Ultrawords for Hebrews 1:3.

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Abstract: Hebrews 1:3 states that He is ". . . sustaining all things by his powerful word." The General Intelligent Design (GID) (mathematical) model establishes the scientific rationality of this statement.

1. Introduction.

In 1963, Abraham Robinson applies the original form of nonstandard analysis to the semantics of a formal language (Robinson, 1963). In particular, he employs a set of individuals U, of an appropriate cardinality, and a set of first-order (lower predicate calculus) statements K that hold for members of U. He then generates a nonstandard model U', for which the K and other statements not members of K hold.

Relative to a first-order predicate language L, he states:

> We now suppose that certain subsets of U are regarded as the constituents of a language L of a first order predicate calculus. That is to say, there are certain disjoint sets of individuals of U, of adequate cardinal numbers, which serve as brackets, commas, connectives ($\sim$, $\wedge$, and $\vee$), quantifiers ($\forall$ and $\exists$), variables, individual constants, relations and functions of L. . . . Going further, we suppose that the terms and well-ordered formula (wff) of L also constitute subsets of U ("L-terms", "L-wff") (Robinson, 1963, p. 90).

Robinson is viewing the members of such sets as the informal objects investigated within Mathematical Logic. To form an L-wff an individual needs to follow a detailed informal procedure. Thus, the sets so obtained are informally defined. This leads to further informal definitions for various relations relative to such a formation process. He then considers the nonstandard extension U' of the U. The model, in this case, needs to be a first-order model. There are two ways to gain information from this model. The most direct is by considering a direct first-order translation or by use of the notion of an interpretation. The last sentence in the following is such a translation.

> Passing to U', we see that the relations which in U define the various sets of L-symbols and L-formula, define corresponding sets in U'. . . . The extended language will be denoted by $L'$and, accordingly, we shall refer to its variables, connectives, and so on, as L'-variables, L'-connectives, etc. Now let F and F' be the sets of L-wff and L'-wff, respectively. Then $F \subseteq U$, $F' \subseteq U'$ and F is a proper subset of F'. . . . Thus, for every

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non-standard natural number l in U' there exists an L'-sentence whose length exceeds l (Robinson, 1963, p. 91).

Robinson applies these notions to semantics and I have no doubt that he conceptually considers L'-sentences as having the same type of symbolic constituents and order properties as those of the L-sentences. However, as pointed out by Mendelson (1987, p. 28), mathematical logic modeling only requires members of a language to be "arbitrary objects rather than just linguistic objects." Thus, the Robinson approach can be viewed on a technical level as Mendelson states. On one hand, a language is composed of actual physical entities that satisfy various relations and, on the other hand, they are merely arbitrary "abstract" objects, such as sets or individuals, that satisfy corresponding abstract relations. The abstract entities are then interpreted in terms of the informal notions.

Applying the more recent developments in nonstandard analysis (Herrmann, 1978-93), in particular the now customary polysaturated enlargement superstructure approach, the external cardinality of such Robinson L'-sentences can be greater than the cardinality of the entire superstructure. Thus, relative to the presently accepted physical universe in which we dwell, such L'-sentences are not physically expressible completely. They are conceptual, but they are physical-like in character for the GGU-model substratum.

How does one describe such sentences? A basic approach to the predicate calculus is to assume a denumerable collection of variables, and a finite or denumerable set of predicates which leads to sentences of arbitrary finite length employing an arbitrary number of finite non-repeated symbolic forms (Mendelson, 1987, p. 55). Consider one-place predicates $\mathrm{P}_i(x)$. Then conceptually, for any natural number n, $\exists x_1 \ldots \exists x_n(\mathrm{P}_1(x_1) \vee \ldots \vee \mathrm{P}_n(x_n))$ is an L-wff. According to Robinson, this statement implies that there is an exactly similar L'-wff. Using "new" predicate symbols, one informally conceives of this as the form $\exists x_1 \ldots \exists x_l(\mathrm{P}_1(x_1) \vee \ldots \vee \mathrm{P}_l(x_l))$. But, can such an L'-statement be more formally represented?

In Herrmann (1978-1993), the notions of **universal logic** are applied to a general language L. Formal languages form a proper subset of L. A "word" is a finite collection of symbols or images combined in a specific observable manner. It is also called a "readable sentence." Words are combined to form other words via a semigroup operator introduced, informally, by Markov. With the addition of the empty word, this becomes a monoid.

