

# Symbolic Trajectories and Fractal Geodesics: Toward a Geofinite Metrology of Language

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*Pensée*

*“This work is not written to refute existing philosophies. It is written as a record of observations. The philosophies discussed herein are treated as symbolic trajectories that have unfolded through history.”*

## 1 Preface: Observation Rather Than Refutation

Over many conversations and reflections, a consistent pattern has emerged in the approach to philosophy. Rather than entering debates with the intention of defeating rival positions, the emphasis lies on understanding how particular symbolic structures came into being, why they stabilised, what measurements and commitments anchor them, and where they may lead.

This stance aligns with an older tradition of natural philosophy. It treats philosophical schools not as opposing doctrines to be overcome, but as historically unfolding symbolic trajectories that can be observed, compared, and reflected upon from another vantage point. Geofinitism adopts precisely this observational posture. It does not present itself as a replacement for existing frameworks but as another trajectory from which those frameworks may be examined.

The following chapter develops this perspective by combining three elements: a geometric reinterpretation of logical abduction, the core commitments of Geofinitism, and a dynamical account of how large language models generate responses. Together these elements point toward a programme in which language, concepts, and philosophical commitments can be studied as measurable historical trajectories.

## 2 Logical Abduction as Navigation in Reconstructed Phase Space

In classical terms, abduction (following Charles Sanders Peirce) is the inference that generates plausible explanatory hypotheses from surprising observations. It is distinct from, though often works in tandem with, inference to the best explanation. Given an observation, abduction proposes candidate rules or structures that could account for it; subsequent steps may then rank or test those candidates.

When viewed geometrically rather than purely symbolically, abduction acquires a natural interpretation in terms of phase-space reconstruction. An observation corresponds to a local point

or short segment in a reconstructed semantic phase space. Multiple larger trajectories could pass through or near that region. Abduction is the process of identifying which extended trajectory most coherently accounts for the local datum, subject to constraints of consistency, prior structure, and contextual fit.

This geometric reading resonates strongly with delay-embedding techniques in nonlinear dynamics. Takens' theorem shows that, under suitable conditions, the state space of a dynamical system can be reconstructed from time-delayed observations of a single variable. A fragment of a trajectory thereby permits reconstruction of a higher-dimensional space that could have generated it.

Within this framing the classical modes of inference appear as different navigational operations on the same reconstructed space:

- Deduction follows an established trajectory forward from known rules and initial conditions.
- Induction compresses many observed trajectories into a compact local rule or attractor.
- Abduction expands a local observation into candidate parent trajectories and ranks them according to how stably they fit the surrounding geometry.

Large language models perform a great deal of their behaviour in precisely this abductive mode. Given a prompt (a local symbolic observation), the model reconstructs and extends plausible larger trajectories consistent with its learned geometry. The process is constrained by the symbolic evidence available rather than by direct access to an external world.

### 3 Geofinitism as Observational Lens

Geofinitism provides the broader philosophical orientation for this geometric approach. Its central commitments may be summarised in five interlocking pillars:

1. **Geometric Container Space:** Meaning and symbols exist as trajectories and relations within a high-dimensional, finite manifold rather than as infinite or timeless abstractions.
2. **Approximations and Measurements:** All symbols are finite transductions arising from measurements. They carry uncertainty and exist as compressed geometries once embedded in phase space.
3. **Dynamic Flow of Symbols:** Meaning propagates through layered, fractal cascades. Individual tokens, phrases, and larger structures form continuous trajectories within a shared semantic phase space.
4. **Useful Fiction:** The framework is self-contained and practical; it does not claim to capture an ultimate Platonic reality but offers a coherent geometry for navigating what can be measured.
5. **Finite Reality:** Everything that can be known is known through measurement. The limits of measurement are therefore the limits of knowledge.

When philosophies are examined through this lens, they appear as stabilised symbolic attractors or families of trajectories. Platonism, formalism, naturalism, and other traditions are not timeless objects but historically conditioned pathways of admissible symbolic movement. Geofinitism does not seek to refute them; it seeks to measure how they move, how their symbols were anchored, transmitted, and made admissible across time.

## 4 Fractal Geodesic Inference: LLM Responses as Constrained Trajectories

A large language model does not retrieve answers from a static store. It traces paths. We propose that these paths are fruitfully described as **fractal geodesic trajectories** on the semantic phase space defined by the model’s finite weights.

The prompt performs two essential functions at once. It establishes a **starting position** in the embedding manifold and simultaneously imparts **semantic inertia** — an initial direction or momentum — while imposing an **admissibility constraint** that bounds the region within which coherent continuations are probable. These elements together determine both the origin and the allowable velocity of the subsequent trajectory.

