. The "semantic context" of this "sum"/'qualitative superposition', of "solved" category-symbols thus builds, gathering mental momentum.

^{**} The diachronic process of '[self-]meta-unit-ization', and the synchronic relation of 'meta-unit-icity', are the typical concrete, specific forms of «aufheben» process / relation encountered in 'contra-Boolean' modeling for typical domains. The process we call '[self-]meta-unitization' is a diachronic, time-taking, 'time-making' [self-]operation. By means of it, units of a predecessor population of units, e.g., atoms, coalesce to form a new, higher, i.e., more inclusive, kind of units, e.g., molecules, constituting a new, higher scale, or "level". The 'meta-unitization' process does so by forming new, higher, more-inclusive 'meta-units' e.g., molecules. Each typical, e.g., molecule, unit is made up out of a normally, typically heterogeneous multiplicity of [some of] the units of the predecessor category, e.g., of atoms. This units-level coalescence creates the population that is to be modeled by a new, successor category, one whose units are thus 'meta¹-units', relative to those predecessor units. The relation that we call 'meta-uniticity' names the synchronic connection, e.g., of present atom units, that may also presently inhere in present 'meta-units', e.g., in present molecule units, e.g., inside the cells of your 'meta-cellular' body. The «aufheben» process, of '[self-]meta-unitization', is the unified, simultaneous «aufheben» self-negation, self-elevation, and self-conservation of [some of the] units represented by an earlier category, but now residing inside the new, 'meta¹-units' of their newly-created category, e.g., <u>atoms</u> \rightarrow <u>atoms</u> \Rightarrow <u>molecules</u>. 'Meta-uniticity' is the «aufheben» synchronic inclusion of units of an earlier-to-be-presented present category, e.g., such that these units are already present inside the concurrentlyexisting 'meta-units' of a later-to-be-presented, but also equally *present*, but richer, category, e.g., <u>atoms</u> - <u>atoms</u> <u>**b**</u> <u>molecules</u>.

Summary: A 'Contra-Boolean Algebraic Algorithmic Heuristic' for New Hypothesis Discovery, for Present Knowledge Organization, for Well-Ordered Knowledge Presentation, for Knowledge Representation Condensation, for Past History Reconstruction, & for Future History Prediction, i.e., for Conjectural 'Pre-Construction'.

We can see, starting with the <u>synchronic</u> model of the English Written Language System, of Appendix 1., how our 'contra-Boolean' algebra can provide "*present knowledge organization*". It generates category-symbols comprising the *present* "kinds of things" content of the *present* Written English domain, in <u>systematic</u> order. I.e., it starts from the simplest category, of [e.g., phonetic] characters, or "letters", and ends with the *presently* most complex category, that of codex archives, e.g., libraries, for this *present* system/domain. The presentation of the progression of categories that encompass the "kinds of things" content of today's Written English domain thus also represents a pedagogically-advantaged, because intuitively *well-ordered*, *knowledge presentation* for that domain. That model achieves, also, "*knowledge representation condensation*". I.e., it contracts its 256 category-symbols series into

a 4 symbolic-element, <u>computable</u> expression, $\int_{a}^{2^{b}}$. This expression can be readily re-expanded into that full non-amalgamative sum of 256 category-symbols. This can be done simply by applying the 4 rules, presented above, of the Q «aufheben» arithmetic, and the single principle of interpretation, for eliminating repeat subscripts, also presented above.

That model also exemplifies the potential of this algebra for triggering *new hypothesis discovery*, and moreover, for *"future-history conjectural <u>pre-construction</u>"*. It does so in the example of the hypothesis that the category symbol

The three <u>diachronic</u> models all illustrate the power of this 'contra-Boolean' modeling method for the "*past history* <u>reconstruction</u>" of various domains. They generate category-symbols for the "kinds of things" populating those histories in their precise "order of appearance", i.e., in the exact <u>chronological</u> order of their first arising in the histories of their domains.

Each of these <u>diachronic</u> models, of appendices 2, 3, and 4, also exemplify the capacity of this 'contra-Boolean' modeling method to generate predictions, *"future-history conjectural <u>pre-constructions"</u>. They do so when they are iterated out to at least one epoch beyond the epochs which describe the contemporaneous development of these domains, e.g., to beyond the final epochs illustrated in our appended diagrams for these models. We have typically chosen not to detail the next-epoch predictions of these models here, given the limited scope of this introductory essay.*

The Appendix 4 model, $\underline{r}^{2^{\circ}}$, for the "total cosmos" domain, exemplifies the value, for "*new hypothesis discovery*", of this modeling method. It provided a model-generated pathway of inference that stimulated the hypothesis of the 'inter-species alliance', '<u>meta-[animal-]social</u>' character of <u>human society</u>, and hypotheses that emergence of the 'proto-<u>language-based animal-societies</u>' was paralleled by that of *biochemical-signaling proto-language-based* 'social plants', that "mutual domestication" of social-animal proto-human[oid]s and of wolf-pack social-animal proto-dogs', was crucial to the emergence of <u>human society</u>, and that this emergence constituted an instance of '[animal-]social symbiogenesis', and of '[animal-]social endosymbiosis' [notwithstanding the fact that similar hypotheses have been arrived at, independently, by other pathways of inference; for more on this, see end note 20].

"Knowledge representation condensation" is exemplified by the three-symbol <u>computable</u> expressions by which we abbreviate each of these three, <u>diachronic</u>-context, models -- \underline{M}^{2^3} , \underline{b}^{2^6} , and \underline{r}^{2^8} , respectively.

