Field Ontology Theory (FOT)

A Semantic Ontology for Regime-Stable Structure

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Abstract

Field Ontology Theory (FOT) introduces an explicit ontological layer beneath semantic regimes and observational frameworks. While Semantic Regime Theory (SRT) explains how meaning stabilizes under admissible action, and Quantum Observation Theory (QOT) explains how observation may occur without execution or intervention, both presuppose an underlying substrate capable of supporting structure, invariance, and persistence.

FOT formalizes this substrate by defining fields as pre-geometric, non-metric carriers of structured possibility. Fields are characterized by intrinsic constraints, admissible transformations, and ontological invariants that persist independently of observation, representation, or dynamics. Ontology, in this framework, precedes geometry, dynamics, semantics, and epistemology.

By separating admissible transformation from ontological change, FOT provides a foundation on which semantic regimes and non-intervening observation become intelligible. The theory introduces no new mathematics and derives no physical laws; it clarifies the ontological conditions that make structure, meaning, and observation possible at all.

Contents

1 Motivation and Scope

Across physics, computation, and formal systems, the notion of a field appears repeatedly as a stabilizing substrate beneath observable phenomena. Physical fields, computational state spaces, policy landscapes, and semantic environments all exhibit field-like behavior: relations constrain behavior, transformations reorganize structure, and invariants persist across admissible change.

Despite this ubiquity, fields are almost always introduced downstream—as mathematical objects, physical quantities, or representational conveniences. They are rarely treated as ontological primitives. This ordering obscures the conditions under which structure itself exists and persists.

This paper argues that the ordering must be reversed. Before geometry, dynamics, observation, or semantics can arise, there must exist an ontological substrate whose internal constraints admit persistence independently of representation. Field Ontology Theory (FOT) isolates and formalizes this substrate.

Semantic Regime Theory (SRT) explains how meaning stabilizes under admissible action. Quantum Observation Theory (QOT) explains how structured systems may be observed without execution or intervention. Both theories presuppose a structured domain on which regimes act and observations project. FOT supplies that domain.

[Foundational Ordering] Ontology precedes semantics, and semantics precedes epistemology. This ordering is structural, not temporal, and is not reversible.

The scope of FOT is deliberately narrow. It does not describe dynamics, measurement, or representation. It addresses a prior question:

What must exist for structure, invariance, and observation to be possible at all?

2 Ontology Before Observation

Observation is often treated as the starting point of knowledge. In physics, measurement defines quantities; in computation, execution defines state; in epistemology, perception defines access. In all such cases, observation presupposes that something exists to be observed.

Field Ontology Theory makes this presupposition explicit.

[Ontology vs. Epistemology] Ontology concerns what exists and persists. Epistemology concerns how that existence is accessed, represented, or inferred.

A field, in the sense of FOT, is not discovered by observation, nor created by it. Observation operates on fields; it does not generate them.

[Observational Presupposition] Any observation operator is defined only over an existing ontological field.

This lemma formalizes the separation used implicitly in QOT, where observation is non-executing and preserves underlying structure.

Without this separation, ontological claims collapse into epistemic ones, and disagreements about observation are mistaken for disagreements about existence. FOT prevents this collapse by construction.

3 The Concept of a Field (Semantic, Not Metric)

In FOT, a field is not defined by continuity, coordinates, equations, or measurement procedures. A field is a carrier of structured possibility: a domain in which relations, constraints, and invariants may exist and persist.

[Field] A field is a structured tuple

$$\mathcal{F} := (\mathcal{C}, \mathcal{A}, \mathcal{I})$$

where:

- $\mathcal{C}$ is a space of admissible configurations,
- $\mathcal{A}$ is a family of admissible transformations,
- $\mathcal{I}$ is a set of ontological invariants.

No metric, topology, or temporal structure is assumed.

[Non-Metricity] Continuity, distance, smoothness, and geometry may emerge downstream, but are not primitives of the field ontology.