The collection of all "words," W', constructed from L is coded via an informal bijection $i\colon \mathrm{W}' \to \mathbb{N}$. Two approaches are now employed, this original coded approach or a Robinson-styled approach, where the standard language is considered as a set of set-theoretic atoms (Herrmann, (2014a)). In most cases, the results are independent from which approach is applied and in Herrmann (2013) a "generic" symbol is employed as a representation for either choice. (In Herrmann (1978-1993), the notation $\mathcal{W}'$ is used for the W'.)

In the coded approach, the coded entities take on the same names as their domain counterparts. As done by Robinson, entities associated with the selected set of atoms also take on the appropriate interpreted names. For this article, the original approach using the informal coding can be employed with the understanding that it directly corresponds to the Robinson approach. The function i simply acts like a "translator" and a strict meta-world comparative interpretation relates the nonstandard members of the formal model directly to members of W' via the inverse of i. There is a natural correspondence between the informally defined relations on L and their formal standard superstructure counterparts. However, the function i itself is not considered as a member of the superstructure. Thus, members of a $[f] \in {}^*\mathbf{L} - \mathbf{L}$ need not be translatable into words taken from L. This fact is highly significant for the GID-model interpretation.

The modeling is based upon informal set-theoretic definitions and relations, which are then embedded into a formal standard set-theoretic superstructure. This structure is then embedded into a non-standard structure. The rational interpretation follows by relating, in a strict manner using a fixed set of terms, entities within the nonstandard structure to those in the standard structure that have the same properties and often the same "names" as the original informal entities to which they directly correspond. The symbolic form indicates whether the "language" is the informal, embedded standard or nonstandard although the term "language" is used in these three cases. *The GID-model comparative interpretation employs informal standard terminology and for the predicted nonstandard entities a modified standard terminology.*

As indicated by $[f]$ above, this coding is further refined via equivalence classes that contain finitely many partial sequences that model the various finite orderings of the symbol strings that produce the exact same word-element. Each equivalence class $[f]$ contains two special partial sequences, f_n, f_0. The partial sequence f_n is interpreted as an ordered "alphabet" composition of the word and f_0 is the numerical code for the entire word. Such words are combined via an operator $\circ$, which, as a monoid, is formally defined in Herrmann (2013, p. 6-7). Due to a consistent interpretation relative to the standard superstructure, the actual origin of the numerical values for each of the partial sequences is not significant since this is an analogue model for the consistent behavior of interpreted entities.

These equivalence classes yield a mathematical model that employs only the natural numbers as its basic component and yields more formalizable statements for the purpose of transfer to the nonstandard model. For a standard language L, this yields the nonstandard coded "language" ${}^*\mathbf{L}$. Within this language, there are entities that "behave" like "alphabet" symbols and correspond to the necessary additional entities that correspond the necessary portions of $\ldots \vee \mathrm{P}_l(x_l)$ to elements in ${}^*\mathbf{L} - \mathbf{L}$.

Various relations that describe the properties of language-elements are, in general, informally defined. As mentioned, when embedded into the nonstandard model, they are **interpreted** via a language similar to the informal language that defines an original coded entity. Great significance is placed upon the formal transfer to ${}^*\mathbf{L}$ of formal first-order statements relative to $\mathbf{L}$. It is through the use of meta-world concepts, interpretation and comparison that additional information is gained.

2. Deduction.

For the GID-model portion of the GGU-model, mental activity corresponds to linguistic practices relative to a general language. The modern methods of "star" transform do not directly yield new information about the relation between the nonstandard objects and the standard ones. All such acceptable investigations employ meta-mathematics, when the model is viewed from the meta-world. All of the rules that govern formal deduction are informally expressed. An actual deduction can be difficult to obtain. It has been shown that given the standard set of rules and any natural number n, that there is a "logical theorem" (a tautology) that takes more than n-steps to establish formally at the last step. Of course, each step in a formal "proof" is a deduction. The informal rules involve recognizing, indeed, searching for word-forms, choices and application of a few specific substitution procedures. It need not be the case that the most general collection of these rules, unless a coding is accepted, are considered as completely expressible in a formal first-order language.