In the appendices to this essay, we have thus outlined 4 models built using this <u>generic</u> 'contra-Boolean' arithmetic and algebra. One, the first, is for the <u>synchronic</u>, "*now*" context. Three are for the <u>diachronic</u>, chronological, historical context. They address 3 aspects of the <u>genesis</u>, from out of our deep past, of our "*now*", for 3 disparate [sub-]domains of our *present* universe. We believe in the teaching power of participatory learning. Thus, these appendices do not specify our solution for every categorysymbol term generated by these categorial progression models. Some of that solving is typically left as a learning task for the interested reader. We will provide our full solutions to these models' equations, via snail mail, upon your request, made via e-mail, to: <u>webmaster@dialectics.org</u>. <u>Appendices</u>: 'Contra-Boolean', "Purely"-Qualitative Mathematical Modeling -- Some Samples.

<u>Appendix 0</u>. The <u>Q</u> System of 'Contra-Boolean' Algebra as a Better-than-Boolean Model of Human "Mental Operations".

[forthcoming].

<u>Appendix 1</u>. <u>Synchronic</u> Application: A 'Contra-Boolean' Categorial Analysis of the Present System of Written English.

Our first sample model is a synchronic model of the contemporary System of Written English. We have selected it because it is a model of a domain about which most of our readers are likely already well-versed -- have "domain expertise". Thereby, even if the modeling language is unfamiliar to them, the domain is not. This model may not yield many new insights, given its domain's familiarity. But this model may still serve to make plain the synchronic workings of the 'contra-Boolean' algebra. Start with $\mathbf{e} = \mathbf{Q}_{\mathbf{r}}$; *letters*, e.g., phonetic *characters*, as starter category, comprising <u>s</u>tep $\mathbf{s} = \mathbf{0}$. Solve for $\mathbf{Q}_{\mathbf{r}}$, in $= \mathbf{\underline{f}} \oplus \mathbf{\underline{\delta}}_{\mathbf{\underline{f}}} = \widehat{\mathbf{\mathbf{a}}}_{\mathbf{\underline{f}}} \oplus \widehat{\mathbf{\mathbf{a}}}_{\mathbf{\underline{f}}} \quad \mathbf{\underline{f}} \longrightarrow \widehat{\mathbf{\mathbf{a}}}_{\mathbf{\underline{f}}} \boxplus \underbrace{\mathbf{\underline{f}}}_{\mathbf{\underline{1}}^2}, \text{ as } \underbrace{\mathbf{\underline{syllables}}}_{\mathbf{\underline{1}}^2}, \widehat{\mathbf{\mathbf{a}}}_{\mathbf{\underline{f}}} \quad \mathbf{\underline{f}} = \widehat{\mathbf{\mathbf{a}}}_{\mathbf{\underline{s}}}, \text{ in } \underline{\mathbf{\underline{s}}} \text{tep } \mathbf{s} = \mathbf{1}. \text{ Then, solve}$ This is the category of 'meta-syllabic', ''multi-syllabic''', Word units, i.e., of typical Word units. Single-syllable words, as ''exceptional''', i.e., as less frequently encountered cases, in contemporary English written language, can then come in, as $\mathfrak{P}_{ws} \mathsf{E} \to \mathfrak{P}_{\mathfrak{l}_{6}}$. This category-symbol signifies «aufheben» elevation, or uplift, of single <u>syllables</u> into the more complex <u>words level</u>. Then, solve $(\underline{w}_{1,p}, as \underline{phrases} / clauses, in \underline{s} tep s = 3, for \underline{w}^2 = \underline{w} \oplus \underline{\delta w} =$ **C** as the, "exceptional", single-**phrase** <u>sentences</u> category. Next, solve the symbol clause <u>sentences</u>. Solve ⁴ sub-book-length documents in general, not just as book chapters, e.g., including certain legal documents -- printed paper money, licenses, diplomas, stock certificates, birth certificates, short contracts, civil complaints, etc. -- and posters, [shorter] correspondence, memos, and scientific papers, as well as **book chapters**. Therefore, $\Box_{128} \leftarrow \Box = \Im_{b}$ might be solved as including longer, sub-sectioned codices in general, e.g., reports, proposals, magazines, journals, multi-author anthologies, diaries, and even [long] mock-ancient scrolls, as well as single-author books. As a result, "single chapter books''', e.g., pamphlets, booklets, etc., might solve-for part of category-symbol Lig2 C-J bd. Then, it would make in general. <u>One-book stocks -- single title inventories</u> -- may then solve for part of the meaning of . Finally, $l_{1512} \leftarrow l_{2} \\ l_{312} \leftarrow l_{2} \\ l_{312} \\ l_{312}$ i.e., of this synchronic model. This model's scope is limited to a narrow, short-duration slice of nearly-contemporary time. This last category might be solved, predictively, as denoting the Internet's extant content today. Today, the Internet is, we hold, a merely, "fractional" present-precursor, to a future, global, omnibus communication, and information-access, public utility, e.g., a digital electronic / photonic '[meta-]archive of archives'. Since this public utility does not presently, empirically, fully exist, we have stopped our model diagram at \mathfrak{A} This model may be ""well-fitting", for the extant Written English System domain, covering most of its phenomena. However, this model may

