A Special Event Sequence for $[0, c)$ or $[0, +\infty]$ types: Zero Observer Time Interval But Nonzero Nonstandard Primitive Time Interval

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In the extended form, the alphabet $\mathcal{A}$ that generates each word in the informal language L can be considered as a nonempty finite collection or $\mathcal{A}$ can be in one-to-one correspondence with the natural numbers. I note that in mathematical logic there is a difference between a symbol for a natural number or other types of mathematical objects and the objects themselves, if they are but abstract mathematical objects that satisfy sets of axioms. The grouping of the members of an event sequence d is modeled after a collection of rational numbers. Using the new form (Herrmann, 2006), the grouping can be generated in a fixed manner as follows: Let K be rather large natural number. One might taken it as 10^{200}, say. Actually any nonzero natural number can be used. It may need to be taken large depending on the analysis employed. Now each standard primitive time notion is first related to the set of rational numbers. For each integer i (i.e. $i \in \{\ldots, -3, -2, -1, 0, 1, 2, 3, \ldots\} = \mathbf{Z}$) define for each natural number $n \in \{0, 1, 2, 3 \ldots\} = \mathbb{N}$

$$t_{(i,n)} = t_{in} = \frac{1}{K}\left(i + \frac{2^n - 1}{2^n}\right) = \frac{1}{K}\left(i + 1 - \frac{1}{2^n}\right). \tag{1}$$

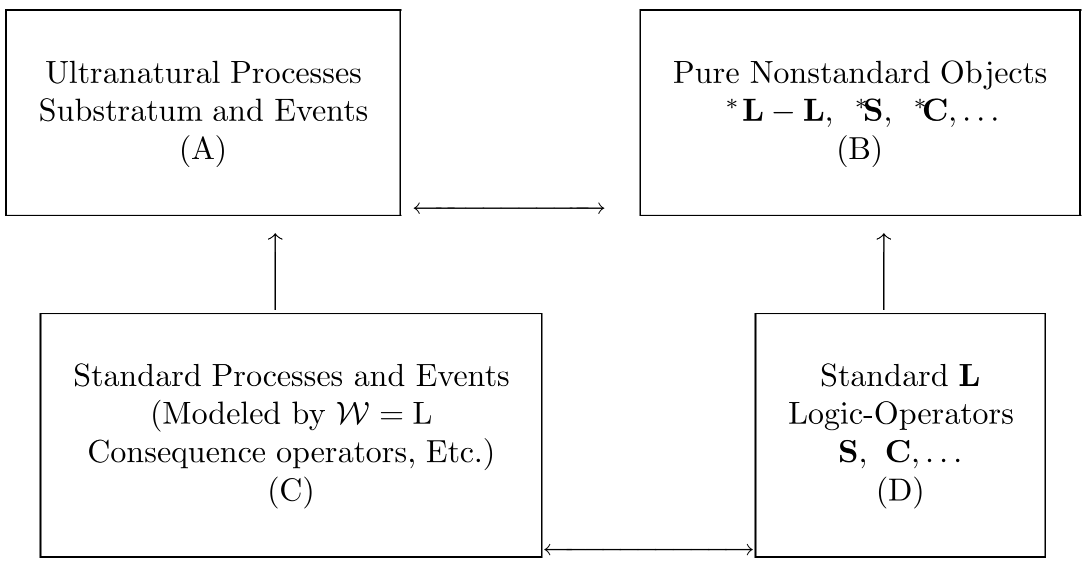
These $t_{(i,n)}$ are in one-to-one correspondence with a subset of L and are used to identify the $\mathrm{F_{(i,n)}}$ members of d. The rational number ordering preserves the "ordered pair" ordering (Herrmann, 2006) and induces an order $<_d$ on d.

