The Attralucian Essays:

Exploring the Finite

First Edition

 Typeset in LaTeX

The Attralucian Essays

Mathematics Within Language On Linguistic Compression

Kevin R. Haylett

Chapter 1

Overview

We demonstrate that mathematics is not a transcendent system accessing Platonic truths, but rather a specialized compression of natural language, which itself emerged as an encoding system for physical measurements. By tracing the fractal geodesic flow from measurement through acoustic patterns, visual symbols, and mathematical notation, we establish that all mathematical symbols inherit their meaning, structure, and constraints from their linguistic ancestry. This language-primacy principle provides an alternative derivation of Geofinite foundations, arriving at identical conclusions about finite symbolic dynamics, measurement uncertainty, and geometric grounding through examination of linguistic structure rather than mathematical axioms. The fractal self-similarity observed across phonemic, lexical, and symbolic scales reveals mathematics as a natural extension of measurement-encoding processes inherent in human language.

1.1 Introduction

1.1.1 The Standard View: Mathematics Above Language

Traditional philosophy of mathematics treats mathematical objects and truths as existing in a realm separate from and superior to natural language:

- **Platonic Realism:** Mathematical objects (numbers, sets, functions) exist eternally and independently in an abstract realm. Language merely provides imperfect labels for these perfect forms.
- **Formalist View:** Mathematics is a self-contained symbolic game operating by formal rules. Its connection to natural language is incidental—mathematics could in principle be conducted in any notation.
- **Logicist Program:** Mathematics reduces to pure logic, which itself transcends the contingencies of natural language. Symbolic logic reveals the "true structure" beneath linguistic expression.

Common assumption: Mathematics discovered or constructed something beyond language—a purer, more precise, more certain form of knowledge.

1.1.2 An Alternative Hypothesis

We propose a radically different view:

Language Primacy Thesis: Mathematics is a specialized subset of natural language, optimized for encoding and manipulating measurements through symbolic compression. All mathematical content, structure, and meaning derives from linguistic operations applied to measurement encodings.

Key claims:

- Natural language emerged as a system for encoding physical measurements into transmissible patterns
- Mathematical symbols are compressions of words that describe measurement operations
- Mathematical structure inherits its properties from linguistic structure
- The "precision" of mathematics comes not from transcending language but from specialized constraints within language
- All mathematical knowledge is ultimately grounded in measurement encoded through linguistic processes

Implications: If this thesis is correct, then:

- Mathematics cannot escape the finite, substrate-dependent, measurement-based nature of language
- Mathematical "truth" becomes a property of stable linguistic patterns rather than correspondence to Platonic objects

- The constraints we've identified in Geofinitism (finite form, measurement uncertainty, geometric embodiment) follow directly from linguistic foundations

- We arrive at Geofinite conclusions through a completely different route—via linguistics rather than mathematical axioms

1.1.3 Structure of This Work

We will trace the fractal geodesic flow of measurement encoding:

Section 2: Measurement as the origin of symbolic systems
Section 3: Acoustic encoding—the emergence of speech
Section 4: Visual encoding—the transition to writing
Section 5: Mathematical compression—symbols from words
Section 6: The alphonic hierarchy—fractal self-similarity
Section 7: Words encompassing mathematics
Section 8: The Platonic illusion exposed through linguistics
Section 9: Convergence with Geofinite principles
Section 10: Implications and future directions

1.2 Measurement as Origin

1.2.1 The Necessity of Distinction

Human cognition begins with distinction:

This vs. that   Here vs. there   One vs. many   Before vs. after   Heavy vs. light

Measurement is the formalization of distinction:

Not just "heavy" but "how heavy?"   Not just "many" but "how many?"   Not just "there" but "how far?"

Survival necessitates measurement:

How many predators?   How much food?   How far to shelter?   How long until sunset?

1.2.2 The Communication Problem

Measurements confined to individual minds have limited utility. Survival and cooperation require transmission:

The fundamental problem: How to transmit measurement information from one mind to another?

Constraints:

- Transmitter and receiver are spatially separated
- Information must travel through physical medium
- Encoding must be interpretable by receiver

- System must be learnable and reproducible

Solution: Encode measurements as physical patterns that can propagate through space and be decoded by others.

1.2.3 The First Encoding: Gesture

Before speech, gesture:

Point to indicate direction/location (spatial measurement) Hold up fingers to indicate quantity (numerical measurement) Pantomime actions to indicate events (temporal/causal measurement)

Limitations of gesture:

- Requires visual line of sight
- Limited bandwidth (can only convey simple measurements)
- Difficult to preserve over time
- Cannot transmit in darkness or at distance

1.2.4 The Acoustic Revolution

Speech emerged as a superior encoding system:

Advantages:

- Works in darkness
- Propagates around obstacles

- Leaves hands free for other tasks
- Higher bandwidth (more distinctions possible)
- Temporally sequential (enables complex combination)

Key insight: Speech is measurement encoded as acoustic patterns.

