The Use of LaTeX for Advanced Linguistic Illustration

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Abstract

In this article, the author recounts his experience as a LaTeX novice — following the painful realization that conventional text-processing packages together with their equation editors fell short of both the technical features and reliability required to author a book of sufficient scope and precision to capture the model of language articulated in bits and pieces by Benjamin Whorf.[1] The article consists principally of a theoretical and formal sampling of the finished work in LaTeX attire, including illustrative equations written in *MINDMATH* — the system of notation developed by the author for the task at hand. The formatting options employed in tandem with the formalism, including integration of supporting definitions and axioms, illustrate the functionality of LaTeX while illuminating the Weltanschauung of Whorf.

Following an excursion into the author's background, the formal appointments necessary to interconnect language, thought, and reality are defined and formalized, leading to a statement of Whorf's principle of linguistic relativity[2] in plain-vanilla form:

(1) $$\oint_{\mathcal{M}x}^{\mathcal{K}x} \mathsf{@Lng}\colon \Big\triangleright \{\mapsto \forall\Lambda\}^{[\triangleq]}_{\nearrow}\{\boldsymbol{X}\} \looparrowright {}_{j}\underline{\underline{\mathbb{M}}} \lessdot \Big\}^{\sharp}$$

A sampling of other equations is given to illustrate the rudiments of *MINDMATH* and LaTeX in their application to fundamental task-specific linguistic operations. BibTeX in tandem with the natlib and hyperref packages serve as the basis for citations and hyperlinks in the article. Given the all-inclusive scope of Whorf's thesis, the author elected to entitle the book devoted to it *LANGUAGE in Capital Letters* (*LICL* for short) and its theoretical base simply *LANGUAGE*.<Lytle, 2009m> Chapters of the book and the model are referenced under these names respectively.

The purpose of the article is not to expound at length upon the author's work but, rather, to exemplify for other writers the flexibility of LaTeX as a tool applied to novel, mathematically-oriented authoring tasks.

[1] Whorf, in tandem with his linguistic mentor, Edward Sapir, was a leading spokesman for the principle of linguistic relativity. For epistemologists at large as well as parties interested in scientific modeling, the author's book on the subject <Lytle, 2009a> is now available online in its first formalized edition. See `http://www.language-icl.com/`.

[2] Whorf never spoke personally of relativity as a 'theory' nor in terms of 'linguistic determinism' in 'weak' or 'strong' versons and the like. All of this is 'hear.say.say.say ...' Rather, he referred to it in his own writings simply as a 'principle' whose validity was so obvious as to not require proof.

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1 Professional Background

The author, albeit self-taught in computer science, has long-term experience in computer programming as well as in the design and development of linguistic-programming languages<Lytle, 1990> and text-formatting systems<Lytle, 1986>. Needless to say, this background facilitated the author's entrance into the intricacies of LaTeX, especially when buttressed by the extensive documentation bundled with the package, supplemented by a library of books <see, for example, Kopka and Daly, 2007, and Mittelback and et al., 2007> — not to mention TUG<TUG, 2009> plus assorted internet forums and blogs.

2 Academic Background

That said, the specialization of the author is applied and theoretical linguistics[3] in the tradition of Benjamin Whorf, a 'renaissance man' par excellence who defined the 'linguistic order' to include *"all symbolism, all symbolic process, all process of reference and of logic"*<Whorf, 1998, pg. 252>. The following rehearsal of past developments in linguistics provides background for subsequent material in the article which features the power of LaTeX for advanced linguistic illustration.

2.1 Model Wars

In the late '60s, while targeting the topic of his Ph.D. dissertation<Lytle, 1971>, the author developed the *Junction Grammar Model of Language* (*JG*)<Lytle, 1979a, 1974; et al., 2004> as a reaction to the incumbent paradigm.[4] *JG* was anchored in algebraic production rules (J-rules) having both operators and operands, complemented by coding grammars which negotiated *sign-signifier*[5] transitions at the interfaces between and among the several 'tracts' comprising the *JG* model. Lytle <2009a, pg. 61> summarizes the argument for this approach:

> ... any model based on a concept of linguistic structure centered in combinations and permutations of words organized by brackets, parentheses and their labels (branching tree diagrams) is — **IN PRINCIPLE** — incapable of either properly representing or explicating what are typically considered 'semantic' phenomena. ... 'Leave out the plus sign and *addition* has NO meaning, NOR can it support semantic interpretation.'<Jackendoff, 1972>[6] By the same token, leave out the operators in linguistic production rules, and the structures generated are literally 'nonsensical.'

[3] Ph.D., Univ. of Illinois (Champaign/Urbana), 1971.

[4] Reference is made to Noam Chomsky's *Transformational Generative Grammar* (*TGG*), a model of 'syntax' centering on concatenations and permutations of words generated by *rewrite/phrase-structure rules* (P-rules) followed by structural manipulation effected by *transformational rules* (T-rules)<Chomsky, 1957>; <Chomsky, 1965>.

[5] The *LANGUAGE* model formalizes the *sign-signifier* relation of de Saussure <1986>.

[6] The fallacy of omitting operators in linguistic representation is a point also made by Millett in his comparative discussion of structuring in *JG* and other models at `http://www.language-included.com/Chap8/Page_8-02/page_8-02.html`

2.2 Biological Base

A second quarrel of the author (AND other more eminent writers) with *TGG* was that it operated in a biological vacuum, implicitly discounting in its design the fact that language is facilitated by an ensemble of specialized anatomical fixtures. In the words of Edelman<Edelman, 1992>, it makes no sense to posit *"mental software that does not exist a priori and then claim that it doesn't matter what hardware (neuralware?) it runs on."* In effect, *TGG*'s proponents had conceptually 'fragmented' their model into so-called *syntactic, semantic, phonological, etc.*<Chomsky and Halle, 1968> components rather than ordering it with respect to biological 'tracts' which, while performing specialized functions, unified their operation by way of sign-signifier linkages.[7] Worse still, the path from the kernel constructions of *TGG*'s 'deep structure' to 'surface structure' via transformation was all paved by a single data type consisting of lexical strings. To quote Lytle <2009c>:

> A RATHER PECULIAR GAP in *linguistic structuralism*, a paradigm founded by Swiss linguist Ferdinand de Saussure <1986> during the first decade of the 20th century, is the widespread acceptance of the *sign* with its dual components (*signifier-signified*) — but with no corresponding biological components in linguistic models to clarify the 'why's' and the 'wherefores' of the linkage phenomenon. In a word, while the literature is replete with *production rules, transformational rules, morphophonological rules, etc.*, there appear to be no *signification* rules per se. One of the objectives of the present *JG* upgrade effort is to refine the formulation of sign-mapping components in *JG* so as to better elucidate what *linkage* — at least in their case — actually entails.

2.3 Tracts and Data Types

The literature of *JG* has long-cited an analogy to make its point.<Adapted from Lytle, 1979a> In nature, we find that animals and plants group together as distinct species and that the boundaries between them are rather firmly drawn. To be sure, animals cross-breed within species and undergo adaptation to some extent therein, but not between them.

> LINGUISTIC DATA TYPES appear to be similarly constrained by virtue of the functional diversity of the tissues and organs which constitute the human capacity for speech. For example, code designed to activate the musculature of the vocal tract could not be used to drive the writing hand, nor to stimulate the neurological tissues of any "semantic" tract. Hence, from the perspective of junction theory, it would be wrong-headed to fuse these codes as though they belonged to a single representational system. Rather, it would be necessary to maintain them separately, in order to satisfy the unique content and formalism of each, and then, additionally, **to facilitate linkage and transit between them as necessary.**

The failure of linguistic science to make this principle a basis for its work is largely responsible for the **embarrassing absence**, at this late date, of the at least relatively unified base from which other scientific disciplines launch their investigations. **Correspondingly, 'linguistics' remains unlisted under the sciences — or, for that matter, any other heading — in the public**

[7] We have reference, of course, to the *vocal tract, audio tract, etc.*

Figure 1: Hibrid Data Types

school curriculum. The crux of the problem may be seen as rooted in the naive practice of 'cross-breeding' data types in unnatural ways ...

Thus, while the resulting offspring are plentiful,[8] *captivating in their infancy and, perhaps promising in their youth, they have a way of aborting prematurely, or developing fatal post-natal deformities. Still others mature as impotent mules, as it were, or as 'linguicorns,' if you will, which have no counterparts in reality, but exist only in the world of what might be termed 'mythological linguistics.'*[9]. ⟸

3 Unsatisfied Notation Requirements

Returning now to *JG*, the J-rule schemata of the model eventually charted what may be regarded as the linguistic counterpart of chemistry's *Periodic Chart of Elements*[10]. It turned out, however, that the formal basis for their generative power<Lytle, 1979a> — coupled with formal paraphernalia for the model's coding grammars<Gessel, 1975> and their associated linkages — while eliminating the need for either P-rules or T-rules, gave rise to new graphic display requirements. This need subsequently intensified when it became apparent that the fundamental structural patterns appearing in the slots of the *PCCS*, were, as perceived by Whorf, everywhere present in the material world as well.

> All that I have to say on the subject that may be new is of the PREMONITION IN LANGUAGE of the unknown, vaster world — that world of which the physical is but a surface or skin, and yet which we ARE IN, and BELONG TO[11] ...

[8] Lytle <2009l, Still Warming Up> lists a dozen existing off-shoots of *TGG* with the likelihood of new sprouts at any time. Add to these an equal or larger number of insurgents.

[9] We note parenthetically that LaTeX has more than ample features for both creating and importing images. The above caricature is imported from <Lytle, 1979a>

[10] Referred to in the literature of *JG* as the *PCCS*(*Periodic Chart of Constituent Structures*).

[11] For an application of this patterning to the description of articulatory dynamics, see Lytle <1979b>.

> Speech is the best show man puts on ... But we suspect the watching Gods perceive that the order in which his amazing set of tricks builds up to a great climax has been stolen – from the Universe!<Whorf, 1998, pg. 248-249>

3.1 A Higher Order of 'Governing Dynamics'

Moreover, it became apparent that 'governing dynamics' of a higher order were involved in the pragmatic selection and use of linguistic structuring (see Section 11, *Modes of Scripting* below).