Each "word" in the informal language L is a finite nonempty (with repetition allowed) collection of alphabet symbols, with a special spacing symbol |||. Thus, the term "word" can be an entire book, a library, etc. Mathematically the set of all words $\mathcal{W} = \mathrm{L}$ is embedded into a mathematical structure in a special manner, and the result of this embedding is denoted by $\mathcal{E} = \mathbf{L}$. Given any member of $\mathbf{L}$, technically, the embedding can be undone and the original informal member of $\mathcal{W}$ identified. However, this is a mathematical model **for behavior** of members of L and the actual objects being investigated in standard $\mathbf{L}$ are finite sequences of natural numbers. Thus, an actual encoding or representation for a word in $\mathcal{W}$, in the mathematical model, is associated with a set of ordered pairs. (Actually, a finite set of such sequences.) For example, $\{(0, 32), (1, 34), (2, 16), (3, 16)\}$ may be one of these associated sequences, where $\mathrm{n}' \sim 32$, $\mathrm{q}' \sim 34$, $\mathrm{p} \sim 16$, and this sequence represents the informal word $\mathrm{n}'\mathrm{q}'\mathrm{pp}$.

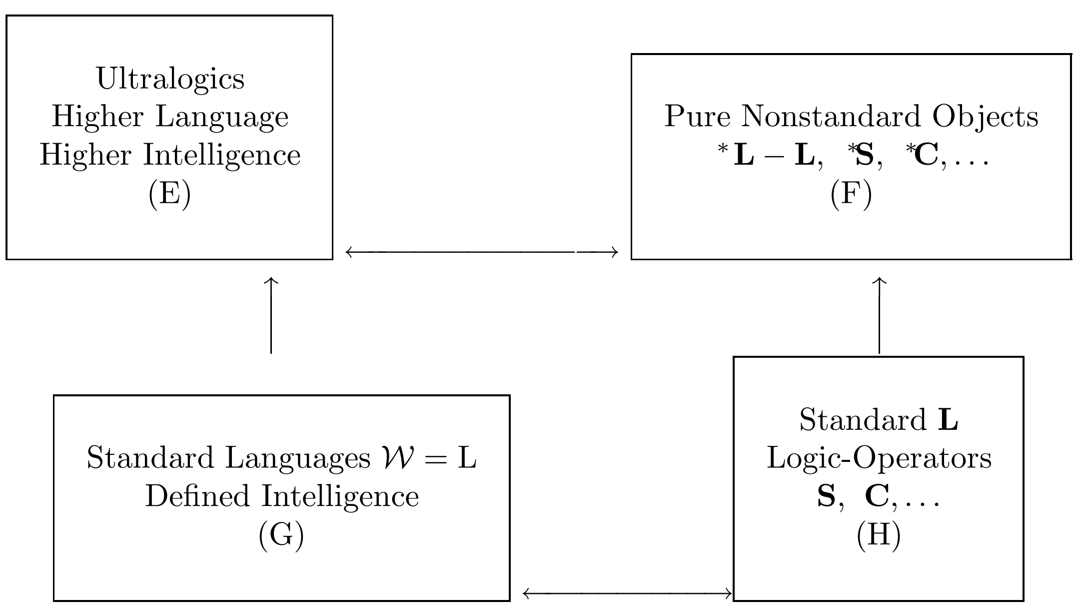
A developmental paradigm or event sequence d is an informal sequence of members of L that is then embedded as a sequence into the standard mathematical structure and becomes $\mathbf{d}$. Each member of d contains a symbol that identifies it with a unique $t_{(i,n)}$. Under equation (1), each d is in one-to-one correspondence with the set of natural numbers. Equation (1) is not part of the sequence of mathematical images, the range members, but, as is customary, it represents an external model for the behavior of the $t_{(i,n)}$. [Mathematical expressions that appear to control physical behavior are not, in general, displayed by the physical images of physical objects being controlled.] Consider the following pictorial representation for how portions of the embedding are related. For this illustration, essentially, the standard mathematical theory of the real numbers and the like is considered as part of (C), (D), (G), (H). The difference is that L is not encoded in (C) and (G), while it is encoded in (D) and (H).