count many "extraneous", "inoperative" terms. That is, it may include algebraic-<u>unknown category-symbols that remain unknowns</u>. It may include many category-symbols for which no linked, corresponding actualities actual content can be found in our present experience. We solve such "inoperative" categories via the 'qualitative full zero value', " The "backbone" of this model is the «aufheben» principle that a typical <u>syllable unit</u> is a '*meta-<u>fetter</u> unit*', each one made up out of a typically heterogeneous multiplicity of <u>fetter</u> units; that a typical <u>word</u> unit is a '*meta-<u>Syllable unit</u>', each one made up out of a typically heterogeneous multiplicity of <u>Syllable</u> units; that a typical <u>phrase /clause unit</u> is a '<i>meta-<u>Syllable unit</u>', each one made up out of a typically heterogeneous multiplicity of <u>Syllable</u> units; that a typical <u>phrase /clause unit</u> is a '<i>meta-<u>Word unit</u>', each one made up out of a typically heterogeneous multiplicity of <u>Syllable</u> units; that a typical <u>garagraph unit</u> is a '<i>meta-<u>sentence unit</u>', each one made up out of a typically heterogeneous multiplicity of <u>Sentence unit</u>; that a typical <u>garagraph unit</u> is a '<i>meta-<u>sentence unit</u>', each one made up out of a typically heterogeneous multiplicity of <u>Sentence unit</u>; that a typical <u>garagraph unit</u> is a '<i>meta-<u>sentence unit</u>', each one made up out of a typically heterogeneous multiplicity of <u>Sentence unit</u>; that a typical <u>Gocument unit</u> is a '<i>meta-<u>sentence unit</u>', each one made up out of a typically heterogeneous multiplicity of <u>Garagraph</u> units; that a typical <u>codex</u> "<u>book</u>" <u>unit</u> is a '<i>meta-*<u>Shorter</u>] <u>Gocument unit</u>', each one made up out of a typically heterogeneous multiplicity of <u>[shorter]</u> <u>Gocument</u> units, and that a typical [*textual*] <u>archive</u> [e.g., a library] <u>unit</u> is a '*meta-codex* <u>unit</u>', each one made up out of a typically heterogeneous multiplicity of <u>shorter</u>] <u>Gocument</u> units. Overall, this model condenses to \int_2^8 . "Solving" the model displayed below means *aptly* replacing each ? marked below, as well as those implied for all of the other "algebraic-<u>unknown</u>" category-symbols, not shown explicitly below, indicated only by ellipsis dots, with either a specific category name/description, or with the • sign.



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<u>Appendix 2</u>. <u>Diachronic</u> Application: A 'Contra-Boolean Model' of the History of the Major Fields of Human Knowledge.

Per this 'model of [psycho]history' -- a model of the history of the major fields of human ideology knowledge -- **Religions** grew out of multiple, typically disparate **Mythologies**; **Philosophies** from out of multiple, potentially warring **Religions**, and **Sciences** from out of conflicting **Philosophies**, or, more specifically, from out of competing **philosophical schools**. In particular, **Natural Science** grew out of what was called, even into Newton's times, by the name "Natural Philosophy" [Indeed, the title of Newton's *magnum opus*, translated into English from his scholarly Latin, is "Mathematical Principles of Natural Philosophy"].

To articulate the meanings of the "hybrid categories" on the "limbs" of this model, as we define or solve them, we can characterize some of the model's "limb" categories in terms of eleven classic texts¹⁶ which, we hold, instantiate them, or which focus upon topics which those categories involve.

Contemporary Mythopoeia, which the category \mathcal{N}_{M} , along with ancient Mythopoeia, most decidedly does include, per our definition/solution, is instantiated by several prominent modern novels, or series of novels. These include J. R. R. Tolkein's trilogy of the Ring, J. K. Rowling's Harry Potter heptalogy, and Isaac Asimov's Foundation heptalogy. As examples for this model, these series have the advantage of affirming that Mythologies are not simply a phenomenon of our ancient past, presently extinct. The latter of these three examples further affirms that the setting for Myths need not be the past, or even the present, per our definition/solution for the, \mathcal{N}_{M} , founding category of this model. That setting can also be the future.

The category, which combines **Philosophies** and **Religions**, \mathcal{P}_{PR} , is instanced by the <u>Summa Theologica</u> of Thomas Aquinas, though, rather than representing the cases of conversions of **Religions** into **Philosophies** which $\mathcal{P}_{PR} \longrightarrow \mathbb{T}_{16}$ directly and primarily connotes, this work might be seen as belonging to the secondary, '<u>retrograde</u> conversion' meaning of this category, as connoted by reversing the order of the two subscripts $\mathcal{P}_{RP} \longrightarrow \mathbb{T}_{16}$, i.e., to '<u>retro</u>-conversions' of **Philosophies** <u>back</u> into **Religions**.

Similarly, <u>The Human Phenomenon</u>, by Pierre Teilhard de Chardin, <u>The Holy Science</u> by Swami Sri Yukteswar, and <u>Science of Religion</u> by Paramahansa Yogananda, might all be seen as works which instantiate the 'conversion of <u>Sciences back</u> into <u>Religions</u>', or the reformulation of traditional <u>Religions</u> as <u>Sciences</u>/in terms of <u>Science</u>. Both are connotations of the category $\mathbb{R}_{RK} \longrightarrow \mathbb{P}_{110}^{-1}$, as distinct from the 'conversions of <u>Religions</u> into <u>Sciences'</u> connotations of the category $\mathbb{R}_{KR} \longrightarrow \mathbb{P}_{110}^{-1}$.