WHAT WAS NEEDED, in effect, was a notation sufficiently flexible and powerful to formalize the whole of Whorf's conceptual model — a model synthesizing LANGUAGE, THOUGHT, and REALITY while at once retaining as a natural subset the generative and explanatory power of *Classical Junction Grammar*.

4 Definitions and Other Formal Constructs

In order to set foot upon the 'unknown vaster world' marked out by Whorf, it was first necessary *in point of fact* to expand the definition of *language* to incorporate '*all symbolism, all symbolic process, all process of reference and of logic,*' as per his afore-noted stipulation<Whorf, 1998, pg. 252>, i.e. an expanse inclusive of any system of coding whatever, regardless of form or medium of expression. Luckily, a thoughtfully designed feature of LaTeX/ is its `theorem` package<Kopka and Daly, 2007, pg. 80>, which facilitates formatting formal constructs (including definitions) in an optimally visible way while at once numbering and tracking them for reference.

THE AUTHOR found it helpful for cross-reference purposes to state key concepts formally as the writing progressed and — as a device for retrospective global evaluation benefiting both author and reader — to collect them and append them to the book when brought to closure<see Lytle, 2009f and Lytle, 2009h>.

By way of illustration, we include next below working definitions constructed for 'language,' 'LANGUAGE,' and 'scripting' in LaTeX format, followed by an `axiom/corollary` sequence[12] central to the *LANGUAGE* thesis. Glance at Section 5 for clarification of the usage of bold-letter identifiers.

Definition 4.1 (Language ($\mathcal{L}$))**.** *We define* 'language' *(adj. 'linguistic') as symbolic, structural specification in the abstract, whether reflexive or nonreflexive, irrespective of the medium in which it is realized.*

Definition 4.2 (LANGUAGE)**.** *The universal, meta-physical system of organization and governance under* $\mathcal{K}$*oncience,* $\mathcal{L}$*anguage, and* $\mathcal{M}$*ateria which forms the basis of the JG Model Upgrade.*

Definition 4.3 (Scripting)**.** *We employ the term* 'scripting' *to denote linguistic activity in general (or the result of it) and the term* 'script' *to denote a particular linguistic formulation.*

[12] The author's rationale for differentiating between axioms, corollaries, and lemmas is spelled out in the foreword to <Lytle, 2009h>.

Axiom 4.1 (Universal Dominion)**.** *Individually primal,* $\mathcal{K}$*onscient agents are innately and variously empowered by the* $\mathcal{K}$*-Forces of their respective klasses and domains to structure (organize) and to superintend matter in the* kosmos.[a]

[a]It is left as an exercise for the reader to 'kontemplate' the difference in meaning between *cosmos* and *kosmos* as well as other terms where 'k' (for $\mathcal{K}$) supplants 'c' in the spelling.

Corollary 4.1.1 (Presence of MIND)**.** *There exists presence of* MIND *in* MATTER *and presence of* MATTER *in* MIND*.*

Corollary 4.1.2 (Mind Over Matter)**.** $\mathcal{K}$*-Forces, mentally applied, are in principle kapable of directly inskribing* $\mathcal{M}$ *with their preskriptive konstructs.*

Corollary 4.1.3 (Universal Purview)**.** *There exists no truly* unsigned *(*passive*) scripting in the kosmos (*`Section` *10.2), i.e. no structured phenomenon exists which does not fall within the purview of* $\mathcal{K}$*-Forces.*

Corollary 4.1.4 (Primal Will)**.** *One's sense of self-konscious being, agency, and rationality is PRIMAL (by definition) and therefore not supervenient upon any material mechanism known or unknown to science — conversely,* 'mekhanism*' (material order) in the world flows from and is supervenient upon it.*

5 Primes – One Force plus Two Factors

The sense of the bold-face identifiers in the above-cited definitions, axioms, and corollaries is as follows: After repeated attempts to arrive at a set of primes able to unify the three-fold dimensionality of language emphasized by Whorf AND exemplified everywhere in the ordinary intercourse of every-day living, it occurred to the author that one FORCE plus two FACTORS were invariably involved — namely:

1. An author/coder.
2. A specific coding system.
3. A (re)presentational medium.

WITH THIS RESULT, it became evident that Whorf had taken definitive leave of the long-standing polemics of 'monist' and 'dualist' traditions by entering a cosmos ruled by a TRIAD of metaphysical primes. Under *LANGUAGE*, it turns out, other time-worn dichotomies 'dissolve'[a] as well, including *empiricism vs. rationalism, neumenal vs. phenomenal, idealism vs. realism, humanities vs. sciences, syntax vs. semantics, science vs. religion,* and, of course — last but not least — *language vs. thought.*

[a]Wittgenstein averred that when linguistic questions are properly clarified, paradoxes and other philosophical problems simply 'dissolve' of their own accord.

5.1 $\mathcal{K}, \mathcal{L}$ and $\mathcal{M}$

LANGUAGE primes can be conveniently labeled by three successive letters of the alphabet, namely, $\boldsymbol{\mathcal{K}}$, $\boldsymbol{\mathcal{L}}$ and $\boldsymbol{\mathcal{M}}$.

• ($\boldsymbol{\mathcal{K}}$) For the FORCE (first prime), a neologism (*konscient/konscience*) was introduced, signifying 'an agent/agency knowing that it knows'.

• ($\boldsymbol{\mathcal{L}}$) For the first FACTOR (second prime), Whorf's designation of the LINGUISTIC ORDER was borrowed.

• ($\boldsymbol{\mathcal{M}}$) For the second FACTOR (third prime), a neologism (sng.*materium*)/(plur.*materia*) was introduced to round out the TRIAD.

THESE GENERIC IDENTIFIERS may be subcategorized as necessary to reflect distinct *orders* of $\boldsymbol{\mathcal{K}}$-Force functionality, either in terms of ontological groupings or $\boldsymbol{\mathcal{K}}$omptence. For example, orders of $\boldsymbol{\mathcal{K}}$ are posited for $\boldsymbol{\mathcal{K}}$-*Forces* operative in humans, plants, living cells, K-12 Grade Levels, etc.; orders of $\boldsymbol{\mathcal{L}}$ reflect specific classes of natural and synthetic languages (aka *coding systems*), even as orders of $\boldsymbol{\mathcal{M}}$ reflect the material conglomerates of categories and constituents utilized by distinct languages and their *transpositions*.

Illustrative Orders of $\mathcal{K}$	
$\mathcal{K}\varnothing$	K–*Forces* vacuum (theoretically not possible)
$\mathcal{K}k$	K–*Forces* in patently rational creatures
$\mathcal{K}c$	K–*Forces* in living tissue
$\mathcal{K}e$	K–*Forces* in atoms and molecules
$\mathcal{K}q$	K–*Forces* in quantum mechanics
$\mathcal{K}\mathbb{C}$	K–*Forces* in computers (synthetic proxy)
$\mathcal{K}\Omega$	K–*Forces* theoretically 'above' (SETI)
$\mathcal{K}\omega$	K–*Forces* theoretically 'below' (microbes)
$\mathcal{K}\blacktriangledown$	K–*Forces* of Flip Wilson Muse (comedy)
Illustrative Orders of $\mathcal{L}$	
$\mathcal{L}$@Natural Languages	Employed by patently rational creatures
$\mathcal{L}$@DNA Languages	Codes operative in living tissue
$\mathcal{L}$ @Chemistry Notation	Structural dynamics of atoms and molecules
$\mathcal{L}$@Quantum Math	Structural dynamics of quantum mechanics
$\mathcal{L}$@Computer Languages	Computer Programming (synthetic)
$\mathcal{L}$@UFO Languages	Theoretically 'above' (SETI)
$\mathcal{L}$@DNA Languages	Theoretically 'below' (microbes)
$\mathcal{L}$@Devil talk	Flip Wilson Muse (comedy)
Illustrative Orders of $\mathcal{M}$	
$\mathcal{M}nd$	Materium of MIND LANGUAGE
$\mathcal{M}lx$	Materium of lexical expression
$\mathcal{M}ph$	Materium of dynamic articulation
$\mathcal{M}rk$	JG Markup Materium
$\mathcal{M}tr$	Motor Response Materium
$\mathcal{M}gr$	Graphic Materia (alphabets, etc.)
${}_{Visual}\mathcal{M}cn$	Materium of visual sensation
${}_{Audio}\mathcal{M}cn$	Materium of audio sensation
${}_{Olf}\mathcal{M}cn$	Materium of olfactory sensation
${}_{Etc}\mathcal{M}cn$	Residual materia of entire 'sensorium'

6 The Whorf 'Effect"

People generally do not yet know that the forces studied by linguistics are powerful and important, that its principles control every sort of agreement and understanding among human beings, and that sooner or later, it will have to sit as judge while the other sciences bring their results to its court to inquire into what they mean.<Whorf, 1998, pg. 232>

–Benjamin Whorf

The table cited directly above[13] illustrates of the 'Whorf effect,' namely, the exponential proliferation of structured phenomena intruding upon LINGUISTICS ('linguistics' in caps)<Lytle, 2009g> in consequence of Whorf's all-inclusive redefinition of 'language' — coupled with the respective SEMANTICS<Lytle, 2009j> of myriad coding systems. We thus discover, after merely skirting the domain which Whorf staked out in the name of 'linguistics', the import of his (in)famous declaration quoted under the section header.

For those with doubts regarding the utility and/or reality of *LANGUAGE* primes relative to $Notation_x$, Lytle <2009e, pp. 322> issues the following challenge:

SIMPLY PROVE that the disputed notation is not based on any systematic form of symbolism (no $\mathcal{L}$), operates independently of any categorization or basis of reference (no $\mathcal{M}$), or is devoid of logic (no $\mathcal{K}$) — which is to say: NO *LANGUAGE* primes. **The irony in this is, of course, is that to prove these points about a particular notation is to prove its utter uselessness and irrelevance to anything at all!**

IN APPLYING SAID NEGATIVE PROOF the author is convinced that the analyst will come away with an appreciation for the universality of *LANGUAGE* primes. The truth is that everyone who sets pen to paper would do well to determine precisely how these apply to the scripting project at hand and what their particulars happen to be in the target setting. This done, the values required for the signature of a *MINDMATH* expression (equation) are at hand (see below 10.2).