Informal — Math. Structure

The GGU-model



The GID-model



The terminology and corresponding objects used in (A) are directly and consistency associated with the corresponding terminology and objects in (B) and this extends the terminology used in (C). The objects in (A) and (C) can be compared relative to properties. The terminology and corresponding objects used in (E) are directly and consistency associated with the corresponding terminology and objects in (F) and this extends the terminology used in (G). The objects in (E) and (G) can be compared relative to properties.

For simplicity, consider that rational number interval $[t_{(-1,0)}, t_{(0,0)}) = \{q \mid q \in$ rational numbers, $t_{(-1,0)} \leq q < t_{(0,0)}\}$. Some members $t_{(-1,n)}$ of this interval are analyzed. Note that (1) still "controls" the depicted members of **d**. There is a one-to-one correspondence f from the set of natural number $\mathbb{N}$ into $[t_{(-1,0)}, t_{(0,0)})$ denoted by $f\colon \mathbb{N} \to [t_{(-1,0)}, t_{(0,0)})$ and defined by $f(n) = t_{(-1,n)},\ n \in \mathbb{N}$. Since each $t_{(i,n)}$ corresponds to a distinct member of d and its representation in **d**, then for each $n \in \mathbb{N}$, $f(n)$ corresponds to a unique member of d and its representation in **d**. Note that although members of d may be unique in that they have different identifiers, some could have no physical content (they might only contain a single word such as |||), or two or more could have equal physical content. *I accept that there is an underlying ordering within nature for the developmental of a physical-system and these symbols for the $t_{(i,n)}$ can aid in comprehending such an ordering. If such an ordering is not accepted for the development of physical-systems, then the symbols used are but modeling artifacts and the "word" in which they are used can be ignored.*

When the function f is analyzed in the Math. Structure, you obtain a function ${}^*f$ that maps (functionally relates), the nonstandard natural numbers ${}^*\mathbb{N}$ to the nonstandard set of rational numbers ${}^*\mathbf{Q}$. In particular, for any $\lambda \in {}^*\mathbb{N} - \mathbb{N}$ (i.e. the nonstandard natural numbers contained in (B) and (F)).

$$ {}^*f(\lambda) = \frac{1}{K}\left(-1 + 1 - \frac{1}{2^\lambda}\right) = -\frac{1}{K2^\lambda}. \tag{2} $$

The number $-\frac{1}{K2^\lambda} = \epsilon$ is a nonzero Robinson infinitesimal in (B) and (F). A significant property for ϵ is the following: For any rational or even real number $q < 0$, it follows that $q < \epsilon$. Further, when d is embedded into the Math. Structure one obtains the set ${}^*\mathbf{d}$ and $F_{(-1,\lambda)} \in {}^*\mathbf{d} - \mathbf{d}$ and is in (B) and (F). Such $F_{(-1,\lambda)}$ correspond to members in ${}^*\mathbf{L} - \mathbf{L}$ due to the "identifiers" that do not appear in any member of L. Analysis shows that, except for the identifier, each such $F_{(-1,\lambda)}$ can contain for all other members, members from **L**, or just a portion of its members from **L** and the remainder from ${}^*\mathbf{L} - \mathbf{L}$, or all members from ${}^*\mathbf{L} - \mathbf{L}$. Depending upon their use, such events are called "nonstandard or ultranatural events." Suppose for what follows, that d is identified with rational number in $[0, c),\ c > 0$, or $[0, +\infty)$. Then, at the least, finitely many of the individuals $F_{(0,\lambda)},\ \lambda \in {}^*\mathbb{N} - \mathbb{N}$, can be accorder symbolic names not in L. Since these are not in standard L, these symbols are termed as "nonstandard symbols," are interpreted as members of a "higher language," and, as mentioned, each $F_{(0,\lambda)}$ is termed as (depicting) a nonstandard or ultranatural event. Special nonstandard event sequences can be defined that would be very difficult to analyze in detail.