The book <u>Primitive Mythology</u>, by Joseph Campbell, bills itself as an application of Science to ancient Mythologies, thus instancing $\mathbb{A}_{KM} \longrightarrow \mathbb{F}_{19}$. The book <u>The Golden Bough</u> by James G. Frazer bills itself as applying Science to both Mythologies and Religions, thus instancing $\mathbb{A}_{KRM} \longrightarrow \mathbb{F}_{111}$. Finally, the books entitled Of Time, Passion and Knowledge, by J. T. Fraser, and <u>The Ever-Present Origin</u>, by Jean Gebser, both combine, and attempt to synthesize, Scientific Knowledges, Philosophies, Religions, and Mythologies -- all four of the major categories of this model -- $\mathbb{A}_{KPRM} \longrightarrow \mathbb{F}_{115}$. These last four categories belong to the present epoch of this model, to epoch $\tau = 4$. We hold that this epoch is not yet "all in", but is only "fractionally", partially actualized, as of this writing. The predicted category corresponding to generic ordinal qualifier \mathbb{F}_{116} is, we hold, not yet widely recognized, nor yet fully extant. We therefore shalln't venture into that terrain of prognostication here, in view of the presently 'pre-constructive' character of that category, and the limited scope of this introductory essay. Our working hypothesis, for this model-solution, is that, first, **Religions** grow out of **Mythologies**, then that **Philosophies** grow out of **Religions**, and then that **Sciences** grow out of **Philosophies**, without either **Mythologies**, **Religions**, or **Philosophies** ever, so far, ceasing to exist as a result of these 'outgrowings'.

In our view, the sociological mechanisms of these 'outgrowings' involve processes of political power maintenance for the successive kinds of ruling classes manifest so far in human history. The 'econo-politico-social' power and privileges of these, minority, ruling classes cannot be maintained by coercive violence alone. The potential power of ideologies to secure the submission, and the <u>self</u>-subjugation, of the <u>non</u>-ruling majorities becomes a paramount concern, a central focus of socio-psychological engineering, for these ruling classes.

Consider the stage of human social formation in which an incipient city-state's state power is congealing from a multi-chiefdom, multi-tribal alliance. There, it is vital, for the emerging new rulers, to help secure allegiance to their newly-emergent state power. They may be aided in doing so by coordinating the diverse **Mythologies** of the then merging tribes and chiefdoms, if they are that merger in a way which cements the new alliance ideologically, e.g., via a *poly*theistic '*meta*-**Mythology**', i.e., via a **Religion**, organizing the disparate deities of a chaotic multitude of tribal **Mythologies** into a single, unified "pantheon".

Again, at the emergent multi-city-state empire stage of human social formation, city-state-specific, potentially warring polytheistic <u>Religions</u>, with different or variant patron Gods or Goddesses for each city-state [e.g., Pallas <u>Athena</u> for ancient <u>Athens</u>], need to be reconciled, if imperial ruling class power is to predominate. The rulers of the conquering city-state -- the one that is imposing the new, imperial, state -- sanction a new kind of '<u>meta-Religion</u>', i.e., one or more <u>Philosophies</u>, to assist in this ideological reinforcement of their power.

Institutionalized *Sciences* emerge, e.g., in late, multi-city-state-imperial, social formations, and, later still, in nationstate social formations, as ruling class power comes to rest more on technology, e.g., on technical, technology-based productive power, and military power, so that <u>reliable</u> knowledge is needed by the ruling class. The *Sciences* thus emerge as '<u>meta-Philosophies</u>'. That is, *fragments* of multiple *schools* of, e.g., "*natural philosophy*", their *speculations* sifted, by *observation* and *experiment*, are logically *unified* into *empirically-corroborated scientific disciplines*, *hypotheses*, and *theories*. The emergence of the *Sciences* might be expected to end the reign of dogmatic *ideologies*. Yet, we can readily observe, including presently, that the old kinds of *ideology* still persist, in modernly modified forms, still found useful, for securing the submission of the various ruled classes, by the late ancient, and by the modern, ruling classes. Moreover, ideological contaminants seep into the *Sciences* themselves, both intensionally, as deliberately engineered by ruling classes, but also unconsciously. The former is especially obvious among social sciences, e.g., in the fields of 'political-economics'. However, if mostly in the latter, more unconscious way, contra-empirical ideological perversions tend to pervade the *natural sciences* as well.¹⁷

On the basis of this working hypothesis, we define, historically, for this model, per our usual «aufheben» principle, the categories of the major fields of human ideology knowledge, as follows.

Mythologies are made up out of story units. They are the results of 'story-makings', *mythopoeias*, often featuring animistic tales as attempted explanations for human experience(s). Each typical **Religion** unit is a 'meta-**Mythology** meta-<u>unit</u>', each one made up out of a typically heterogeneous multiplicity of **Mythology** units, coordinated, and even codified and reconciled. Each typical **Philosophy** unit is a 'meta-**Religion** meta-<u>unit</u>', each one made up out of **Religion** units, critiqued, systematized, and even unified. Next, each typical **Science** unit -- each typical "field", "discipline", or "theory" unit -- is a 'meta-**Philosophy** meta-<u>unit</u>'. Each one is made up out of a typically heterogeneous multiplicity of those speculations that constitute the various [schools of] **Philosophy** units. Such a Science unit is constituted via the critical logical analysis, and via the observational/experimental testing, and even via the axiomatization, for only the "surviving" fragments, i.e., for the empirically, observationally and/or experimentally <u>non</u>-falsified dogmas, of those disparate [e.g., former] schools of **Philosophy**. These historical definitions form the "backbone" of this model.

Overall, this model condenses to \underline{M}^{2^3} .