7 Exploiting the Powers of LaTeX

Needless to say, as the formalization progressed — and the number and internal formating of variables, special identifiers, and stock expressions became burdensome to type repeatedly — the author discovered and exploited the newcommand option proffered by LaTeX to construct meaningful shorthand for coding sequences used repeatedly.

[13]The LaTeX longtable package facilitated construction of this table. Had it been too long for its start page, the table would have been automatically extended to successive pages.

TO WRITE THIS ARTICLE, the author simply selected and pasted the set of relevant command definitions from the preamble of *LANGUAGE* into the preamble of the article. The motivating concept of LaTeX as an open source system is, of course, that the author too could supply upon request a package of this same stock material for others interested in writing *MINDMATH* expressions.[a]

[a]Whereupon the marginal coding techniques of a novice would no doubt be streamlined by LaTeX experts and passed on in improved form.

Purely as a matter of convention, the author elected to employ the LaTeXś mathcal font to prefix primal identifiers (e.g., $\mathcal{K}$), mathfrak to represent inscribed identifiers (e.g., $\mathfrak{F}\mathfrak{F}$), and so on.<See pg. 143 Lytle, 2009c, for more detail on font usage>. Further, it became necessary to define bracketing which corresponded to a variety of situations, such as, for example, whether a particular scripting event happened to be iterative '$\{\!\{ \}\!\}$', iterative volitional '$\big\{\!\!\lhd \big\}$' or non-volitional '$\oslash\!\!\big\{ \big\}\!\!\oslash$', and so on. Again, the inventory of brackets provided by LaTeX math resources proved to be more than sufficient to accommodate the contrasts required when overlays of supplementary symbols were used<for a comprehensive listing, see Lytle, 2009e, *Bracketing*>.[14]

8 The Three-Place *LANGUAGE* Relation

Therefore, given $\mathcal{K}$, $\mathcal{L}$, and $\mathcal{M}$ as the primes of the *LANGUAGE* model, analogous to the two-term set-theoretical affirmation

(2) $\boldsymbol{x} \in \boldsymbol{X}$ 'x is an element of X'

given $\mathcal{K}\boldsymbol{x}$, $\mathcal{L}\boldsymbol{x}$ and $\mathcal{M}\boldsymbol{x}$ as instances of $\mathcal{K}$, $\mathcal{L}$, and $\mathcal{M}$ in a scripting event, we have the three-term relation

(3) $((\mathcal{L}\boldsymbol{x} \ltimes \mathcal{K}\boldsymbol{x}) \Rsh \mathcal{M}\boldsymbol{x})$ ('$\mathcal{L}\boldsymbol{x}$ is a script of $\mathcal{K}\boldsymbol{x}$ in $\mathcal{M}\boldsymbol{x}$')

Definitions for '$\ltimes$' and '$\Rsh$' are given in the explanatory gloss. *Note the numbered equations. As of this juncture, we begin to exploit LaTeXś extensive options for formating, numbering, and — in the background — labeling equations and expressions for cross-reference* <see, e.g., Mittelback and et al., 2007, Chapter 8>.

9 The *LANGUAGE* Continuum

By incorporating $\mathcal{K}$ as the PRIMAL FORCE and defining it as a PRINCIPLE OF INTELLIGENCE<see Lytle, 2009d, *Principle of Intelligence*> exercising individual agency, RELATIVITY becomes intrinsic

[14]The optimal solution, of course, would be to build the required symbols from scratch via METAFONT (or resources akin to it), but at this juncture the author has not as yet acquired the expertise to accomplish this.

to the *LANGUAGE* system. Consequently, natural languages are not 'planetary' phenomena, but morph into spectral variations of similarity and difference which manifest openly as the blend of idiolects, dialects, and national languages which extend themselves as a *language continuum* 'up and down' the length and breadth of the globe. Correspondingly, each linguistic event ($\boldsymbol{\mathcal{L}x}$) transpires at some point on the continuum as a function of a particular $\boldsymbol{\mathcal{K}x}$ scripting in some $\boldsymbol{\mathcal{M}x}$.

10 About *MINDMATH*

10.1 Basis for Conflation

PRESCRIPTION, INSCRIPTION, DESCRIPTION (Section 11) — as well as other scripting operators and operands — are comparable to those of conventional mathematics in the sense that they typically consist of multi-step/part phenomena represented by a single symbol. The mechanics of long division, for example, are not reflected in the expression '**23765/34529**', but must be supplied by either the person doing the calculation or a computer algorithm.

In the course of developing *MINDMATH*, it has often been the case that once algorithms or sets of linguistic calculations coalesced as a factor found to occur repeatedly in diverse environments to achieve a particular end, it became convenient to conflate the notation by introducing special symbols for them. In such cases, therefore, the 'MINDMATICIAN' is to consider the patterning of the higher-level phenomena represented by them, holding associated mechanical minutiae in reserve unless application or discussion requires them.

10.2 The *MINDMATH* Scripting Signature

To represent the *continuum*, purely as a matter of convention, we adopt the '$\rightsquigarrow$' symbol. Further, to represent a 'summation' of FORCES and FACTORS active in a particular linguistic event on the continuum, we borrow '$\int$' from Leibnitz and synthesize to obtain '$\oint\!\!\!\!\rightsquigarrow$'. Finally, to incorporate all three primes into a header for scripting events, a SIGNATURE (cf. music notation) is employed which facilitates specification of each prime as a prefix to the actual scripting activity to be described:

(4) $\oint\!\!\!\!\rightsquigarrow_{\boldsymbol{\mathcal{M}x}}^{\boldsymbol{\mathcal{K}x}} \boldsymbol{\mathcal{L}}$@Lang: $_{\boldsymbol{x}}\boldsymbol{Svar}$

The LaTeX source for this expression employs `newcommand` definitions in the preamble to streamline repeated coding of SIGNATURE elements. In this case, the verbatim code is:

```
\lsig^{\Kx}_{\Mx}\ \bk \bk \mcL \textsf{@Lang:} \ _xSvar
```

By convention, given that '$\boldsymbol{\mathcal{L}}$' is redundant in the context of the `@Language` identifier, it may be omitted. Thus, for example, to customize a scripting event for authorship, language, and materium (lexicalization in this case), one might write:

(5) $\oint_{\mathcal{M}lx}^{\mathcal{K}-Fred}$ @Germ: ${}_{x}\boldsymbol{Text}$

In *MINDMATH*, since the conventional subscript slot is reserved for specification of $\mathcal{M}$, ordinary subscripts are preposed to their variables — hence ${}_{x}\boldsymbol{Text}$ as opposed to $\boldsymbol{Text}_{x}$.

10.2.1 Complex Signatures

(6) $\oint_{\mathcal{M}x\ldots}^{\mathcal{K}x\ldots}$

To represent certain phenomena it becomes necessary to add complexity to the basic components of the *scripting signature*. For example, some linguistic events entail sequential mappings among orders of $\mathcal{K}$ and $\mathcal{M}$as they transit multiple linkages. In such instances it is convenient to express the superscript and subscript of the kontinuum symbol as extended limits.

(7) $\oint_{\mathcal{M}x}^{\mathcal{K}x}\left[\frac{@Lng}{WaveForm}\right]:Svar$

Also, to describe input from $\mathcal{K}$-*Side* channels (i.e., $\mathbf{2}^{nd}$-Person channels such as voice, print, etc.), the @Lang specifier must be structured to expose the multi-factor materia involved. Fraction format is employed for this purpose inasmuch as $\mathcal{K}$om codings become client components of the host *materia*.

(8) $\oiint_{\mathcal{M}nd\ldots Au\mathcal{M}cn}^{\mathcal{K}k\ldots\mathcal{K}e}\left[\frac{@Lng}{WaveForm}\right]:Svar$

Optionally, the continuum symbol may be compounded to highlight the layered nature of the event described.

For examples of the use of these refinements to the signature, see Section 17. *MINDMATH* provides addition options for:

- Updating signatures.<Lytle, 2009e, Updating>
- Amending signatures.<Lytle, 2009e, Amending>
- Omitting signatures.<Lytle, 2009e, Omitting>

When $\mathcal{K}$and $\mathcal{M}$ values are either implicit, all-inclusive, or not to the point, it is convenient to write scripting expressions in their *passive*, or *unsigned* form (see Section 12.1.

11 Modes of Scripting

Analysis of linguistic activity gives rise to the observation that our use of language falls into three pragmatic categories. Either we are (1) stating/formulating/inducing a principle (formula, law, blueprint, recipe, theme etc.), (2) actualizing one of these generic scripts or deducing from it, OR (3) describing circumstances relating to the first two.

Correspondingly, given the availability of appropriate terminology, the author fashioned the paradigm of Table 2, representing modalities operationally with dedicated iconic symbols (drawn readily from the LaTeX store of mathematical symbols). The symbols cited for each mode of scripting (highlighted in blue) function as operational identifiers in *MINDMATH*, appearing either as exponents or conventional operators<Lytle, 2009e, *Special Operations*> as the case may require.