The GGU-model, even in the secular case, employs procedures that mimic deductive processes. However, for the GGU-model, the rules that yield deductions are much easier to apply since they are restricted to but a few distinct linguistic patterns. This simplification also leads to other modes of presentation. For the GGU-model and its GID-model interpretation, the **basic informal pattern**, relative to simple words, is a collection of hypotheses of the form A, and "If A, then B." where distinct $\mathrm{A},\ \mathrm{B} \in \mathrm{L}$. Since this is not ancient Greek, where no spacing was used between symbol strings, and to correspond to the actual Markov word-forms, a "spacing" symbol $|||$ is used for this general language approach. This yields the form "If$|||$A, $|||$then$|||$B." Then these are gathered into a standard but simplified form of presentation (I) $\mathrm{A}|||\mathrm{If}|||\mathrm{A},|||\mathrm{then}|||\mathrm{B}.|||\mathrm{If}|||\mathrm{B},|||\mathrm{then}|||\mathrm{C}.|||\mathrm{If}|||\mathrm{C},|||\mathrm{then}|||\mathrm{D}.|||\cdots$ and represents a finite length hypothesis, where the $\mathrm{A}, \mathrm{B}, \mathrm{C}, \mathrm{D}\ldots$ are distinct members of L. For the GGU-model, a developmental and instruction paradigm so presented has a "length" as measured by the increasing sequence of natural numbers. However, for application to "formal deduction" this word is considered as decomposed into the collection $\{\mathrm{A},\ \mathrm{If}|||\mathrm{A},|||\mathrm{then}|||\mathrm{B}.,\ \mathrm{If}|||\mathrm{B},|||\mathrm{then}|||\mathrm{C}.,\ \mathrm{If}|||\mathrm{C},|||\mathrm{then}|||\mathrm{D}.,\ldots\}$.

The rule of inference is **modus ponens**. A general description for this simplified deductive process is: Take A and find the "If A, then B." statement in the set of hypotheses. Then write down as a deductive step the B entity. Now repeat this process but start with the B, and so forth. This indicates the actual mental activity required in order to achieve the required deductive results. This generates an informal consequence operator (operation) that corresponds to a formal standard operator relative to the **L**. In Herrmann (1978-93), a deduction algorithm is viewed relative to a corresponding consequence operator, which does not itself display the algorithm. A more detailed process, the **logic-system**, that produces this operator has been introduced (Herrmann, (2001, p. 94)). This approach allows for a more formalized presentation.

Logic-systems are generally informally defined. They are very general in nature and are used to investigate general languages and universal logics. For the above example, except for the additional set-theoretic details, this may seem, at first, not to be a great improvement. But, such logic-systems have varying presentations. The hypotheses form a u-ary entity, that is a set. For this basic example, (II) $\{\mathrm{A},\ \mathrm{If}|||\mathrm{A},|||\mathrm{then}|||\mathrm{B.},\ \mathrm{If}|||\mathrm{B},|||\mathrm{then}|||\mathrm{C.},\ \mathrm{If}|||\mathrm{C},|||\mathrm{then}|||\mathrm{D.},\ldots\}$ which directly corresponds to the word (I). Then the rules of inference form a collection of 3-tuples $\{(\mathrm{A},\mathrm{If}|||\mathrm{A},|||\mathrm{then}|||\mathrm{B.},\mathrm{B}),(\mathrm{B},\mathrm{If}|||\mathrm{B},|||\mathrm{then}|||\mathrm{C.},\mathrm{C}),\ldots\}$, relative to the distinct elements A, B, C, ... taken from a general language L. Independent from how one mathematically models a general language and universe logic, the actual language elements taken from L are those expressed by statements such as (I) or corresponding members of sets such as the set of hypotheses in (II).

The refined mathematical model is, however, based upon the logic-system (III) $\{\mathrm{A}\}$ and the collection $\{(\mathrm{A},\mathrm{B}),(\mathrm{B},\mathrm{C}),\ldots\}$. The logic-system algorithm states: Using the u-ary entities or a deduced entity, find in the additional collection of n-tuples, $n > 1$, the first $n-1$ coordinates. Then the nth coordinate is the one deduced and can be used for further deductions. Notice that using this rule for deduction (II) yields A, B, C, ... in the indicated order. Using the "simpler" (III) logic-system, which does not include a mimic for modus ponens, the same "deduced" results are obtained in the same order.