Below, we have suggested solutions for every one of the seven category-symbols -- initially 'algebraic <u>unknowns'</u> -- generated by this model. If you have historical anthropological background, can you further "flesh out" the "limbs"?



<u>Appendix 3</u>. <u>Diachronic</u> Application: A 'Contra-Boolean Model' of the History of Human Social Formation.

The formation of this model has been facilitated by the broad synthesis of historical, archaeological, and modern anthropological, ethnographic, and sociological material achieved by Robert Wright, in his book <u>Non-Zero</u>: *The Logic of Human Destiny*¹⁸, major portions of which are available online via the URL: <u>http://nonzero.org/chap2.htm</u>.

Wright's own summary of this synthesis is as follows: "...even after granting these early and occasionally momentous contacts, we are left with three large realms of ancient civilization, quite removed from each other: China, the Near East, and the New World. The scholarly consensus is that each developed its energy and information technologies -- farming and writing -- indigenously. And each underwent its early civilizational history in essential isolation from the others. *Yet, in all three cases, the same thing happened*. In all three regions, loosely defined <u>city-states</u> -- urban cores surrounded by farmlands and <u>villages</u> and *towns* -- seem to have evolved ... And these <u>city-states</u> merged, forming *multicity states*, and these *multicity states* grew into <u>empires</u>."

"The first large *multicity state* in Mesopotamia was the Akkadian *empire*, formed around 2350 B.C.[E.], when Sargon of Akkade conquered Sumerian *cities* in southern Mesopotamia. Sargon's conquests came with a divine seal of approval; having toppled a *city*, he asked the local priests to declare his victory the will of the Mesopotamian god Enlil. Perhaps to facilitate clear thinking on their part, he exhibited the vanquished local king in neck-stock. As a further aid to theological interpretation, Sargon installed his daughter as high priestess of the goddess Nanna at Ur, the religious capital of southern Mesopotamia."

"In east Asia, farming seems to have evolved a millennium or so later than in the Middle East, but its consequences followed just as surely: bigger *villages*, more artifacts, more trade, vaster conflict, bigger buildings, bigger realms of political control, starker status hierarchies ... An age of *chiefdoms* seems to have been reached by the late fourth millennium B.C.[E.], and in the second millennium B.C.[E.] came testaments to *state*-level organization: writing, cities, a king who could lead 13,000 men into battle and oversee epic engineering. All of this belongs to what is known as "the Shang civilization," but the suggestion of homogeneity may be misleading. Some scholars now dissent from the long-accepted Chinese view of a unified national past, and envision the Shang as much like early Mesopotamia: individual, perhaps amorphous, *city-states* that trade and battle, ally and fall out. ... *The main point is that the story in China moves in the same direction as the stories elsewhere*. The Shang's successor -- the Chou, who dominated the first millennium B.C.[E.] -- forged a vast *state* with many *cities*. But control was diffuse, and Chou principalities -- Ch'i, Ch'in, Chin, Ch'u, and others -- finally fell into open warfare. The Ch'in eventually prevailed, carrying Asian political unity to unprecedented scope. Hence the name China. ... Meanwhile, back in the Near East, more names had come and gone, and the regions they represented had continued to get bigger, if fitfully: the Assyrian <u>empire</u> dwarfed the Akkadian ... and was in turn dwarfed by the Persian <u>empire</u>..., which was then overcome by Alexander the Great (the "son of God" and "general governor and reconciler of the world"), whose Macedonian <u>empire</u> would soon be overshadowed by the Roman **Empire** [sic] (its emperor being "the savior of all mankind")."

"If in 200 B.C.[E.] the Han, or the Romans, had magically gotten a peek at life in the ... New World, they would have been unimpressed. A casual glance across the Americas would have suggested a hemisphere full of *savages* and *barbarians*; almost everywhere, social structure fell somewhere on the *spectrum* from simple *band* to *chiefdom*. But here and there, visible on close inspection, were cradles of *civilization*, small pockets where culture was crossing the hazy line between *chiefdom* and [*city*-] *state*. ...Monte Alban (in southernmost Mexico, near Guatemala), is reminiscent of the first big *city* in Mesopotamia, Uruk. In both cases, the *city*-to-be was at first a mere *town*, outshining its neighbors in size and architecture, and dominating them politically, in the classic fashion of a *chiefdom* 's *hub*[*-village*]. In both cases war and trade helped drive complexity upward, and in both cases information technology and urbanization proceeded hand-in-hand. In Monte Alban by 300 B.C.[E.] there were calendrical notations, and glyphs used to label sculptures of dead enemies. But Monte Alban was destined to be outclassed by Teotihuacán, a trading partner to the north that by A.D. [C.E.] 550, with 125,000 residents, would be one of the six largest *cities* in the world [at that time]...Teotihuacán is not to be confused with the nearby *city* of Tenochtitlán, the Aztec capital that, when seen by Cortez in 1519 [C.E.], housed around 200,000 people (more than any European *city* [at that time]) and anchored a *state* twice the size of Portugal. Cortez called Tenochtitlán "the most beautiful *city* in the world," and compared it to Venice...The *city*'s waterborne commerce involved tens of thousands of canoes, and its central marketplace, according to Cortez, could accommodate 60,000 buyers and sellers." [Non-Zero¹⁸, pp. **108-114**, square-bracketed commentary, & color-coded *text emphases added*].