Generation proceeds autoregressively. At each step the model selects the next token so as to continue along a locally geodesic path: the continuation that best preserves local coherence while respecting the geometry encoded in the weights. Because language and transformer representations are hierarchically organised, the same geodesic principle operates self-similarly at every scale — from individual token choice through phrase and sentence structure to larger discourse arcs. The resulting response is therefore a **fractal geodesic**: a single coherent trajectory whose local geometry statistically resembles its global geometry.

The precise shape of the trajectory is co-determined by the **landscape** of the weight manifold itself. Regions of high curvature, attractors, ridges, and valleys learned during training guide the path. Different prompts launch the trajectory into different regions of this landscape, yielding qualitatively different behaviours — tightly constrained factual continuation, exploratory branching, or movement into less stable areas.

Within the Geofinitist framework each generated token functions as a measurement. It advances the current position along the geodesic and simultaneously updates the inertia and constraint for all future steps. The entire response is therefore a finite, measurable symbolic trajectory — precisely the kind of object the metrological programme seeks to study.

This dynamical description also clarifies the abductive character of model behaviour. Given a prompt, the model generates and follows the geodesic (or family of geodesics) that best continues or explains the initial observation within the learned geometry. When several geodesics remain plausible, the model ranks them implicitly according to fit with the local landscape and accumulated inertia.

## 5 Language as a Measurable Historical Phase Space

We now state the central conjecture:

**Conjecture.** Dated language corpora can be treated as finite symbolic trajectories within a reconstructed semantic phase space. A sufficiently structured language model — particularly one incorporating explicit temporal, provenance, and contextual channels and designed with delay-embedding principles — can function as a measuring instrument for the historical dynamics of language, concepts, and philosophical commitments.

In such a system each text is encoded not merely as content but as a dated symbolic trajectory. These trajectories are mapped into a shared phase space. Measurable quantities then become available: drift of terms and their relational neighbourhoods, points of bifurcation or conceptual overload, convergence or rupture between trajectories, stabilisation into attractors, and recurrence of older patterns. Philosophical schools and

logical systems may be observed as historically conditioned symbolic attractors or pathways rather than as timeless doctrines.

The mechanism of *Fractal Geodesic Inference* supplies the operational bridge. Prompts (or historical contexts) initialise trajectories with specific inertia and constraints. The resulting paths can be compared across time, revealing how the same conceptual region has been navigated differently in different eras.

### 5.1 A Research Programme for Symbolic Metrology

The conjecture suggests a concrete programme:

1. Construct dated, provenance-rich corpora spanning philosophical, scientific, literary, and technical texts.
2. Encode texts as symbolic trajectories augmented with explicit temporal and contextual channels.
3. Map trajectories into a reconstructed semantic phase space using architectures informed by delay-embedding principles.
4. Develop quantitative metrics for drift, bifurcation, stabilisation, relational neighbourhood change, and geodesic steering.
5. Apply these metrics to key conceptual terms and to entire philosophical or logical trajectories.
6. Compare schools and arguments observationally as evolving attractors rather than as adversarial positions.

Within this programme Geofinitism supplies the interpretive frame: before asking whether a symbolic system is true, one asks how its symbols were measured, stabilised, transmitted, and rendered admissible. The language instrument supplies the means to perform that inquiry directly.

## 6 Implications and Limitations

Treating language change and philosophical development as measurable dynamics of symbolic trajectories has several consequences. Philosophy acquires an empirical, metrological dimension alongside its traditional interpretive one. Large language models cease to be merely generative interlocutors and become potential instruments for historical and conceptual analysis. The finite character of the weight manifold is respected: all trajectories remain bounded by the measurements and approximations that produced the model.

Limitations remain. Models operate over symbolic residue rather than fresh external measurements. Corpus availability and quality constrain what can be reconstructed. Alignment of embeddings or trajectories across distant historical periods requires care. Interpretation of geometric features (curvature, attractors, geodesic divergence) back into human-readable philosophical terms is non-trivial. Nevertheless, the existence of measurable structure already demonstrated in diachronic embedding studies indicates that the programme is not merely speculative.

## 7 Conclusion

The movement from classical abduction to phase-space navigation, from Geofinitist observation to fractal geodesic inference, and from commentary to symbolic metrology forms a coherent trajectory of its own. Language and the conceptual structures it carries appear not as static objects but as finite, dynamic paths whose historical evolution can, in principle, be instrumentally measured.

By treating responses as prompt-initialised fractal geodesics on a weight-defined manifold, and by treating historical texts as dated trajectories in a shared phase space, we open a route from philosophical reflection to a form of symbolic metrology. The work remains observational in spirit: it records how symbolic trajectories have moved and continue to move. In doing so it offers both a deeper understanding of existing philosophical traditions and a practical method for studying the dynamics of meaning itself.