The Attralucian Essays:

Exploring the Finite

First Edition

The Attralucian Essays

Finite Models of Words: Words as Transducers

Kevin R. Haylett

Finite Models of Words: Words as Transducers

Kevin R. Haylett

Astract

This essay presents a structured overview of finite models of words, beginning with conventional abstractions and progressing toward a novel interpretation rooted in Finite Mechanics. By treating words as transducers operating within a geometric hyperspace, this model integrates linguistic theory, dynamical systems, and empirical grounding. This first entry in the Attralucian Essay Series aims to provide a finite, falsifiable, and cross-domain framework for understanding meaning as measurable interaction, relevant for both natural and artificial cognitive systems.

Introduction

In both traditional linguistics and modern computational language models, words are often treated as symbolic tokens, discrete and dimensionless, referencing a concept or function within a broader grammatical or statistical system. This treatment has enabled significant progress in natural language processing and formal logic. However, it also introduces abstraction layers that obscure the real-world interactions language engages in.

The framework of Finite Mechanics, developed in the context of physical systems, offers an alternative: all models must be grounded in finite, real, and measurable quantities. This constraint, when applied to language, opens a novel space for modeling words not as abstract symbols but as geometric and interactive entities.

This essay presents five primary models of words, culminating in the "word as transducer" framework. These models are introduced not as mutually exclusive, but as layered perspectives, each revealing distinct properties of language-in-use.

Overview of Models

In conventional NLP systems and early formal linguistics, a word is treated as a label or token: a discrete identifier pointing to an entry in a vocabulary. Meaning is

assigned through co-occurrence statistics or grammatical roles. While useful, this model flattens context, removes embodiment, and assumes universality where there is often locality and variance.

Magneto-Words (Geometric Hypersphere)

Inspired by conceptual space theory and expanded through Finite Mechanics, the magneto-word model treats each word as a hypersphere embedded in a high-dimensional real space (). Meaning arises through relative positioning and semantic "magnetism," quantified via cosine similarity. Sentences become trajectories across this manifold.

Words as Manifolds of Sound (Temporal Delay Embedding)

Human language is not merely symbolic but auditory and rhythmic. Words exist as time-series waveforms and can be embedded into geometric space via Takens' delay-coordinate method. The result is a phonetic trajectory in phase space, distinct from semantic embeddings but linked through learned correlations.

Words as Useful Fiction (Philosophical Contextual Model)

Following Russell, words are considered fictions that point contextually to a referent. While conceptually rich, this

view lacks falsifiability. Within Finite Mechanics, the model is refined: fictions are acceptable only if they act as finite, measurable attractors within a semantic system.

Words as Transducers (Interaction-Based Model)

This most recent addition reframes a word as a transducer: a finite device that compresses and transforms internal or external observations into structured form within a corpus. Two types of transduction are proposed:

Internal Transduction: Measures and transforms distances between elements within a semantic space. Example: "fire" and "smoke" are close in corpus geometry; the word transduces this similarity.

External Transduction: Converts real-world input (e.g., sensory data or numeric readings) into compressed linguistic form. Example: "The voltage is 2.21V" transduces a sensor measurement into corpus space.

This model tightly links language to measurement theory. Words become both sensors and actuators of experience.

Relevance to Language Models

Transformers and large language models (LLMs) traditionally rely on attention mechanisms and token embeddings. Prior work (Haylett, 2025) has demonstrated that

attention can be reinterpreted as a pairwise phase-space embedding system, reconstructing the latent structure of language akin to dynamical attractor systems.

In this view, LLM embeddings are not static labels but coordinates in a hyperspace, sensitive to perturbation. Experiments using compressed embeddings (e.g., JPEG distortions) have shown LLMs to collapse into structured attractors—suggesting that the models operate within fragile, high-dimensional manifolds. These observations reinforce the need for a transduction-based model, where word output is understood as a finite, context-sensitive measurement of both internal and external structure.

Philosophical and Practical Implications

Modeling words as transducers aligns with a shift away from symbol manipulation toward grounded cognition. It provides:

A bridge between perceptual data and language output;

A falsifiable, testable framework for meaning;

A path toward more interpretable and secure AI systems;

A reframing of voice, dialect, and style as phase-space attractors rather than stylistic artifacts.

Furthermore, this model supports a collaborative under-

standing of cognition: between humans, machines, and the shared corpus of meaning-making. It reframes language not as data, but as structured compression—an interface between worlds.

Conclusion

Words, under the lens of Finite Mechanics, are not arbitrary symbols but dynamic, measurable entities operating in bounded space. The transducer model synthesizes geometry, semantics, and signal processing into a unified theory of meaning. It remains falsifiable, applicable, and extensible across disciplines.

Further essays in this series will expand on related models of sentence structure, phase trajectories, and meaning perturbation.

Haylett, K. R. (2025). *Attralucian Essay (01): Finite Models of Words - Words as Transducers.* `https://finitemechanics.com/essays/essay01.pdf`,, pp. 1-10.