Pragmatic Linguistic Activities

Inflection (*Symb*)	**Linguistic Effect**
PRE-scription ($\nearrow$)	`A generic statement or the process of formulating one.`
IN-scription ($\lightning$)	`The process or act of prescriptive actualization.`
DE-scription($\leftarrow$)	`The process or act of describing other scripting.`

Table 2: Scripting Modalities

11.1 Variations on the Arrow

Not a few other *MINDMATH* operations are root-based as well and are therefore appropriately handled as exponents represented by variations on the arrow. The following table lists the present inventory. The active language (`@Eng[lish]` in this case) would normally have been given in the *signature* and, therefore, being understood, not written. *Transpositions* formalized as exponents reflect the integral status of language 'tracts' in the JG model and their respective data types (orders of $\mathcal{M}$):

Table 3: Arrows Symbolizing *MINDMATH* Exponents

$\mathcal{L}\boldsymbol{x}^{\nearrow}$	$\mathcal{L}\boldsymbol{x}$ prescribed
$\mathcal{L}\boldsymbol{x}^{\lightning}$	$\mathcal{L}\boldsymbol{x}$ inscribed
$\mathcal{L}\boldsymbol{x}^{\leftarrow}$	$\mathcal{L}\boldsymbol{x}$ described
$\mathcal{L}\boldsymbol{x}^{\circlearrowright}$	$\mathcal{L}\boldsymbol{x}$ in Autonomic Cycle
$\mathcal{L}\boldsymbol{x}^{\textcircled{\lightning}}$	$\mathcal{L}\boldsymbol{x}$ in Empirical Cycle
$\mathcal{L}\boldsymbol{x}^{\textcircled{\leftarrow}}$	$\mathcal{L}\boldsymbol{x}$ in Text-based Analysis Cycle
$\mathcal{L}\boldsymbol{x}_{\mathcal{M}\boldsymbol{lx}}^{\leftrightarrow\mathcal{M}\boldsymbol{nd}}$	$\mathcal{L}\boldsymbol{x}$ transposed from $\mathcal{M}\boldsymbol{lx}$ to $\mathcal{M}\boldsymbol{nd}$
$\mathcal{L}\boldsymbol{x}_{\mathcal{M}\boldsymbol{nd}}^{\leftrightarrow\mathcal{M}\boldsymbol{lx}}$	$\mathcal{L}\boldsymbol{x}$ transposed from $\mathcal{M}\boldsymbol{nd}$ to $\mathcal{M}\boldsymbol{lx}$
$\mathcal{L}\boldsymbol{x}^{\Upsilon\Downarrow}$	$\mathcal{L}\boldsymbol{x}$ F-koded
$\mathfrak{F}\mathfrak{F}^{\Upsilon\Uparrow}$	$\mathfrak{F}\mathfrak{F}$ S-koded
$\mathcal{L}\boldsymbol{x}^{@A\rightsquigarrow@B}$	$\mathcal{L}\boldsymbol{x}$ Translate from @A to @B
$\mathcal{L}\boldsymbol{x}^{@A\Leftrightarrow@B}$	$\mathcal{L}\boldsymbol{x}$ Transvert from @A to @B
$\mathcal{L}\boldsymbol{x}^{@A\nleftrightarrow@B}$	$\mathcal{L}\boldsymbol{x}$ Konversion from @A to @B
${}_{x}\boldsymbol{Key} \mapsto @\mathbb{R}\boldsymbol{egistry}$	Register ${}_{x}\boldsymbol{Key}$ in $@\mathbb{R}\boldsymbol{egistry}$
${}_{x}\boldsymbol{Key} \mapsfrom @\mathbb{R}\boldsymbol{egistry}$	Lookup ${}_{x}\boldsymbol{Key}$ in $@\mathbb{R}\boldsymbol{egistry}$
${}_{x}\boldsymbol{Sc}^{\Upsilon[{}_{x}\mathfrak{Sc}]}$	$\mathcal{K}$-*Side* Infusion (e.g., **voice**) in ${}_{x}\mathfrak{Sc}$ carrier
${}_{x}\boldsymbol{Sc}^{\Upsilon[{}_{x}\mathfrak{Sc}]}$	$\mathcal{K}$-*Side* Extraction (e.g., **voice**) from ${}_{x}\mathfrak{Sc}$ carrier

My purpose in producing this arrow-laden table is not to convince the reader of the expressive power of *MINDMATH* but, rather to demonstrate the degree of detail which LaTeX can muster for advanced linguistic illustration.

11.1.1 Upwards Compatibility with *JG*

JG in its original definition, made provision for the so-called *LEVEL I data type*,<Baird, 2004> which is equivalent to the *inscriptive* mode (↯) of *LANGUAGE*. Think of it this way:

- *Prescription* and *description* are '*RE-presentative*' in the sense of employing symbols which denote referents existing in other media.
- *Inscription*, in point of fact, is 'PRESENTATIVE' in the sense that its constituents signify themselves.

If, for example, a word in a sentence is in italics/quotes and refers to itself (e.g., the word 'word'), the quote is in *inscriptive* mode. Similarly, if the objects in a demonstration represents themselves, they are in *inscriptive* mode. Or, should someone prescribe something for you to do (an imperative directive) and you actually do it as per specs, then our performance constitutes the *inscription* of the *prescription* (instruction) given.

Thus, in the present formalization of *LANGUAGE, inscriptive mode* is defined as effecting a reflexive relation between sign and signifier, which, to be precise, constitutes more than a seamless bond but, in effect, an *equivalence* between MIND(THOUGHT) and REALITY. To quote Lytle <2009a, Chapter 1, pg. 6>:

> The key to understanding the interplay between language in the conventional, representative sense and its immanence in organized matter (the material domain) is this:
>
> - **Reflexive Symbolism:** *If the reference field of symbols is redrawn so that entities can refer to themselves, then the prescriptive language spelled out in the acorn is inscribed (and perpetuated) in the tree which springs from it — the oak is language incarnate, as it were.*

THIS REFINEMENT OF THE SYMBOLIC MAP has the effect of definitively extending Whorf's *linguistic order* into the structured world at large, which, of course, is consonant with his formula of 'Language, Thought, AND REALITY'.

11.2 Magic to Come

The act of inscription in the $\mathcal{M}$aterial domain is merely one episode in a longer story, however. Another entails extracting $\mathcal{L}$anguage incarnate from its material embeddings and returning it to its $\mathcal{K}$onscient origins in gray matter. We engage the latter 'MAGIC' directly, but must first devote space to another key property of scripts.

12 Linguistic Roots

A *'factellite'* orbiting the scripting paradigm of Table 2 is that every inflection of the scripting paradigm entails creation, preservation, or articulation of one or more common *bases* or ROOTS. Such roots embody a semantic kernel consisting of neither more nor less than the quintessence

of 'what the script is saying.' For clarity, we will refer to such roots as *working* roots (as opposed to *primal* roots capturing the identities of $\mathcal{K}$, $\mathcal{L}$, and $\mathcal{M}$.). *LANGUAGE* makes such roots axiomatically official<Lytle, 2009h> and represents scripting operators involving them either as appointments of '$\surd$' or as exponents on scripting variables:

Axiom 12.1 (Quintessence)**.** *For a given* $_{x}\boldsymbol{Script}$*, there exists a common 'root', or quintessence of sense/meaning, which the konscient agent normally endeavors to preserve (maintain as a constant) during scripting operations, be it modal cycling, mental modeling, transposition, or other operations centering on* semantic *stability.*

Thus, it is not 'heretical' to write '$\left(^{\boldsymbol{Theme}}\surd_{x}\boldsymbol{Text}\right)$' to refer statically to the thematic root of a text. Alternatively, we may feel to write '$\left(_{x}\boldsymbol{Text}^{\nearrow} \looparrowright \underline{\boldsymbol{Theme}}\right)$' to signify exponential extraction (via $^{\nearrow}$) of the root of $_{x}\boldsymbol{Text}$ and its registration as a mental model<see Lytle, 2009e, *Assorted Notational Detail.*>.

UNDERLINING identifies scripts which function as mental models. Also, in *MINDMATH*, the 'yields' sign ($\looparrowright$) supplants the production reading of '=' in conventional notation.

12.1 Extraction of Working Roots

The following equations formalize typical linguistic problems which entail extraction of 'roots' in canonical/passive form, i.e., the 'yield' is unspecified as to the production $\mathcal{M}$edium and no $\mathcal{K}$-agent is identified. A given problem of this variety, owing to LINGUISTIC RELATIVITY, is virtually certain to have as many solutions as solvers:

$$\left(^{\boldsymbol{Report}}\surd\boldsymbol{Book} \looparrowright \boldsymbol{Report}\right)$$

Report: Identify the essentials and write them down in a specified format.

$$\left(^{\boldsymbol{Outline}}\surd\boldsymbol{Article} \looparrowright \boldsymbol{Outline}\right)$$

Outline: Identify and label topics and sub topics in outline form.

12.2 Exercises

It is left as an exercise for the reader (or a reader group) to formulate parallel expressions for the following assignment scenarios:

1. Write a book report.
2. State the central theme of an article.
3. Keep notes for History-200 lectures.
4. Pick a synoptic title for an editorial.
5. Write a topic sentence to encapsulate a long paragraph.
6. Write a lead sentence for a newspaper article.
7. Write a synoptic abstract for an academic work.

As a follow-on exercise, appoint a committee to formulate and then execute the formula for each assignment. Overheard in the attendant discussion will be such expressions as 'the gist of it,' 'what it's *actually* saying,' 'the *substance* of it all,' and so on. These are all paraphrases of what *LANGUAGE* defines as 'working roots.'

12.3 Routine Scripting Sequences

To specify the scripting modality of variables in *MINDMATH*, prefix them with the symbol of the operative mode. Thus $\nearrow\!\boldsymbol{Script}$ is *prescription*, $\nleftarrow\!\boldsymbol{Script}$ is *description*, and $\lightning\!\boldsymbol{Script}$ is *inscription*. Exponents produce scripting in their own respective modes, i.e. $\left(\nearrow\!\boldsymbol{Script}^{\lightning} \ \looparrowright \ \lightning\!\boldsymbol{Script} \right)$. ⟸

The expressions given next below reduce familiar activities to *MINDMATH* notation by applying modal exponents to transfer roots between modes. Such are regarded as being representative of all structured (i.e. *planned, organized, ordered ...*) behavior, which necessarily falls under the 'governing dynamics' of *LANGUAGE* as defined by the options for scripting which it affords. These expressions too are given in their unsigned, or 'passive,' form (neither signature nor dynamic $\boldsymbol{\mathcal{K}x/\mathcal{M}x}$ specifiers are included. Parentheses are used when description takes prescription into account:

$$\boxed{\nearrow\!\boldsymbol{Game.Plan}^{\lightning} \looparrowright \boldsymbol{Game}^{\nleftarrow} \looparrowright \boldsymbol{Newspaper.Reviews}}$$

Depicts the execution (inscription) of a game plan (its prescription) and the description of the game itself by newspapers.

$$\boxed{\left(\nearrow\!\boldsymbol{Game.Plan}^{\lightning} \looparrowright \boldsymbol{Game}\right)^{\nleftarrow} \looparrowright \boldsymbol{Post.Game.Review}}$$

The parentheses indicate that an evaluation of the game vis-à-vis the game plan is carried out in the post-game review.