The "backbone" of this model is the «aufheben» principle that a typical <u>Camp</u> unit is a 'meta-<u>band</u> unit', each one *initially* made up out of a typically heterogeneous multiplicity of <u>band</u> units; that a typical <u>village</u> unit is a 'meta-<u>Camp</u> unit', each one *initially* made up out of a typically heterogeneous multiplicity of <u>Camp</u> units; that a typical <u>chiefdom</u> unit is a 'meta-<u>Village</u> unit', each one *initially* made up out of a typically heterogeneous multiplicity of <u>Village</u> units; that a typical <u>city-State</u> unit is a 'meta-tribal', 'meta-chiefdom unit', each one *initially* made up out of a typically heterogeneous multiplicity of <u>tribal</u>, <u>chiefdom</u> units; that a typical <u>empire</u> unit is a 'meta-<u>city-State</u> unit', each one made up out of a typically heterogeneous multiplicity of <u>city-State</u> units; and that a typical <u>nation-state</u> unit' is a 'meta-<u>empire</u> unit', each one typically *initially* made up out of a disparate, heterogeneous multiplicity of the <u>fragmentary remains</u> of multiple, sometimes overlapping, <u>fallen</u>, multi-city-state <u>empire</u> units.

Overall, this model condenses to $\underline{\mathbf{b}}^{\mathbf{2}^{\mathbf{6}}}$

"Solving" the model below means *aptly* replacing each 2 marked below -- as well as those implied for all of the other "algebraic-<u>unknown</u>" category-symbols, not shown explicitly below, indicated only by ellipsis dots -- with either a specific category name/description, or with the ' ϕ ' sign. If you have historical/archeological expertise, can you cite certain ancient sites that instantiate these "<u>unknowns</u>"?

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<u>Appendix 4</u>. <u>*Diachronic*</u> Application: A 'Contra-Boolean' Model of the [Known] Natural History of Our Cosmos as a Whole. *Taxonomy Level One Categories Only*.

This model excludes the category of "*Dark Energy*", and the category of "*Dark Matter*", as both being, as yet, not sufficiently known to science to be coherently included in it. These categories are thus, in effect, assimilated into implicitude, in the $_0 \leftarrow = 0$ \leftarrow category, or, in this, <u>diachronic</u>, context, in the $_0 \leftarrow = 0$ \leftarrow category, that of the 'qualitative full zero' value, which we use to register the likely existence of as yet <u>unknown</u>, or <u>insufficiently</u> known, actualities. This value tacitly, invisibly accompanies/adds-into the entire sequence of series of this model, even though this value is not included explicitly in the diagram below. This value operates as the additive identity element in the wQ qualifiers' space, or qualifiers' set. Our "full zero" category-symbol for the <u>generic</u> context is $_0 \leftarrow = 1$.

Generically, the "backbone" of this model is the reconstructed, natural-historical, «aufheben» progression of the scaled self-similarity recurrences of <u>quantitative</u> self-expansions of the populations of a given scale of physical units. This leads to physical-spatial local concentrations of these units, and therefore, eventually, to coalescences, of some of these units, into 'meta-units'. These 'meta-units' thereby form a new, larger, more inclusive, and also <u>qualitatively different</u>, '<u>qualitatively higher</u>' scale of physical, kind of thing content. These 'meta-units' then, in turn, again self-proliferate and self-concentrate....

The kinds of "mechanisms", "forces", or "interactions", within each scale, that cause these coalescences, are apparently disparate. Our sciences have not yet achieved an exhaustive account of how each such mechanism gives birth to its successor-mechanism.

Each "limb" of this model is constituted by a sub-series of categories modeling the interactions, and combinations, and hybridizations among different 'qualo-quantitative' scales of physical units, each one subsumed by the most advanced, most inclusive kind of units, forged by such coalescence, for the epoch populated by that "limb".

More specifically, the "backbone" of this model is the «aufheben» principle that a typical <u>atom unit</u> is a '<u>meta</u>-"pa<u>r</u>ticle" unit', each one made up out of a typically heterogeneous multiplicity of "pa<u>r</u>ticle" units [e.g., of protons, electrons, and neutrons]; that a typical <u>molecule unit</u> is a '<u>meta</u>-atomic <u>unit</u>', each one made up out of a typically heterogeneous multiplicity of <u>atom</u> units; that a typical "<u>prokaryotic living cell" unit</u> is a '<u>meta</u>-molecular <u>unit</u>', each one made up out of a typically heterogeneous multiplicity of <u>molecule</u> units; that a typical <u>Qukaryotic living cell unit</u> is a '<u>meta</u>-prokaryotic <u>unit</u>', each one made up out of a typically heterogeneous multiplicity of prokaryote units; that a typical '<u>meta</u>-biotan [<u>meta</u>-zoan or <u>meta</u>-phytan] multi-[eukaryotic-]cellular organism <u>unit</u>' is a '<u>meta</u>-eukaryote <u>unit</u>', each one made up out of a typically heterogeneous multiplicity of prokaryote units; that a typical '<u>meta</u>-biotan [<u>meta</u>-zoan or <u>meta</u>-phytan] multi-[eukaryotic-]cellular organism <u>unit</u>' is a '<u>meta</u>-eukaryote <u>unit</u>', i.e., a typical 'anima<u>l</u>-society', is a '<u>meta</u>-meta-zoan <u>unit</u>', each one made up out of a typically heterogeneous multiplicity of <u>meta</u>-zoa unit<u>s</u>, i.e., of multi-cellular animal individuals, and that each typical <u>human society unit</u> arises as a '<u>meta</u>-[anima<u>l</u>-]socia<u>l</u> unit', each one made up out of a typically heterogeneous multiplicity of 'anima<u>l</u>-societies', as its 'mutually-interiorized', 'mutually-<u>domesticating</u>' unit<u>s</u>.

