

Fundamental Interaction Language

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Chapter 1

Foundations and Semantic Constants

1.1 The Information–Observation–Language (I–O–L) Triad

Modern knowledge systems reveal a recurring motif: comprehension requires only the *differences* between two bodies of knowledge, not their entirety. We formalise this with the **Information–Observation–Language triad**

$$(\mathcal{I}, \mathcal{O}, \mathcal{L}) = (\mathcal{I}, \mathcal{O}, \mathcal{L}), \quad (1.1)$$

where \mathcal{I} denotes possible information states, \mathcal{O} the set of admissible observations, and \mathcal{L} the symbolic language capable of encoding both. Minimal "bridges" between domains are implemented by Local Language Constructors (LLCs), treated in Chapter ??.

1.2 Foundational Postulates

Postulate F1 (Semantic locality). Any act of communication factors through a finite sub-language $B \subseteq \mathcal{L}$ such that $E \otimes B \cong \mathcal{L}$, with E the receiver's existing language fragment.

Postulate F2 (Minimal bridges). Among all such B , natural communication selects one that minimises $|B|$.

Postulate F3 (Hierarchical union). Languages compose by hierarchical union and the semantic density ρ is non-decreasing under this union.

1.3 Semantic Constants

We introduce two universal constants:

c_s the *semantic light-speed*, bounding information propagation in a knowledge graph:

$$d_G(v_1, v_2) \leq c_s \Delta t. \quad (1.2)$$

\hbar_s the *semantic Planck constant*, appearing in an uncertainty relation between discovery and invention operators:

$$\Delta D \Delta I \geq 12 \hbar_s. \quad (1.3)$$

Convenient units set $c_s = \hbar_s = 1$; deviations measure complexity.

1.4 Road-map

This chapter establishes notation for the remainder of the book. Chapter ?? develops the geometric view (c_s as cone slope), Chapter ?? derives global limits from Eq. eq:sem-uncertainty, Chapter ?? treats drift and masks, and Chapter ?? links the constants to physical information bounds.

Take-away. The triad $(\mathcal{I}, \mathcal{O}, \mathcal{L})$ and constants (c_s, \hbar_s) provide an irreducible substrate on which all higher FIL structures are built.