[Domain Generality] Physical fields, semantic fields, computational fields, and policy fields are instances of the same ontological concept under differing downstream structures.

4 Ontological Primitives

Field Ontology Theory introduces a minimal set of ontological primitives.

4.1 Fields

Fields are primary ontological entities. They support structure without encoding meaning, measurement, or dynamics.

4.2 Configurations

[Configuration] A configuration is a possible internal arrangement of a field, belonging to $\mathcal{C}$.

Configurations are ontological possibilities, not events or states.

[Atemporality] The configuration space $\mathcal{C}$ is defined independently of time.

4.3 Constraints

[Constraint] A constraint is an intrinsic restriction determining admissibility of configurations and transformations.

Constraints exist independently of observation or enforcement.

4.4 Invariants

[Invariant] An invariant is a structural feature preserved under all admissible transformations in $\mathcal{A}$.

4.5 Absence of Measurement

Fields, configurations, constraints, and invariants exist without observers, execution, or measurement. This is an ontological claim, not an empirical one.

5 Field Identity and Persistence

[Field Identity] Two fields $\mathcal{F}_1$ and $\mathcal{F}_2$ are identical if and only if they admit the same admissible transformations:

$$\mathcal{F}_1 \equiv \mathcal{F}_2 \iff \mathcal{A}_1 = \mathcal{A}_2.$$

[Identity Invariance] Field identity is invariant under all admissible transformations.

[Configuration Change] Changes in configuration do not constitute ontological change.

Persistence is structural consistency, not durability through time. Time, if introduced, occurs within a field.

6 Admissible Transformations

[Admissible Transformation] A transformation T is admissible if:

$$T \in \mathcal{A} \Rightarrow T(\mathcal{C}) \subseteq \mathcal{C}.$$

[Quotient Validity] Equivalence relations induced by admissible transformations preserve field identity.

Symmetries are downstream representations of admissibility, not its definition.

7 Interaction and Ontological Change

[Interaction] An interaction is a transformation that violates admissibility by altering field constraints.

[Ontological Change Criterion] Ontological change occurs if and only if admissibility fails.

Observation preserves admissibility; interaction may destroy it. This aligns with the non-executing semantics of QOT.

8 Relation to Semantic Regime Theory

Semantic Regime Theory operates over a fixed field ontology. SRT defines equivalence classes induced by admissible action. FOT defines the substrate on which such equivalence is meaningful.

SRT answers what remains meaningful under action; FOT answers what exists prior to action.

9 Relation to Quantum Observation Theory

Quantum Observation Theory formalizes non-executing observation. FOT defines what such observation preserves.

An observation is admissible if and only if it preserves field constraints.

QOT constrains how observation occurs; FOT constrains what may be observed without ontological change.

10 Relation to Physics and Other Domains

FOT does not derive physics. It grounds it. Physical fields are special cases of ontological fields under additional geometric and dynamical structure.

The same ontology applies to compilers, policy systems, and semantic analysis without reduction.

11 Non-Goals and Exclusions

FOT does not define dynamics, predict measurements, replace physics, or introduce execution. These exclusions are principled and preserve ontological clarity.

12 Implications

Once ontology is explicit, semantic lifting becomes clean, abstraction becomes stable, and cross-domain structural transfer becomes possible without paradox or semantic drift.

13 Conclusion

Ontology is not discovered by observation.

Observation is possible only because ontology is already there.

A Examples and Applications

A.1 Physics

Field: spacetime or gauge field. Constraints: causal structure, gauge invariance. Admissible transformations: diffeomorphisms, gauge transformations. Interaction: curvature or coupling altering constraint structure.

A.2 Compilers and Computation

Field: representational space. Constraints: equivalence relations. Admissible transformations: structure-preserving rewrites. Interaction: state-altering intervention.

A.3 Policy and Governance Systems

Field: policy space. Constraints: legal or operational rules. Admissible transformations: refactoring or normalization. Interaction: enforcement or override.

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