Let $\Gamma \in {}^*\mathbb{N} - \mathbb{N}$. Consider the internal set of infinitesimals $E = \{-1/(K2^x) \mid (x \in {}^*\mathbb{N})$ and $(x \geq \Gamma)\}$. By considering restrictions of nonstandard extensions of standard functions, there is a collection of (internal) functions with domain E and codomain ${}^*\mathbf{L} - \mathbf{L}$ in the Math. Structure that preserve the identifier process (i.e. an h such that $h(x) = F_{(-1,x)} \in {}^*\mathbf{L} - \mathbf{L}$). ("Internal" functions actually need not be used for this purpose.) This means that they relate each member of E to single members of ${}^*\mathbf{L} - \mathbf{L}$ and the members are identified by something that corresponds to $t_{(-1,\lambda)}$. The general Axiom of Choice allows for a choice of any of these functions say h. Except for general statements such as those made above, such members of such a function's range yield little information as to what they are depicting. It is important to notice that this "interpretation" uses new terminology for (A) that has something in common with the terms in (C). The reason for this is that if you have various relational behaviors depicted in (C), in many cases, such behaviors are replicated in (A). For comparison purposes, suppose that there is (C) type F'_n that has actual physical content different from that of the (C) type $\mathrm{F}_{(0,0)}$ and $\mathrm{F}'_\mathrm{n} <_\mathrm{d} \mathrm{F}_{(0,0)}$.

Observer time is related to *alterations* in members of d, where the identifiers correspond to standard values, that are not just identifier alterations. Hence, to have the notion of observer time one needs two or more such standard members of **d** that have different physical content. But no matter how small nonzero $|q|$ might be, if $q < 0$, then by definition of the external h, the only members that could supply a type of physical content are of the $F_{(-1,\lambda)}$ type. But each of these is modeled by the primitive time $-1/(K2^\lambda) = \epsilon$ such that $q < \epsilon < 0$. A way to describe this is to state that *If there was an observer time interval prior to the event* $\mathrm{F}_{(0,0)}$, *then all of the nonstandard events* $h(\lambda)$ *would "appear" to occur over zero observer time.* If the range of h is adjoined to ${}^*\mathbf{d}$, it would not affect the analysis of the internal ${}^*\mathbf{d}$.

Now there is another somewhat similar result that is always interpreted as having, at the least, an indirect affect upon our physical world. The objects used for this are all members of (B) and (F). As an illustration, consider the primitive time interval $[0, 1/K)$. An event sequence d relates in a one-to-one manner each value of the primitive time function $k(0,n) = 1 - \frac{1}{K2^n}$ with $\mathrm{F}_{(0,\mathrm{n})} \in \mathrm{L}$. The result of this correspondence is an event subsequence d_0 of d. That is, you can consider $k(0,n)$ as generating these values. By indexing the values over the natural numbers, one obtains the nonstandard subsequence ${}^*\mathbf{d}_0$ of ${}^*\mathbf{d}$. Due to the method of identification used, each ${}^*k(0,\lambda)$ corresponds to a member of ${}^*\mathbf{d} - \mathbf{d}$. For intuitive comprehension, assume that there is a $\mathrm{F}_{(1/\mathrm{K},0)} \in \mathrm{d}$. Intuitively, the interpretation in (A) is that the ultranatural events $F_{(0,\lambda)} \in {}^*\mathbf{d} - \mathbf{d},\ \lambda \in {}^*\mathbb{N} - \mathbb{N}$ are all grouped "to the left in primitive time" of $\mathrm{F}_{(1/\mathrm{K},0)}$ and whatever their indirect affects may be they can again be described as occurring over zero observer time. Some of these ultranatural events can be analyzed in more detail. They are considered as a type interface that is required in order to "hold together" the entire **d** and, hence, by implication d.

Herrmann, Robert A. 2006. http://arxiv.org/abs/math/0605120