The diagram below is 'summited' by a '<u>meta-humanity</u>' category, which, we hold, is already, presently emergent from out of the most concentrated core of <u>humanity</u>, in our present epoch, on Earth. However, we also hold that <u>it</u> is, presently, only "fractionally" manifested / evident, empirically. <u>Its</u> emergence goes largely unnoticed by our present <u>human</u> population. We hold that three species of '<u>meta-humanity</u>', in terms of the bodily constitution and morphology of its ultimate units, are gradually gaining reality --

(1) a species characterized by the science/technology-mediated *self-re-engineering of our human genome*;

(2) a contra-genomic 'meta-human' species, via "Artificial Intelligence"-anchored android robotics, and;

(3) a species, *combining genomic self-re-engineering* and *android robot parts*, via **cyborg bionics/prosthetics**.

We hold that this prefigurative hypothesis -- or 'pre-construction' -- of an expected next stage of cosmological natural history, is plausible, based upon the evidence already at hand. However, we will not even begin to enter into the marshalling of that evidence here, given the limited scope of this introductory essay.

Overall, this model condenses to $\underline{\mathbf{r}}^{2^{\circ}}$.

"Solving" the model displayed below means *aptly* replacing each '? marked below, as well as those implied for all of the other "algebraic-unknown" category-symbols, not shown explicitly below, indicated only by ellipsis dots, with either a specific category name/description, or with the '*' sign. model "backbone" 1 model "<mark>limbs</mark>"

model	"backbone"	model "limbs"
τ = 8: ♠	₽	$\frac{\partial}{\partial h} \mathbf{h} = \frac{\partial}{\partial y} \longleftrightarrow \text{ predicted, presently only fractionally [\frac{\partial}{\partial}] manifest meta-humanity;$
	⊞	$ \begin{tabular}{lllllllllllllllllllllllllllllllllll$
	Ħ	
τ ∓ 7:	_ ₽	$ \overset{\bullet}{\otimes}_{ll} \mathbf{F} \equiv \overset{\bullet}{\otimes}_{\mathbf{h}} \longleftrightarrow \underline{\mathbf{h}}_{uman}[oid] \underline{meta} \cdot social ities^{19}, via social endosymbiosis/symbiogenesis^{20}; $
	⊞	$ \ \ \ \ \ \ \ \ \ \ \ \ \ $
		 ▲ ▲ ▲
 τ = 6 : ▲	⊑	$\widehat{\Psi}_{bb} \vdash = \widehat{\Psi}_{\ell} \longleftrightarrow proto-language based animal [and plant] socialities;$
	⊞	
	Ħ	
 τ = 5: ♠	₽	$\widehat{\Theta}_{ee} \vdash = \widehat{\Theta}_{b} \longleftrightarrow meta-\underline{b}iota - \underline{meta-phyta} \otimes \underline{meta-zoa}; \underline{multi-eukaryotic-cellular organisms};$
	⊞	
	⊞	
τ = 4: ↑	⊑	$\widehat{\mathfrak{P}}_{pp} \mathbf{F} \equiv \widehat{\mathfrak{P}}_{e} \longleftrightarrow \underline{e}^{ukaryotic \ living \ cells}, via \ cellular \ endosymbiosis/symbiogenesis^{20};$
	⊞	◈ ◈[੫៉ ₁₉ ←∃]∜ _{pr} ⊦≡፻◈[੫៉ ₁₀ ←∃]∜ _{pa} ⊦≡፻◈[੫៉ ₁₁ ←∃)∜ _{par} ⊦≡፻…
	È	
τ = 3: 1	₽ <mark>.</mark> ← →	$ H \equiv \Re_{p} \longleftrightarrow \text{ pre-eukaryotic/"prokaryotic" living cells;} $
	⊞	 ⊕
τ = 2 : ▲	₽←=) ₩	$ \widehat{P}_{aa} \vdash = \widehat{P}_{m} \longleftrightarrow \underline{molecules}; $
	≖ ¤ ←∃	
1		Prr Pa ♦ ≈
τ = 0 :	4.←∃	$ r \equiv p\underline{\mathbf{r}}e\text{-atomic "pa}\underline{\mathbf{r}}ticles". $

Introduction to 'Contra-Boolean' Thinking, **v.2.0**, by Karl Seldon. **21**

End Notes.