When a human says “three”:

- Physical measurement (visual count of objects)
- Encoded as acoustic pattern (specific sequence of phonemes)
- Transmitted as pressure waves through air
- Decoded by listener (acoustic → neural → meaning)
- Reconstructs measurement concept in receiver’s mind

Language is measurement transmission.

1.3 Acoustic Encoding: The Emergence of Speech

1.3.1 Phonemes as Acoustic Alphon

Discovery: Human speech consists of a finite set of distinct sounds—phonemes.

English phonemes: $\sim$44 distinct sounds

Critical observation: This is an acoustic alphon $\mathcal{A}_{\text{phoneme}}$.

Properties:

- Finite cardinality: $|\mathcal{A}_{\text{phoneme}}| \approx$ 40-50 for most languages
- Discrete distinctions: $/p/$ vs. $/b/$ are categorically different, not continuous variations
- Combinatorial generativity: Phonemes combine to form morphemes and words
- Geometric embodiment: Each phoneme has physical acoustic signature (frequency spectrum, duration, amplitude envelope)

1.3.2 Words as Acoustic Composites

Words are combinations of phonemes:

$$\text{“cat”} = /k/ + /\text{æ}/ + /t/ \quad \text{“tree”} = /t/ + /r/ + /i/$$
$$\text{“measurement”} = /m/ + /\epsilon/ + // + // + /r/ + /m/ + // + /n/ + /t/$$

This is alphonic structure at the acoustic level.

1.3.3 Words as Measurement Containers

Each word encodes measurement information. Every word is a compressed encoding of measurements or measurement relationships.

1.3.4 Acoustic Uncertainty

Phonemes are not perfect point-like sounds but fuzzy acoustic regions. This is the acoustic analogue of alphonic uncertainty $\pm\delta_k$.

1.4 Visual Encoding: The Transition to Writing

1.4.1 The Compression from Time to Space

Speech exists in time; writing encodes acoustic patterns as visual spatial patterns.

1.4.2 Alphabets as Visual Alphons

The alphabet is a visual encoding of the acoustic alphon: $\mathcal{A}_{\text{letter}} = \{A, B, C, \ldots, Z\}$

The underlying structure remains alphonic.

1.4.3 Writing as Frozen Measurement

Writing provides persistence, portability, precision, and accumulation.

Each written symbol is a geometric object with uncertainty bounds.

1.4.4 The Provenance Chain

Every written symbol has provenance: person, time, place, substrate, purpose. There is no "abstract A" floating in Platonic space—only specific instantiations.

1.5 Mathematical Compression: Symbols from Words

1.5.1 The Inefficiency of Words for Calculation

Using full words for measurement operations is cumbersome.

1.5.2 Numbers: From Words to Symbols

Evolution of number representation:

- Stage 1—Fully linguistic: "one," "two," "three"

- Stage 2—Abbreviated: Roman numerals
- Stage 3—Positional notation: Hindu-Arabic numerals 1, 2, 3, 4, 5

The meaning is inherited from the words.

1.5.3 Operations: From Verbs to Symbols

- "Add three to five" $\to 3 + 5$
- "Subtract two from seven" $\to 7 - 2$
- + compresses "add," "plus," "combine"
- Every mathematical operator has linguistic ancestry.

1.5.4 Functions and Relations

Even the most abstract symbols (sin, log, $\int$, =,¡)$tracebacktowordsdescr$

1.5.5 The Compression Hierarchy

Mathematics is hyper-compressed linguistic encoding of measurement operations.

1.6 The Alphonic Hierarchy: Fractal Self-Similarity

1.6.1 The Nested Structure

Level	Name	Alphabet	Domain	E
0	Phonemes	$\mathcal{A}_{\text{phoneme}} \approx$ 40-50	Acoustic	/
1	Letters	$\mathcal{A}_{\text{letter}} = 26$	Visual	C
2	Words	$\mathcal{A}_{\text{word}} \approx 170{,}000$	Semantic	T
3	Math symbols	$\{0\text{-}9, +, -, \times, \div, =, \sin, \ldots\}$	Operational	2
4	Equations	Well-formed equations	Relational	F

1.6.2 The Universal Pattern

At every level: finite discrete alphabet, combinatorial generation, geometric embodiment, uncertainty bounds.

1.6.3 Formalization: The Alphonic Fractal

Definition 6.1 (Alphonic Level): An alphonic level L_k consists of a finite alphabet $\mathcal{A}_k$, combination rules Γ_k, geometric embodiment E_k, uncertainty measure δ_k.

Theorem 6.1 (Fractal Self-Similarity): The structure $(\mathcal{A}, \Gamma, E, \delta)$ is preserved across levels.