12.4 More Exercises

For those who may be interested, here are additional scenarios for which simple *MINDMATH* formulas of the same vintage can be written. Write expressions for them and then add another five to the list.

1. Mission Plan - Mission - Mission Film
2. Mission Plan - Mission - Debriefing
3. Musical Score - Performance - Layman Discussion
4. Musical Score - Performance - Critical Reviews
5. Program Code - Execution - Printout
6. Constitution - Government - Judicial Review

THE POINT THE AUTHOR IS MAKING, of course, is that scripted patterning of this ilk pervades intelligent behavior.

12.5 Scripting as Root Management

Exponent symbols, while written discretely, actually represent complex procedures, the constituency of which is dependent upon operative circumstances. The arrow selected for each exponent is quasi-iconic insofar as it suggests the nature of the scripting event. Consider the operation of the following in terms of 'root management.'

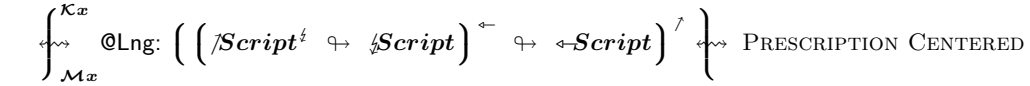
Script$^{\nearrow}$ Incorporate root into prescription (cycle **up** – mode change).
Script$^{\downarrow}$ Embody root in inscription (cycle **down** – mode change).
Script$^{\leftarrow}$ Capture root as description (cycle **aside** – mode change).
Script$^{\leftrightarrow}$ Transposition – inter-$\mathcal{M}$ root *transplant* (preserves mode).
Script$^{\rightsquigarrow}$ Translation – inter-$\mathcal{L}$ root *transplant* (preserves mode).

13 Scripting Cycles

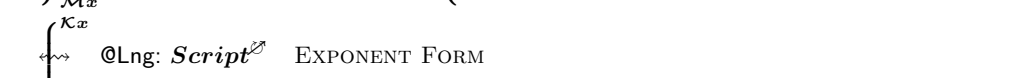
Scripting cycles proffer differing functionality depending upon their modal focus and the initial disposition of scripts. The next three equation sequences illustrate cycles which are *prescription-*, *inscription-*, and *description-* centered, respectively. These correspond to the three 'cyber' cycles introduced and discussed in Lytle <2009c>. Whether one writes the full cycle, its conflation, or its exponential form depends upon the degree of detail which must be exposed and/or recorded to achieve a particular purpose.

Functionally, the exponent in each case, if executed, presents the 'base/root' value in its conflated and full expressions. **Bear in mind that the use of '*Script*' as a common variable in each cycle type stems from the Axiom of Quintessence (12.1) which asserts that there exists a psycholinguistic semantic base in such operations which serves as a common 'root.'**

13.1 The Autonomic Protocol

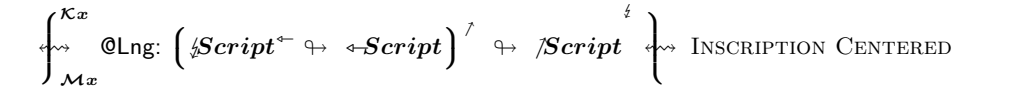
(9) 

(10) 

(11) 

Prescription in this protocol is a priori. Inscription is evaluated via descriptive feedback and prescription is adjusted dynamically (not changed) to yield inscription that is subject to special circumstances. (<See Lytle, 2009g, Autonomic Protocol>)

13.2 The Empirical Method

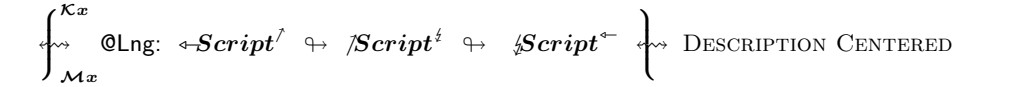
(12) 

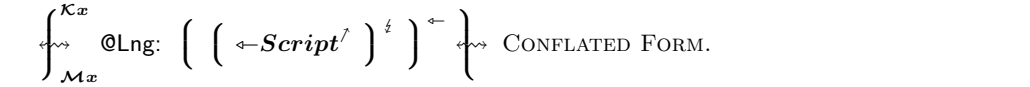
(13) 

(14) 

Inscription is available and under observation. Its description is taken, assessed, and prescription is induced. Adjustment and update are effected as necessary to reflect the commonalities of inscription. (<See Lytle, 2009g, Empirical Protocol>).

13.3 Text-Based Analysis

(15) 

(16) 

(17) 

Description is available and under analysis. Inscription may be largely or totally lacking. Descriptive thematics are assessed for predictive adequacy vis-à-vis available texts and reformulated as necessary. (<See Lytle, 2009g, Text-Based Discovery>).

14 Pure Perception

Language sets everyone the same traps; it is an immense network of easily accessible wrong turnings. And so we watch one man after another walking down the same paths and we know in advance where he will branch off, where walk straight on without noticing the side turning, etc. etc. What I have to do then is [to] erect signposts at all the junctions where there are wrong turnings so as to help people past the danger points.

– Wittgenstein <1922>

Not a few have long been 'bewitched' by a dichotomy dating back to the philosophy of Kant (*Critique of Pure Reason*) who coined the terms 'neumenal' and 'phenomenal' to distinguish between 'things as they are' and our mental representation of them. The perspective of those espousing this distinction as true and complete is that the universal perception of things as both 'immediate' and 'real' is a fantasy — merely 'naive realism' — that beyond the images and perceptions of what we sense as reality are in fact the faint outlines of one's own skull. Lehar Lehar <2002> has recently added to the affirmation of this perspective in a major work, citing none other than Russell as a fellow proponent, who asserts that one simply cannot, without assuming some kind of '*preposterous kind of discontinuity, suppose that the [one's] percept . . . is anywhere else but in the [his] head.*'<Russel, 1927, pg. 137-143>

The issue is whether to believe what intuition witnesses to one and all about the immediacy of sensation or to downgrade its testimony to the status of *hearsay, seesay, touchsay, etc.* — for that is precisely what our most acute perceptions are purported by Lehar et al. to be!

FOR THE AUTHOR'S FULL APPRAISAL and counter argument to representationalism, see Lytle <2009c>. The nutshell version is that the attempted marriage of Kant (1724-1804) and state-of-the-art mathematical simulations comes off as a caricature of Flintstone vintage, where the overlay of antiquity and modernity is perhaps entertaining but not apt for the purpose.

A better philosopher to quote is Bergson (1859-1941):

> A priori and apart from any hypothesis on the nature of the matter, it is evident that the materiality of a body does not stop at the point at which we touch it: a body is present wherever its influence is felt; its attractive force, to speak only of that, is exerted on the sun, on the planets, perhaps on the entire universe. The more physics advances, the more it effaces the individuality of bodies and even of the particles into which the scientific imagination began by decomposing them: bodies and corpuscles tend to dissolve into a universal interaction.<Bergson, 1911>

This statement encapsulates Bergson's perspective of PURE PERCEPTION, and forms the basis for the aspect of the *LANGUAGE* model whereby REALITY (*inscription*) is imported directly into the organism via the senses, whereupon it subsequently completes a scripting cycle (↯ – see Section 13.2.) consisting of transposition to registered *description* and, ultimately, *prescription* (inclusion in a mental model) — which are truly RE-presentative codes occupying the materia of MIND.

14.1 The LANGUAGE Sense

LANGUAGE as a model, integrates all orders of $\mathcal{K}$ (i.e., all life forms) with their associated orders of $\mathcal{L}$ and $\mathcal{M}$. This concept is expressed by the following definition:

Definition 14.1 (The LANGUAGE Sense)**.** *We define 'the LANGUAGE Sense' to be the sum of anatomical appointments which integrate $\mathcal{K}$onscient $\mathcal{K}$reatures with the LANGUAGE system, enabling them to spontaneously exploit the functionality of $\mathcal{L}$ in $\mathcal{M}$(scripts) for learning (discovery), communication, and material management (<for further detail, see Lytle, 2009b, The LANGUAGE Sense>).*

Among the anatomical assets presumed to function in the organism is the *sensorium* (the conventional five senses plus many newly discovered ones<Lytle, 2009k, Sensors Multiplied>) and the *CNM* <Lytle, 2009c, The *Continuation Mass*>), which together ingest *inscription* and channel it as *pure perception* to neural networking which parses and RE-presents it for intra-cranial use.

14.2 Sensation Streams

Returning now to the topic of *roots*, there exists a form of 'root-taking' which figures in sensation. We have reference to the process of noting specifically what the senses absorb with respect to an object and bundling the sensation streams emanating therefrom for topical registration.

We stipulate that '$_{\boldsymbol{x}}\odot$' refers to a particular sensation source 'in and of itself' (normally an observed object or concept); the following expression describes extraction of its 'sensation root' as *pure perception* (see Section 14).

(18) $\quad {}^{\{\mathfrak{S}\mathfrak{s}\}_1^n}\surd_{\boldsymbol{x}}\odot \;\hookrightarrow\; {}_{\boldsymbol{x}}\mathfrak{F}$

Extract and bundle the sensation base of a pristine object. This expression represents the 'MAGIC' alluded to earlier in the article.(Section 11.2)

The yield ($_{\mathfrak{r}}\mathfrak{F}$) is a 'flok'. We state its definition:

Definition 14.2 (Flok ($\mathfrak{F}$))**.** *A kollective manifold of sensation streams ($\mathfrak{S}\mathfrak{s}$) consisting of pure perception which constitute a 'fokal point' in the perception field by exhibiting the totality of sensory data available for the object at their source.*

15 An Expanded Perspective

Under *LANGUAGE*, the PTRI (*Presentation-To-Representation Interface*) is an amalgamation of registries (specialized *dictionaries*) and linkages which transduce scripting to specific $\mathcal{M}$-forms required for $\mathcal{K}$-select purposes. For the present purpose, we summarize:

- Inscription (pure perception) hosted by the *CNM*[15] is referred to as $\mathfrak{P}$-*Side* data.