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- Ivor Grattan-Guinness, Gérard Bornet, editors, George Boole: Selected Manuscripts on Logic and its Philosophy, Boston, MA: 2. Birkhäuser Verlag, 1997, pp. 5, 7, 13, 17, 33-34, 41, 47, 51, 53-54, 57-63, 64-67, 69-71, 75-76, 112-113, 184, 186-189, etc.
- 3. George Boole, The Mathematical Analysis of Logic: Being an Essay towards a Calculus of Deductive Reasoning, Sterling, VA: Thoemmes Press, 1998 [hereinafter referenced as MAL].
- 4. George Boole, An Investigation of the Laws of Thought on which are Founded the Mathematical Theories of Logic and Probabilities, New York, NY: Dover Publications, Inc., 1958 [hereinafter referenced as LOT].
- **LOT**, *ibid.*, pp. 47-48. 5.
- Cf. Ivor Grattan-Guinness, Gérard Bornet, editors, ibid., pp. 98-101. 6
- 7. LOT, ibid., p. 4.
- 8. **LOT**, *ibid.*, p. 408.
- 9. Nicholas Rescher, Dialectics: A Controversy-Oriented Approach to the Theory of Knowledge, New York, NY: State University of New York Press, 1977, p. 46.
- 10. See, for example, Walter Kaufmann, translator & editor, Hegel: Texts and Commentary, Garden City, NY: Doubleday, 1966, p. 33.
- For Plato's philosophy of "the kinds" [e.g., as «gene» categories], see E. Hamilton, H. Cairns, editors, Plato: The Collected Dialogues, 11. Princeton, NJ: Princeton University Press, 1989, pp. 522 [Phaedrus, 274d-277d], 998-999 [Sophist, 253b-254a], 1025-1026 [Statesman, 262a-c]. For a brief -- and ancient -- introduction to Aristotle's philosophy of the «Katêgoriai», i.e., of the categories, see Edwin W. Warren, translator, Porphyry the Phoenician: Isagoge, Toronto: Pontifical Institute of Mediaeval Studies, 1975.
- Charles Saunders Peirce, Collected Papers, Volume I, Principles of Philosophy, Book III., Phenomenology, Chapter 3., A Guess at the 12. Riddle, 1. Trichotomy, Cambridge, MA.: The Belknap Press of Harvard University Press, 1974, p. 183. See also Boole, LOT, ibid., pp. 50n, 51.
- 13. Non-algebraic "recipes" -- "heuristics" -- mostly ineffectual, abound. See, for example, Arthur B. VanGundy, <u>Techniques of Structured</u> Problem Solving, New York, NY: Van Nostrand Reinhold Company, 1981.
- 14. See, for example, Stuart A. Kauffman, The Origins of Order: Self-Organization and Selection in Evolution, New York. NY: Oxford University Press, 1993, pp. 38, 42.
- Using $\underline{\mathbf{E}}$, as the \mathbf{W} generalization of the calculus of finite differences operator \mathbf{E} , which commands the shifting of its operand to the 15. consecutive next value of that operand, this "*first times last nets next*" recipe, for category-symbol-by-category-symbol, category-symbols-sum advance, can be formulated, ideographically, as follows: $\underline{\mathbf{E}} \underbrace{\mathbf{H}}_{0}^{\mathsf{w}} \equiv \underbrace{\mathbf{H}}_{0}^{\mathsf{w}+1} = \underbrace{\mathbf{H}}_{0}^{\mathsf{w}} \boxplus [\underbrace{\mathbf{H}}_{1}^{\mathsf{w}} \boxtimes [\underbrace{\mathbf{H}}_{1}^{\mathsf{w}} \boxtimes \underbrace{\mathbf{H}}_{1}^{\mathsf{w}} \boxtimes \underbrace{\mathbf$

wherein $\underline{H}_{0}^{1} = \underline{H}_{0} \equiv \underline{\Pi}_{11}^{1}$, & wherein the symbol ' ---+ , commands the operation of the extraction of the most advanced

category-symbol from the $\mathbf{H}_{\mathbf{0}}^{\mathbf{w}}$ sum of a count of $\mathbf{0} < \mathbf{w} \in \mathbf{W}$ distinct category-symbols, representing qualitatively different, "consecutive" categories. This, generic, formula covers the specific cases of both synchronic models & diachronic models.

- See: Thomas Aquinas, Summa Theologica, Notre Dame, IN: Christian Classics, 1981; Isaac Asimov, The Foundation Trilogy, 16. New York, NY: SFBC Science Fiction, 1974; Joseph Campbell, *The Masks of God: Primitive Mythology*, New York, NY: Penguin Group, 1991; Pierre Teilhard de Chardin, The Phenomenon of Man, New York, NY: Harper & Row, Colophon Books, 1975; J. T. Fraser, Of Time, Passion, and Knowledge, Princeton, NJ: Princeton University Press, Inc., 1990; James G. Frazer, The Golden Bough, New York, NY: Avenel Books, 1981; Jean Gebser, The Ever-Present Origin, Athens, Ohio: Ohio University Press, 1991; J. K. Rowling, Harry Potter and the Deathly Hallows, Scholastic, Inc., 2007; J.R.R. Tolkein, *The Lord of the Rings*, Boston, MA: Houghton Mifflin Co., 1987; Paramahansa Yogananda, Science of Religion, Mansfield Centre, CT: Martino, 2015; Swami Sri Yukteswar, The Holy Science, Mansfield Centre, CT: Martino, 2013.
- 17. See, for example, Lee Smolin, Roberto Unger, The Singular Universe and the Reality of Time: A Proposal in Natural Philosophy, Cambridge: Cambridge University Press, 2015.
- Robert Wright, Non-Zero: The Logic of Human Destiny, New York, NY: Pantheon Books, 2000. See also the website offering major 18. portions of the content of this book online, and free of charge: http://nonzero.org/chap2.htm.
- 19. See, for example, Pat Shipman, *The Animal Connection*: A New Perspective on What Makes Us Human, New York, NY: W. W. Norton & Company, 2011. See also Jon Franklin, *The Wolf in the Parlor*, New York, NY: Henry Holt and Company, 2009.
- Lynn Margulis, Victor Fet, editors, <u>Symbiogenesis</u>: A New Principle of Evolution, Cambridge, MA: Harvard University Press, 2010. 20. We see the 'self-bio-endosymbiosis' of the prokaryotes, creating the eukaryotes, and the 'self-socio-endosymbiosis' of the animal societies, leading to human 'meta-societies', as but special cases of the general principle of «aufheben» 'self-meta-unit-ization'.