In Herrmann, (2013), a slight modification to (III) and the algorithm was introduced. In this special case, the algorithm is further set-theoretically simplified and, as such, it is more easily characterized. This is done only for set-theoretic convenience and corresponding simpler set-theoretic expressions. It is the algorithm employed for certain recent refinements and yields the same results as the propositional modus ponens process applied to restricted linguistic patterns. However, the GID-model interpretation for the predicted results employs the strict terminology that is employed for the basic informal pattern.

3. Ultrawords.

In Herrmann (2013, p. 25), the following statement is found "Consider an appropriate (q,r), x, a, b and any $\lambda \in \mathbb{N}_\infty$. There is an ultra-logic-system ${}^*\mathbf{\Lambda}^{(q,r)}(x,\lambda)$ and ${}^*\underline{\mathcal{A}}(({}^*\mathbf{\Lambda}^{(q,r)}(x,\lambda),\{{}^*\mathbf{F}^{(q,r)}_{\nu,\gamma,\lambda}(a,b)\}))$."

The specialized notation for this expression can be suppressed when an interpretation is rendered. The symbols (q,r) indicate the type of universe being generated. The $\{{}^*\mathbf{F}^{(q,r)}_{\nu,\gamma,\lambda}(a,b)\}$ behaves like a single hypothesis, and ${}^*\mathbf{\Lambda}^{(q,r)}(x,\lambda)$ behaves like the (III) binary system. The ${}^*\underline{\mathcal{A}}$ behaves like the logic-system algorithm. This all corresponds to the form (I) and the separated (II) form and basic modus ponens deduction when interpreted. In each case, for the GID-model and mental-like activity, ${}^*\underline{\mathcal{A}}$ represents that of an higher-intelligent agent. This agent's mental activity is "greater than" any form of "infinity" that is set-theoretically definable (Herrmann, (2014b)).

The standard coded language $\mathbf{L} \subset {}^*\mathbf{L}$ and ${}^*\underline{\mathcal{A}}(({}^*\mathbf{\Lambda}^{(q,r)}(x,\lambda), \{{}^*\mathbf{F}^{(q,r)}_{\nu,\gamma,\lambda}(a,b)\})) = D \subset {}^*\mathbf{L}$ and, depending upon the components employed, D is either a **hyperfinite** developmental or instruction paradigm. The ${}^*\underline{\mathcal{A}}$ generates these paradigms in the appropriate order that, at the least, yields the step-by-step generation of a (q,r) type universe.

For notational simplicity, let $\omega < \xi,\ \omega, \xi \in {}^*\mathbb{N}$ and the hyperfinite ordered $D = \{D_i \mid \omega \leq i \leq \xi\}$, where ω, ξ depend upon the type of (q,r) universe being considered. Each $D_i = [d_i] \in {}^*\mathbf{L}$. Let $f_0(0) = i(\&)$. Assume that the symbol coded $i(\&)$ is not used to represent a symbol in any of the $[d_i]$. Via the properties of ${}^*\mathbf{L}$ there exists an entity $W \in {}^*\mathbf{L}$ of the form $[d_\omega]\,{}^*\!\circ[f_0]\,{}^*\!\circ[d_{\omega+1}]\,{}^*\!\circ[f_0]\,{}^*\!\circ\cdots{}^*\!\circ[f_0]\,{}^*\!\circ[d_{\xi-1}]\,{}^*\!\circ[f_0]\,{}^*\!\circ[d_\xi] = W$. The W is an **ultraword** and portions can be decoded and directly related to linguistic expressions within the standard language L. For the strict interpretation applied to ${}^*\mathbf{L}$, this ultraword corresponds to the symbolic form $\mathrm{A}_\omega\&\cdots\&\mathrm{A}_\xi$ taken from a generalized first-order propositional calculus, where the individual conjuncts $\mathrm{A}_i = [d_i]$ are *deducible by an higher-intelligence.

4. The Participator Universe.

Note: In this section, the foundations for the participator universe have been completely altered and this new approach replaces the corresponding entity found in the original Section 9 in Herrmann, (2013-08-23).