[15]Think of the CONTINUATION MASS (*CNM*) as a fibrous extension of sensors which hosts pure perception (inscription) inside the organism until it undergoes *RE-presentation*.

- RE-presentative (non-reflexive) scripting is referred to as ***R**-Side* data.
- Scripting recovered from communication channels (sound, sight, touch [braille]) is referred to as $\mathcal{K}$*-Side* data.
- All $\mathcal{M}$-forms converge at the PTRI in the Unified Data System ($\mathcal{UDS}$).[16]

Definition 15.1 (Unified Data System ($\mathcal{UDS}$))**.** *The order of* $\mathcal{M}$ *which unifies all orders flowing from* $\mathfrak{P}$*-Side sources 'on one playing floor' and assigns their formants constituency in MindMath (aka* MIND LANGUAGE*).*

$\mathcal{UDS}$, for the sake of consistency with $\mathcal{M}lx$, $\mathcal{M}ph\ldots$, is assigned the alias $\mathcal{M}nd$ when employed in *MINDMATH* notation. ⟸

While it is beyond the scope of this article to elaborate further (Lytle <see 2009c, for detail>), it is necessary to resume discussion (2.1) of one of the PTRI's complementary assets, namely, LINKAGE, which facilitates transit of the 'floks' of Equation 18 and other input data to the $\mathcal{M}$-forms required for *mental modeling* — the corner stone of Whorf's Fundamental Theorem, to which we ultimately return.

16 Formalizing Linkage

The agreement is, of course, an implicit and unstated one, but its terms are absolutely obligatory; we cannot talk at all except by subscribing to the organization and classification of data which the agreement decrees.

– Benjamin Whorf

By incorporating LINKAGE as a salient aspect of *LANGUAGE* notation, we officially incorporate Saussure's formulation of '**Signifier-Signified**' as it relates to discrete signs, plus Whorf's assertion of *a general state of linkage* between distinct and diverse layers, levels, or domains language when he wrote that "*... the non-motor processes that are the essential thing are, of their nature, in a state of linkage according to the structure of a particular language ...*" <Whorf, 1998, pg. 68>

By convention we represent the relation between Saussurian signs as '$\boldsymbol{Sgfier} \bowtie \boldsymbol{Sgfied}$', as opposed to the Whorfian perspective of composite mappings as '${}_{x}\boldsymbol{Script}_{\mathcal{M}lx} \parallel {}_{x}\boldsymbol{Script}_{\mathcal{M}nd}$'. Complicating the picture is whether the linkage is arbitrarily constructed by konscience or anatomically facilitated in some way (iconic). Inasmuch as humans intermingle the two, it is necessary to make provision for this aspect of linkage.

16.1 Iconic (Non-Arbitrary) Linkage Relation and Operation

MINDMATH notation inverts the operands of relational expressions and replaces '=' (read *equals*) with '↬' (read *yields*) to obtain the operations which produce them. In either mode, the *linkage* specifier is written as a superscript (exponent).[17] Thus, in the case of a singular, *iconic*[18] linkage

[16] This is the 'basic data' of *Classical JG* which has for categories such familiar labels as 'noun', 'verb', 'adjective,' etc.

[17] Chapter <See Lytle, 2009e, for discussion of *roots* in *MINDMATH*> .

[18] Addenda are affixed to '⋈,' depending upon the extent to which the link is non-arbitrary (i.e., *iconic* [<Lytle, 2009c, Linguistic Iconism>]).

(⋈), we apply [Method] to expose the connection:

(19) $${}_{x}\boldsymbol{Sfier}_{\mathcal{M}lx} \;=\; {}_{x}\boldsymbol{Sfied}_{\mathcal{M}nd}^{\overset{[\text{Method}]}{\bowtie}\{\mathcal{M}lx\}}$$ (Relation: ${}_{x}\boldsymbol{Sfier}_{\mathcal{M}lx}$ is sign for ${}_{x}\boldsymbol{Sfied}$ in $\boldsymbol{\mathcal{M}nd}$.)

(20) $${}_{x}\boldsymbol{Sfied}_{\mathcal{M}lx}^{\overset{[\text{Method}]}{\bowtie}\{\mathcal{M}nd\}} \;\rightarrowtail\; {}_{x}\boldsymbol{Sfier}_{\mathcal{M}nd}$$ (Operation: Retrieve the sign for ${}_{x}\boldsymbol{Sfied}_{\mathcal{M}lx}^{\overset{[\text{Method}]}{\bowtie}\mathcal{M}nd}$).

ONCE UNIT LINKAGES ARE IN PLACE (*signs* in the Saussurian sense), we accord their operands the status of reciprocal 'roots,' which is why *transpositions* for scripts containing them are normally written as exponents.

The above equations describe the linkage of a single formative. This same process (mapping from one order of $\boldsymbol{\mathcal{M}}$ to another) when applied to entire scripts falls under the definition of *transposition*.

(21) $${}_{x}\boldsymbol{L.String} \;=\; {}_{x}\boldsymbol{Corpus}_{\mathcal{M}nd}^{\leftrightarrow\mathcal{M}lx}$$ (${}_{x}\boldsymbol{L.String}$ is the lexical transposition of ${}_{x}\boldsymbol{Corpus}_{\mathcal{M}nd}$.)

(22) $${}_{x}\boldsymbol{Corpus}_{\mathcal{M}nd}^{\leftrightarrow\mathcal{M}lx} \;\rightarrowtail\; {}_{x}\boldsymbol{L.String}$$ (Transposition of ${}_{x}\boldsymbol{Corpus}$ in *MindMath* to a lexical string.)

16.1.1 Arbitrary Linkage

To create an arbitrary *signifier-signified*[19] relation from scratch, the linkage symbol is used as an operator and, by virtue of their becoming seamlessly bonded, yields what we stipulate are effectively *reciprocal roots* (each constituting a *base* in the other, as it were). To set this circumstance apart, we append $\sim$ to the linkage symbol (⋈$\sim$):[20]

(23) $$\left({}_{x}\boldsymbol{Sfier}_{\mathcal{M}nd} \;\bowtie\sim\; {}_{x}\boldsymbol{Sfied}_{\mathcal{M}lx}\right) \;\rightarrowtail\; \left\{ \begin{array}{l} {}_{x}\boldsymbol{Sfied}_{\mathcal{M}lx} \;=\; {}_{x}\boldsymbol{Sfier}_{\mathcal{M}nd}^{\bowtie\sim\mathcal{M}lx} \\ {}_{x}\boldsymbol{Sfier}_{\mathcal{M}nd} \;=\; {}_{x}\boldsymbol{Sfied}_{\mathcal{M}lx}^{\bowtie\sim\mathcal{M}nd} \end{array} \right\}$$

Subsequently, one would write $\boldsymbol{X}^{\bowtie\sim}$ as an exponent to signal the arbitrary *origins* of the sign.

(24) $${}_{x}\boldsymbol{Sfied}_{\mathcal{M}lx}^{\overset{[\text{Method}]}{\bowtie\sim}\mathcal{M}nd} \;\rightarrowtail\; {}_{x}\boldsymbol{Sfier}_{\mathcal{M}nd}$$

To write linkage as a root without having first operationalized the link is to assert that the operands somehow dynamically derive from one another (e.g., *phono-semantics*[21]), as in the following, presumably *phono-semantic* linkage:

[19] Two identifiers linked in this manner correspond to Saussure's definition of the arbitrary *sign*.
[20] Shorthand for '⋈$\sim$' is simply '$\sim$'.
[21] See further comment on *sound symbolism* at <Lytle, 2009c, Continuity of Resonance>

(25) No expression effecting the linkage of ${}_{x}\boldsymbol{Sememe}_{\mathcal{M}nd}$ and ${}_{x}\boldsymbol{Lexeme}_{\mathcal{M}lx}$.

(26) ${}_{x}\underline{\underline{\textsf{Sem}}}_{\mathcal{M}nd}^{[PhonSem]\bowtie}{}_{\mathcal{M}lx} \;\not\mapsto\; {}_{x}\underline{\underline{\textsf{Lex}}}_{\mathcal{M}lx}$ (Phono-Semantic Mapping linkage specified.)

Otherwise — as noted — the relation is first given as the two operands joined by the arbitrary linkage symbol '$\bowtie\!\!\sim$'.[22] If the method of calculating linkage is not transparent, [`Method`] is specified as, for example, via the `Lexical Mapping Rules` '[LMap]' of the L-rule transposition system together with its associated dictionaries (which catalogue sememe-to-lexeme linkages in *JG* -driven software).(<See Lytle, 2009d, *The Verbot*>) ⟸

HERE AGAIN, the author's point is not so much what *MINDMATH* facilitates by way of representing linguistic contrast but, rather, THE FACT THAT LaTeX makes possible by virtue of its illustrative power the creation of formulations which merely lurked as possibilities at the time of its design.

16.2 Transposition

Transposition (↔) facilitates the bi-directional, Whorfian passage of entire texts between orders of $\boldsymbol{\mathcal{M}}$ at interfaces as, for example, conversion of lexical strings ($\boldsymbol{\mathcal{M}lx}$) to *MindMath* ($\boldsymbol{\mathcal{M}nd}$) and vice versa (see Table 11.1). While *transposition* is facilitated at its core by the linkage of individual content formants it also entails, as formerly noted, the operation of context-sensitive mapping processes effected by *coding grammars* (Section 2.1).

(27) $\oint_{\mathcal{M}lx}^{\mathcal{K}x}$ @Eng: ${}_{x}\boldsymbol{Script}_{\mathcal{M}lx}^{\lceil WMP\rceil} \;\not\mapsto\; {}_{x}\boldsymbol{Script}_{\mathcal{M}nd}$

This equation transposes the lexical string '${}_{x}\boldsymbol{Script}_{\mathcal{M}lx}$' to its $\boldsymbol{\mathcal{M}nd}$ correspondent using the $\lceil\boldsymbol{WMP}\rceil$ coding grammar<Lytle, 2009e, *Komputer Works*>.