1.7 Words Encompass Mathematics

1.7.1 Mathematical Statements Are Sentences

Every mathematical statement has linguistic structure (subject-verb-object, conditionals, quantifiers).

1.7.2 We Read Mathematics as Language

Symbolic form decompresses into natural language. When teaching, we always translate symbols into words.

1.7.3 Etymology of Mathematical Terms

Every mathematical concept has linguistic origin (zero, algebra, calculus, function, etc.).

1.7.4 Proofs Are Arguments

Proofs follow rhetorical structure using linguistic devices ("suppose," "therefore," etc.).

1.7.5 Mathematics as Specialized Vocabulary

Mathematics is a specialized dialect of natural language, not a separate realm.

1.8 The Platonic Illusion Exposed Through Linguistics

1.8.1 Revisiting the Platonic Catalog

The absurdities of Platonic mathematics (infinities, perfect circles, dimensionless points, etc.) arise because we forgot symbols are compressed linguistic encodings of measurements.

1.8.2 Language Detached from Reference

Historical process: words → symbols → formal manipulation → forgetting measurement origin → postulating Platonic realm.

1.8.3 Infinity: Procedural Instruction Reified

"Keep going" treated as completed object.

1.8.4 Zero, Points, Lines, Planes, Perfect Circles, π, Continuum Hypothesis

All are linguistic reification errors.

1.8.5 Summary

Mathematical pathologies are linguistic artifacts. Geofinitism resolves them by maintaining geometric grounding.

1.9 Convergence with Geofinite Principles

Two independent routes (axiomatic and linguistic) arrive at identical conclusions: finite form, measurement uncertainty, geometric containment, base dependence, procedural infinity, attractor-based truth, provenance.

This convergence is powerful evidence that Geofinitism reflects fundamental constraints.

1.10 Implications and Future Directions

- Mathematics education: teach as measurement encoding
- Philosophy: dissolves traditional debates
- Computer science: computation is symbolic dynamics in linguistic space
- AI: LLMs show mathematics is within language

- Cross-linguistic mathematics: universality from shared measurements
- Future research programs enabled by this framework

1.11 Conclusion

Mathematics is not a transcendent system but a specialized dialect of natural language optimized for encoding and manipulating measurements. The fractal geodesic flow from measurement through language to mathematics reveals a deep unity in human symbolic systems.

Geofinitism, now supported by both axiomatic and linguistic foundations, provides a coherent, grounded alternative to Platonism.

Acknowledgments

This work emerged from collaborative dialogue exploring linguistic foundations of mathematics. The analysis builds on Kevin R. Haylett's Geofinite framework and extends it through systematic examination of language as the medium in which mathematics exists and operates.

Bibliography

[1] Haylett, K. R. (2025). *Geofinitism: A Measurement-Based Mathematical Framework*. Collaborative document with Claude.

[2] Haylett, K. R. (2025). *Geofinite Resolution of Division by Zero*. Collaborative document with Claude.

[3] Lakoff, G., & Núñez, R. E. (2000). *Where Mathematics Comes From*. Basic Books.

[4] Dehaene, S. (2011). *The Number Sense*. Oxford University Press.

[5] Chomsky, N. (1965). *Aspects of the Theory of Syntax*. MIT Press.

[6] Wittgenstein, L. (1953). *Philosophical Investigations*. Blackwell.

[7] Everett, D. L. (2005). Cultural Constraints on Grammar and Cognition in Pirahã. *Current Anthropology*, 46(4), 621–646.

[8] Menninger, K. (1969). *Number Words and Number Symbols*. MIT Press.

.1 Linguistic Evidence Table

Mathematical Symbol	**Linguistic Origin**	**Measurement F**
0	"Nothing," "empty"	Absence of count
$+$	"And," "plus"	Combination
	"Less," "minus"	Removal
$\times$	"Times," "by"	Repeated additio
$\div$	"Divide," "split"	Partition
$=$	"Equal," "same"	Equivalence
¡	"Less than"	Comparative mag
$\sqrt{\cdot}$	"Root"	Inverse of squarin
$\int$	"Sum," "integral"	Accumulation
Σ	"Sum"	Total of series
π	"Circumference"	Circle ratio
sin	"Sine," "curve"	Vertical compone
log	"Logarithm"	Exponential inver
lim	"Limit," "boundary"	Approach behavio

Fractal Levels Formal Specification

Level 0: Phonemic $\mathcal{A}_0 \approx$ 40-50 phonemes, acoustic embodiment

Level 1: Alphabetic $\mathcal{A}_1 = 26$ letters, visual embodiment

Level 2: Lexical $\mathcal{A}_2 \approx 170{,}000$ words

Level 3: Mathematical	core symbols, precision limits
Level 4: Equational	compositionally unbounded

Fractal Property: Structure preserved across levels.