For the GGU-model, one of the most difficult requirements is to include the concept of the "participator" universe. As stated at the May 1974 Oxford Symposium in Quantum Gravity, Patton and Wheeler describe how the existence of human beings alters the universe to various degrees. "To that degree the future of the universe is changed. We change it. We have to cross out that old term 'observer' and replace it with the new term 'participator.' In some strange sense, the quantum principle tells us that we are dealing with a participator universe." (Patton and Wheeler (1975, p. 562).) This aspect of the GGU-model is only descriptively displayed in section 4.8 in Herrmann (2002). It is now possible to obtain, in a somewhat more formal manner, the collection of universes that satisfies this participator requirement. For simplicity and for our universe, it is assumed in this section that a single-complexity type universe is used throughout. The universe in which we dwell is one that needs to satisfy the notion of participator alterations.

For simplification purposes, a special set-theoretic definition was previously employed, which is interpreted as a specific member of the language L or, in this case, **L**. In what follows, this simplification is not employed. In the set-theory employed, an ordered pair (a, b) is the set $\{\{a\}, \{a, b\}\}$. Thus, a binary logic-system is such a collection. For the participator model and $m > 1$ finitely many participators, let partial sequence $g_0(0) = i(\wedge)$, and none of the Section 3 ultrawords W_p contains the coding $i(\wedge)$. There is a member of ${}^*\mathbf{L}$ of the form $W_1 \,{}^*\!\circ[g_0]\,{}^*\!\circ \cdots {}^*\!\circ[g_0]\,{}^*\!\circ W_m = W'$. Logic-systems are generally defined and as such are not dependent upon the language employed. Thus, one can define a logic-system relative to such members of ${}^*\mathbf{L}$. In this case, this is a metamathematical definition.

Let $\Sigma = \{(x, y) \mid (x = W') \wedge (y = W_p) \wedge (1 \leq p \leq m)\}$. This is a binary relation logic-system definition. Let $A^{(q,r)}$ denote the logic-system operator defined by the informal logic-system rule. Thus $A^{(q,r)}$ is applied to Σ and the hypothesis W' and then each of the W_p is "deduced." When, at least, portions of this hypothesis are viewed informally, then corresponding informal language defined relations are acceptable within Mathematical Logic. For example, "Thus, we have in U one place relations $Q_v(x)$ 'x is an L-variable', $Q_c(x)$ 'x is an L-connective', $Q_f(x)$ 'x is an L-wff', $Q_s(x)$ 'x is an L-sentence', etc." (Robinson, (1963, p. 90)). From this view point, since $\mathbf{L} \subset {}^*\mathbf{L}$ and each member of **L** can be decoded and is a member of a general informal language, then, for the GID-model, a modified informal-styled but strict interpretation has continually been applied to ${}^*\mathbf{L}$. Thus, the hyper-linguistic expression W' is an ultraword. The logic-system corresponds to a hyper-propositional tautology and the logic-system algorithm is equivalent to a hyper-form of modus ponens deduction.

The entity W' is an hyperfinite member of ${}^*\mathbf{L}$. As now known, the cardinality of each hyperfinite entity is greater than the cardinality of the standard superstructure itself. Thus, for the GID-interpretation such "deduction" is a higher-intelligence deduction. Although apparently unnecessary for our present universe, these results can be extended to a denumerable set of participators, in which case Σ and $A^{(q,r)}$ are external entities.

5. A Theological Interpretation.

In Hebrews 1:2-3 (NIV), we find ". . . through whom he made the universe. The Son is the radiance of God's glory and the exact **representation** of his being, sustaining all things by his powerful word." The Greek used here is not the term "logos" but rather the term "rhema" that has numerous textual meanings. As analyzed in Herrmann (1984), it a "supernatural" linguistic entity, an utterance, that is "spoken," at least, from a mental viewpoint. In this case, being a representation, then the standard attribute transfers to the predicted higher-intelligence form. The above ultrawords, as interpreted as a string of linguistic entities that convey "information," are not physical entities and, hence, satisfy this Biblical concept. Such rationally defined ultrawords model God's higher-intelligence attribute as represented by Hebrews 1:3, where an appropriate universe is produced from an ultraword in that the collection of acceptable altered universes is produced via hyper-deduction. Then each developing universe is sustained by application of higher-intelligence deduction to an ultraword and the changing of "thoughts" into physical reality. The method that chooses a specific development can be produced as described in Herrmann (1978-93), where the appropriate instruction-entity is chosen, or through a special intervention.

These are my final remarks as to the correspondence of Hebrews 1:3 and it being a representation that corresponds to the standard developmental paradigm and its generation.

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