(28) ${}_{x}\boldsymbol{Script}_{\mathcal{M}lx} \overbrace{\underset{\lceil WMP\rceil}{\|}}^{\{\mathbb{LEX}.\mathbb{SMC}\}} {}_{x}\boldsymbol{Script}_{\mathcal{M}nd}$

This expression is a static representation of the interface with its coding grammar and dictionaries. $\{\mathbb{LEX}.\mathbb{SMC}\}$ are the dictionaries utilized by grammar $\lceil\boldsymbol{WMP}\rceil$ for the transposition. Writing them is a redundancy inasmuch as the $\boldsymbol{\mathcal{M}lx} \| \boldsymbol{\mathcal{M}nd}$ pairing selects the required dictionaries.

16.3 Ground Hog Day

16.4 Applying the Formalism

The *linkages* in prairie dog gray matter appear to be *predetermined by harmonic resonance* as opposed to being *arbitrary* (<Lytle, 2009c, *Linguistic Iconism*>). Recall that to write *linkage*

[22] Computationally, this is accomplished by keying dictionary entries.

as an exponent without having first initialized the link is to assert that the operands somehow dynamically derive from one another (16.1.1). Since this appears to be precisely the case for prairie dogs (***K*pd**categorized as ***Kpd***), we express their perception-to-articulation linkage as an *uninterrupted*, non-arbitrary *exponent sweep* from predator detection to warning cry (`Equation 29`). We employ '∞' on the signature $\boldsymbol{\mathcal{K}}$ factor because the process involved is characterized by Slobodchikoff as being devoid of volitional kustomization. We symbolize 'hawk' with $\boldsymbol{H}$:

$$\int_{\substack{\rightsquigarrow \\ \mathcal{M}ix}}^{\mathcal{K}pd}_{\infty} @\{\mathtt{Ss}\}_1^n : \Bigg\{\Bigg\{\Bigg\{\Bigg\{\Bigg\{\Bigg\{ \{\Subset_{\mathtt{s}}\}_1^n \surd \overset{H}{\odot} \looparrowright {}_{\mathfrak{r}}\mathfrak{F}\Bigg\}^{\bowtie_R \mathcal{M}}\Bigg\}^{\bowtie \mathcal{M}nd}\Bigg\}^{\bowtie \mathcal{M}lx}\Bigg\}^{\bowtie \mathcal{M}ph}\Bigg\}^{\bowtie \mathcal{M}tr}\Bigg\}^{t} \looparrowright {}_H Cry \tag{29}$$

Given the presence of adjective modifiers in the acoustic profiles structured by the animals <Slobodchikoff, 2005>, we include $\boldsymbol{\mathcal{M}nd}$ (*MindMath*), $\boldsymbol{\mathcal{M}lx}$ ('sign-'ification), and $\boldsymbol{\mathcal{M}ph}$ (articulation) in the transposition sequence.

16.5 The Human Impediment

16.5.1 The $\mathcal{K}$ Divide

This said, we now move on to the 'gist of the matter,' as it were: We have here entered upon a vast divide in the orders of $\boldsymbol{\mathcal{K}}$ involved — a consideration which is routinely neglected by default in discussions of animal (and human) kommunication because the linguistic models employed simply omit it from their formulations.

THE FACT OF THE MATTER IS that in this — and in every other case of '$\boldsymbol{\mathcal{K}}$-divide' — what constitutes the difference between species (each a distinct order of $\boldsymbol{\mathcal{K}}$) is the scope of the world in which each resides and the provisions made for it via the *LANGUAGE* Sense (14.1). A prairie dog lives in a micro-world where predators, food-gathering, and reproduction essentially encompass what has to be dealt with. The number of objects and concepts to be attended to and brought into 'harmony' in that world is miniscule compared to those comprising the WORLD of WORLDS — the systems of complex systems (the kaleidoscopic blur) — which the human konscient struggles konscientiously to organize.[a]

[a]Hence our endeavor to develop assessments of linguistic harmony which encompass an entire expanse of text (<Lytle, 2009c, *Context Set*>), not just the individual words within them.

As we perfect a notation expressive of the $\boldsymbol{\mathcal{L}}$-workings of myriad $\boldsymbol{\mathcal{K}}$-specific MINDS in an array of $\boldsymbol{\mathcal{M}}$-settings, it will perhaps be seen that in some individuals, unity of conception is common place, while in others pervasive fragmentation is the rule.<Lytle, 2009i, Quote from Bohm under the chapter title.>. For the world's best thinkers, sememic organization may exhibit near perfect harmony with REALITY — who are nevertheless obliged to misspeak by the lexical systems imposed upon them (Section 16).

The equation for humans, therefore, takes the following modified form, wherein the sweep of expo-

nents is interrupted by the *Ko-optioning*[23] of @Lang with arbitrary linkages drawn from @LNG[24] forward. The first and second lines of Equation 30 represent the origin and path of the warning for the presence of a hawk. Exponential and arbitrary sequences are divided between lines:

(30) $$\oint_{\mathcal{M}ix}^{\mathcal{K}hm} \text{@}\{\text{Ss}\}_1^n : \left(\left(\left(\{\mathfrak{S}s\}_1^n \surd \overset{Hawk}{\odot} \right) \hookrightarrow {}_x\mathfrak{F}_{P\mathcal{M}} \right)^{\bowtie_R \mathcal{M}} \right) \text{@Lang} : \ \ldots$$

$$\left(\left(\underline{\underline{Hawk}}^{\mathcal{K}k}_{\mathcal{M}nd} \right)^{\bowtie\sim\mathbb{CGL}}_{\hookrightarrow} \left(\text{Hawk}^{\mathcal{K}k}_{\mathcal{M}lx} \right)^{\bowtie\sim\mathbb{CGF}}_{\hookrightarrow} \left(Hawk^{\mathcal{K}c}_{\mathcal{M}ph} \right)^{\bowtie\sim\mathbb{CGM}}_{\hookrightarrow} \textbf{\textit{Hawk!}}^{\mathcal{K}e}_{\mathcal{M}tr} \right)$$

Note the persistence of '$\bowtie\sim$' in specifying arbitrary linkage at each interface on the second line. Expression 31 is a Whorfian depiction of the linkages transited after entry into the $\mathcal{UDS}$ (Unified Data System) at the human Ptri.

(31)
$$\underline{\underline{Hawk}}^{\mathcal{K}k}_{\mathcal{M}nd} \ \overset{\text{SMC.LEX}}{\|}\ \text{Hawk}^{\mathcal{K}k}_{\mathcal{M}lx} \ \overset{\text{LEX.FON}}{\|}\ \text{Hawk}^{\mathcal{K}c}_{\mathcal{M}ph} \ \overset{\text{FON.MTR}}{\|}\ Hawk^{\mathcal{K}e}_{\mathcal{M}tr}$$

17 Kommunication Channels

Sensation streams flowing from sight, sound, and touch do double-duty as $\mathcal{K}$ommunication channels ($\mathcal{K}$-channels, for short), entering the system from the $\mathcal{K}$-*Side*, as it were (Section 15). They resemble other streams in that their natural modality is pure perception but are unlike them in that they serve as carriers for the RE-presentations of a given @Language.

17.1 Vocalization

When someone speaks, the koding to be transmitted via sound essentially transits the Ptri (<Lytle, 2009c, Portal To Rebirth>) in reverse as RE-presentative, $\mathcal{K}$-*Side* content, its path becoming in effect 'Rtpi.' The multi-phase nature of the coding involved (<Lytle, 2009c, Manifold Of Events>), regardless of 'direction' vis-á-vis this key interface, entails *transversion* — as opposed to *transposition* alone.[25] In effect, special operators which trace the linkages and access registries involved for infusion ($\curlyvee$) and extraction ($\curlywedge$) are defined (<Lytle, 2009e, *Infusion Signatures*>). Their background service facilitates significant conflation of the notation (Section 10.1) unless internal detail must for some reason be exposed.

[23] The term '$\mathcal{K}$o-option' refers to the manner of coding developed by a particular culture/langauge.

[24] The dictionary of @Lang.

[25] A term denoting not only transposition to alternate orders of $\mathcal{M}$(*materia*), but also of scale and/or $\mathcal{K}$-status, as from rational to mechanical mode, or vice versa. This term is properly used in reference to Ptri 'crossings' as well as to *translation* or *paraphrase*<Lytle, 2009c, *Supplementary Definitions*>.

Optionally, linkage intervals circumscribed by the operators may be written as limits on the signature itself, as illustrated in Equation 32. For additional discussion of technical detail as well as supplementary notational conventions, see Lytle <2009e, *Infusion Signatures*>. Both the unconflated and conflated formulas for audio inscription (vocalization) during ordinary conversation are given and explained in Lytle <2009c, Vocalizaton>. We include the conflated here with supporting commentary:

(32) $$\overset{\mathcal{K}k\ldots\mathcal{K}e}{\underset{\mathcal{M}nd\ldots_{Au}\mathcal{M}cn}{\oint\!\!\!\!\!\!\sim}} \left[\frac{\text{@English}}{_{Au}\mathcal{M}cn}\right] : \left\{ \mathsf{SCRIPT}^{\mathfrak{Y}} \;\rightarrowtail\; {}_{x}\mathfrak{Script} \right\}$$

The initial script is couched in $\mathcal{M}nd$ within the province of $\mathcal{K}k$, but passes to the domain of $\mathcal{K}c$ via $\mathcal{M}lx \| \mathcal{M}ph$ and thence to $\mathcal{K}e$ of ${}_{Au}\mathcal{M}cn$ (written in the subscript limit as the interval '$\mathcal{M}nd\ldots_{Au}\mathcal{M}cn$' when infused in that materium.

Embedding in the carrier is specified as a fraction (Section 7) in the `@Lng` portion of the equation signature. The exponents and subscripts of the defining sequence (`Equation` 32) specify its initial and final $\mathcal{K}$ and $\mathcal{M}$ status, while before-and-after font contrasts broadcast its *generic* $\mathfrak{P}$*-Side* disposition once '$\mathfrak{Y}$' has done its work. Note in this regard that if ${}_{Au}\mathcal{M}cn$ were supplanted by ${}_{Vis}\mathcal{M}cn$, the inscription would manifest visually in the patterning of print, writing, etc. rather than sound.

For *recognition*, the reverse process extracts infused koding from $\mathcal{K}$*-Side* channeling. Under the following header, we discuss *voice* recognition.

