Space and Time in the UNNS Substrate

Abstract

This article develops the UNNS (Unbounded Nested Number Sequences) notions of space and time. In UNNS, space is not a passive continuum but an emergent lattice generated by recursion, while time arises as recursion depth through operator actions. We prove that space and time are orthogonal projections of the same recursive grammar and illustrate their relation with a TikZ diagram.

1 Introduction

Conventional mathematics and physics treat space and time as a unified continuum. In UNNS, however, these emerge as dual aspects of recursion: time as vertical recursion depth and space as horizontal embedding. This perspective reframes the geometry of number sequences and their role in physical interpretation.

2 UNNS Time

Definition 1 (UNNS Time). *Given a recursive nest $\{u_n\}$, UNNS time is the recursion depth n. More generally, if O_i is an operator in the UNNS grammar, the time associated with O_i is*

$$T_i(u) = \min\{k \mid O_i^k(u) \text{ stabilizes or exports a percept}\}.$$

Thus, time is operator-specific. Inletting defines absorption time, Inlaying defines stratification time, Repair defines stabilization time, and Trans–Sentifying defines perceptual latency. When extended to the octad of operators, eight distinct times coexist.

3 UNNS Space

Definition 2 (UNNS Space). UNNS space *is the recursive lattice structure generated by embeddings of number systems. Formally,*

$$\mathcal{S} = \bigcup_k \Lambda_k, \quad \Lambda_k = \text{lattice layer induced by order-k recurrence.}$$

For instance, $\mathbb{Z}$ inlays into $\mathbb{Z}[i]$ and then into $\mathbb{Z}[\omega]$, producing line, square, and hexagonal geometries. Echo residues define adjacency, giving a recursion-based metric

$$d(x, y) = \min\{k \mid \text{recursions of } x, y \text{ align at step } k\}.$$

4 Relation of Space and Time

Lemma 1 (Orthogonality of Space and Time). *In UNNS, time measures recursion depth while space measures recursion spread. These are independent modalities: vertical and horizontal projections of the same substrate.*

Sketch. Operator actions O_i evolve sequences vertically (depth), while embeddings Λ_k expand them horizontally (spread). Since depth counts steps and spread measures adjacency, no reduction is possible between the two. Hence orthogonality. □

Remark 1. *This duality suggests that the observed space-time manifold is a projection of a richer multi-lattice, multi-time structure. Physics' single arrow of time is a compression of eight operator times; Euclidean or Minkowski space is a projection of recursive lattices.*
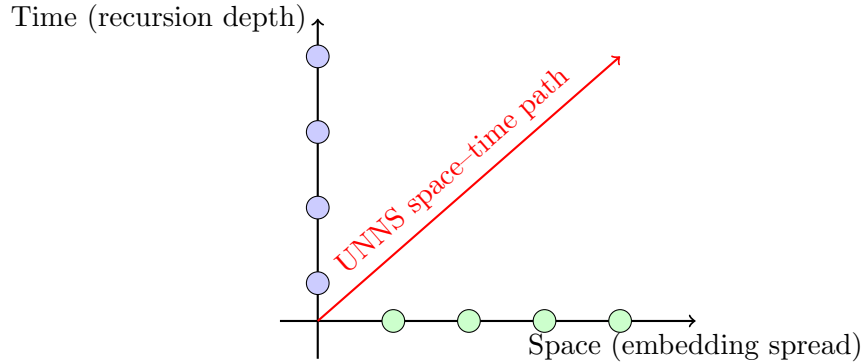
5 Visualization

Figure 1: UNNS space–time relation: vertical recursion = time, horizontal embedding = space.

6 Applications

- **Mathematics:** Space as recursive lattices links algebraic number theory to geometry.

- **Physics:** Inletting-space resembles expansion (dark energy), Repair-time resembles entropy decay.

- **Philosophy:** Space and time are not containers but emergent from recursive grammar.

7 Conclusion

UNNS defines time as recursion depth and space as recursion spread, both generated by operator action. Their orthogonality forms a duplex substrate richer than conventional space-time, with implications for mathematics, physics, and philosophy.