17.2 Voice Recognition

We begin by simply noting that the presence of audible speech is detected by kommunicators and recovered from its inscripted state during the course of ordinary conversation. The 'lite' version of infusion cited above (Equation 32) has its correspondent for voice recognition, namely:

(33) $$\overset{\mathcal{K}e\ldots\mathcal{K}k}{\underset{_{Au}\mathcal{M}cn\ldots\mathcal{M}nd}{\oint\!\!\!\!\!\!\sim}} \left[\frac{\text{@English}}{_{Au}\mathcal{M}cn}\right] : \left\{ \mathfrak{Script}^{\mathfrak{Y}} \;\rightarrowtail\; {}_{x}\mathsf{SCRIPT} \right\}$$

Note that the sequencing of $\mathcal{K}$ and $\mathcal{M}$ specifiers in the *signature* is reversed for recognition.

Both Equations 32 and 33 entail implicit, mechanics which should be understood by the dedicated LINGUIST. A discussion of those particulars, however, is beyond the scope of this cursory glance at *MINDMATH* and the *LANGUAGE* model.

18 J-Koding

The setting for the *LANGUAGE* model is an electro-magnetic neural substrate<Becker and Selden, 1985> and, accordingly, formulates registry entries at the PTRI which have EM signatures as identifiers<Lytle, 2009c, *Energizing the Semanticon*>. The scenario envisioned entails a 'cloud' of EM firings in response to the stimuli occasioned by $\mathfrak{P}$-*Side* , $\boldsymbol{R}$-*Side*, and $\mathcal{K}$-*Side* data impacting the registries of the interface and activating RE-presentative $\boldsymbol{\mathcal{M}nd}$ constituents. Neural networking — presumably stemming from the *LANGUAGE Sense* — focuses on the EM elements thus activated and constructs *MindMath* representative of their patterning. We state the axiom:

Axiom 18.1 (Natrex Neuralware)**.** *There exists* $\boldsymbol{R}$*-Side neural-ware which* SENSES *MindMath patterning relations among the sememes of* UNIFIED DATA *radiating from the* PTRI *and represents them in MindMath to konscient* MIND *for its perusal.*

(34)

$$\left(\frac{\{\underline{\underline{\mathbf{Sem}}}\}_1^n}{{}_{\mathbf{x}}\mathbf{Network}}\right)^{\Upsilon_{\uplus\{\boldsymbol{JKode}\}}} \hookrightarrow {}_{\boldsymbol{x}}\boldsymbol{Script}_{\boldsymbol{Mnd}}$$

This expression encodes as a *MindMath* script a set of sememes (*JG* content formatives) $\{\underline{\underline{\mathbf{Sem}}}\}_1^n$ sensed in ${}_{\boldsymbol{x}}\boldsymbol{Network}$.

With respect to this formula, we add the relevant definition:

Definition 18.1 (To J-kode ($\overset{\Upsilon}{\uplus}$))**.** *To abstract from the effusion of sememes issuing from the* PTRI *the J-rule complexes comprising MindMath descriptive of the sensation which is stimulating it.*

An associated corollary to the above is that:

Corollary 18.1.1 (Model Integration)**.** *The MindMath scripting obtained via J-koding is simultaneously integrated by konscience with its* WEB OF MENTAL MODELS*, of which the sememes of semanticon* ${}_{@\boldsymbol{Lang}}\mathbb{SMC}$ *form the unifying component (<Lytle, 2009c,* Energizing the *SEMANTICON* of the *Unified Data* System>*)*

18.1 Mental Models

Consider now the official *LANGUAGE* definition for a mental model:

Definition 18.2 (*Mental Model* ($\underline{\underline{\mathbf{M}}}$, $\underline{\underline{\mathbf{S}}}$ ...))**.** *A mental prescription for either a natural class or an individual which governs konscient behavior and expectations with respect to the entity modeled.*

Consider next the structural template for modeling, whether the target is a class or an individual:

(35) $$\oint_{\boldsymbol{\mathcal{M}x}}^{\mathcal{K}\boldsymbol{x}} \text{@Lang: }{}_{\boldsymbol{x}}\boldsymbol{Corpus}^{[\boldsymbol{Method}]} \hookrightarrow \underline{\underline{\boldsymbol{M}}}$$

18.2 Formulating Whorf's Fundamental Theorem

To arrive at Whorf's fundamental theorem, an equation unifying language, thought, and reality, it is first necessary to expand $_{x}\boldsymbol{Corpus}$ to include all contributive scripting sources.

(36) $$\forall\boldsymbol{\Lambda} = \left\{ \begin{array}{l} \boldsymbol{\mathfrak{P}.Side} \\ \boldsymbol{R.Side} \\ \boldsymbol{\mathcal{K}.Side} \\ \boldsymbol{J.Kode} \\ \boldsymbol{Etc.} \end{array} \right\}$$

• We next apply iterating braces ('$\{\!\{\ \forall\boldsymbol{\Lambda}\ \}\!\}$') to accommodate a continuing — though perhaps intermittent — flow of data from this all-inclusive amalgamation of both *presentation* and REPRESENTATION.

• For [method] we specify a mode able to both initialize and update the model ('$\overset{[\doteq]}{\nearrow}$') and liberalize for any supplementary procedures ('$\boldsymbol{\{X\}}$').

• For the signature, we emply the variable '@Lng' to cover whatever may materialize in terms of orders of $\boldsymbol{\mathcal{L}}$, supplemented by variables '$\boldsymbol{\mathcal{K}x}$' and '$\boldsymbol{\mathcal{M}x}$' for variability in exponent and index.

• To the core of the modeling process we apply appropriate cycling under konscient control ('$\Big\{\!\!\Big\triangleright\ \triangleleft\Big\}\!\!\Big\}$').

• Double underlining on the model identifier ('$\underline{\underline{\boldsymbol{M}}}$') provides for coverage of both classes and individuals.

• Finally, we append an inscriptive exponent ('$\boldsymbol{\mathfrak{f}}$'), thus signifying that the model is generating active projection and feedback.

With these refinements we arrive at the equation cited in the *Abstract* and thus arrive at our destination. Hopefully the reader will perceive that its operation extends outward to encompass the environment, generates structuring internally, all the while importing 'skripts' manufactured 'abroad.' In covering all bases, it is congruent with Whorf's conceptual model unifying language, thought, and reality.

(37) $$\oint_{\boldsymbol{\mathcal{M}x}}^{\boldsymbol{\mathcal{K}x}} \texttt{@Lng}\colon \Big\{\!\!\Big\triangleright \{\!\{\forall\boldsymbol{\Lambda}\}\!\}^{\overset{[\doteq]}{\nearrow}\boldsymbol{\{X\}}} \hookrightarrow\ {}_{j}\underline{\underline{\mathbb{M}}} \triangleleft\Big\}\!\!\Big\}^{\boldsymbol{\mathfrak{f}}}$$

Actually, Whorf took things a step further, citing instances of telekinesis and other direct manifestations of Mind over matter — a phenomenon now scientifically verified by Dean Radin <1997>. Thus, for example, adopting '$\boldsymbol{\mathcal{K}\psi}$' to designate an order of $\boldsymbol{\mathcal{K}}$ for individuals so gifted, and augmenting the inscription symbol to designate this type of activity, one might also write:

(38) $$\oint_{\boldsymbol{\mathcal{M}x}}^{\boldsymbol{\mathcal{K}\psi}} \texttt{@Lng}\colon \Big\{\!\!\Big\triangleright \{\!\{\forall\boldsymbol{\Lambda}\}\!\}^{\overset{[\doteq]}{\nearrow}\boldsymbol{\{X\}}} \hookrightarrow\ {}_{j}\underline{\underline{\mathbb{M}}} \triangleleft\Big\}\!\!\Big\}^{\boldsymbol{\mathfrak{f}\mathfrak{f}[Tele]}}$$

Or, taking note of the confirmatory evidence for what is referred by the United States military as 'Coordinate Remote Viewing,' <Remote Viewing> we may as well create an order of $\mathcal{K}$ for remote viewers, say '$\mathcal{K}\Phi$', include '$\mathcal{M}rm$' (an order of $\mathcal{M}$ for 'remote channeling') within the scope of '$\forall\Lambda$' and write:

$$(39) \qquad \oint_{\mathcal{M}rm}^{\mathcal{K}\Phi} \texttt{@Lng:} \left\{ \vdash \forall\Lambda \dashv \right\}^{[\triangleq]} \{x\} \rightarrowtail {}_{j}\underline{\underline{\mathbb{T}}} \left\langle \right\}^{\iota}$$

Then, to enrich the conventional modeling scenario, we could upgrade the equation to reflect the fact that while modeling a particular $\mathbf{3}^{rd}$ -*Person* topic (${}_{j}\underline{\underline{\mathcal{3T}}}$), we optionally model any $\mathbf{2}^{nd}$ -*Person* konscient source (${}_{\mathbf{2}^{nd}}\underline{\underline{\mathcal{K}y}}$) of the information:

$$(40) \qquad \oint_{\mathcal{M}nd}^{\mathcal{K}x} \texttt{@Lng:} \left\{ \vdash \forall_{\mathcal{K}y}\Lambda \dashv \right\}^{[\triangleq]} \{x\} \rightarrowtail \left\{ \begin{array}{c} {}_{j}\underline{\underline{\mathcal{3T}}} \\ [{}_{\mathbf{2}^{nd}}\underline{\underline{\mathcal{K}y}}] \end{array} \right\} \left\langle \right\}^{\iota}$$

THESE LAST EQUATIONS illustrate not only the SCOPE of the GOVERNING DYNAMICS encompassed by Whorf's conceptual model and formalized in *MINDMATH* , but also the facility with which LaTeX can provide for the kinds of illustration they require to make them explicit.

19 Concluding Remarks

I have less than one work-year of LaTeX under my belt and by that measure remain a novice, but look forward to a continuation of what has thus far evolved — at least for me — as very worthwhile venture. Readers will, of course, judge for themselves whether the illustrative potential of the system demonstrated in this article surpasses that of other authoring software. Regardless of their response, I have no reservations about recommending LaTeX to both students and savants for their own technically-oriented authoring projects.

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