UNNS Trans–Sentifying:
Interface Protocol Between Recursion and Perception

UNNS Research Notes

September 22, 2025

Abstract

Unbounded Nested Number Sequences (UNNS) form a recursive substrate capable of generating algebraic and topological structures. To make UNNS useful for humans and machines, invariants must be mapped into channels of perception, interpretation, and action. We call this process *Trans–Sentifying*: the systematic export of UNNS echoes and constants into perceptual, semantic, or symbolic domains. This paper formalizes Trans–Sentifying as a functorial interface, defines encoding and rendering layers, and explores mathematical properties, algorithmic implementations, and analogies to sensory biology and physics.

Contents

1 Introduction **2**

2 Definitions **2**

3 Examples **2**

4 Mathematical Properties **3**

5 Algorithmic Recipe **3**

6 Analogies **3**

6.1 Biology: sensory transduction 3

6.2 Physics: observables 3

7 Diagram **4**

8 Conclusion **4**

9 Introduction **4**

10 Definitions **5**

11 Examples **5**

12 Mathematical Properties **5**

13 Algorithmic Recipe **5**

14 Analogies **6**
14.1 Biology: sensory transduction . . . 6
14.2 Physics: observables . . . 6

15 Diagram **6**

16 Conclusion **6**

1 Introduction

UNNS is self-contained: it propagates sequences and echoes recursively. Yet without a way to *see, hear, or interpret* these invariants, they remain locked in abstraction. *Trans–Sentifying* provides the bridge: mapping recursive invariants into channels of perception (visual, auditory, semantic, or machine embeddings).

This paper develops a detailed account of Trans–Sentifying:

- definitions and theoretical framing,
- encoding and rendering protocols,
- stability and fidelity properties,
- algorithmic recipes,
- analogies to biology (sensory transduction) and physics (observables).

2 Definitions

Definition 2.1 (Trans–Sentifying protocol)**.** *A* Trans–Sentifying protocol *is a mapping*

$$\mathcal{T} : \mathcal{U} \longrightarrow \mathcal{S},$$

where $\mathcal{U}$ *is a UNNS substrate and* $\mathcal{S}$ *is a perceptual or semantic space (audio signals, visual fields, symbolic tokens, or embeddings).*

Remark 2.2. *The protocol* $\mathcal{T}$ *is typically two-layered:*

1. Encoding: *extract a finite feature vector* $\mathbf{f}(\mathcal{R})$ *from a region* $\mathcal{R} \subset \mathcal{U}$*.*
2. Rendering: *map* $\mathbf{f}$ *to perceptual or symbolic output.*

3 Examples

Example 3.1 (Visual trans–sentifying)**.** *Residue magnitudes* $\{|r_i|\}$ *are mapped to luminance; phases* $\{\arg(c_i)\}$ *to color hue; lattice levels to concentric rings.*

Example 3.2 (Audio trans–sentifying)**.** *Dominant eigenvalue* λ *of local companion matrix is mapped to a pitch* $f = f_0 \cdot |\lambda|$*. Residue growth factors map to amplitude envelopes.*

Example 3.3 (Semantic trans–sentifying)**.** *Quantized Gauss or Jacobi sums are mapped to symbolic tokens, which can be embedded in a language model.*

4 Mathematical Properties

Definition 4.1 (Feature map)**.** *Let $\mathcal{R} \subset \mathcal{U}$ be finite. A feature map is*

$$\mathbf{f}(\mathcal{R}) = \big(\rho(C_{\mathcal{R}}),\ \max|r_i|,\ \arg(c_j),\ \textit{Gauss sum residues}, \dots\big).$$

Proposition 4.2 (Lipschitz stability)**.** *If $\mathbf{f}$ is normalized (e.g. residues divided by max) and rendering applies smoothing, then $\mathcal{T}$ is Lipschitz:*

$$\|\mathcal{T}(\mathcal{R}_1) - \mathcal{T}(\mathcal{R}_2)\| \leq L\|\mathbf{f}(\mathcal{R}_1) - \mathbf{f}(\mathcal{R}_2)\|.$$

Sketch. Normalization prevents unbounded growth; smoothing ensures bounded variation. Composition of Lipschitz maps is Lipschitz. □

Remark 4.3. *This ensures that small perturbations in UNNS do not cause catastrophic perceptual distortions.*

5 Algorithmic Recipe

1. **Select region** $\mathcal{R}$ in $\mathcal{U}$.
2. **Encode** features $\mathbf{f}(\mathcal{R})$ (spectral radius, residues, phases, constants).
3. **Choose channel** (visual, audio, symbolic).
4. **Render** by mapping $\mathbf{f}$ into chosen channel parameters.
5. **Deliver** output to human or machine.

6 Analogies

6.1 Biology: sensory transduction

- Retina: photons $\rightarrow$ electrical pulses.
- Cochlea: sound waves $\rightarrow$ frequency-coded signals.
- Trans–sentifying: UNNS residues $\rightarrow$ perceptual tokens.

6.2 Physics: observables

- Quantum theory: states $\rightarrow$ observables via measurement operators.
- UNNS: recursive state $\rightarrow$ perceptual channel via $\mathcal{T}$.

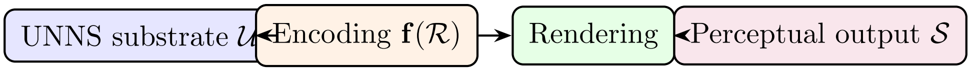

Figure 1: UNNS Trans–Sentifying pipeline: substrate → features → rendering → output.

7 Diagram

8 Conclusion

Trans–Sentifying elevates UNNS from abstract recursion to a communicative substrate. It defines a functorial mapping from recursive invariants to human- and machine-accessible signals. As in biology, where sensory systems convert raw energy into meaning, Trans–Sentifying ensures UNNS invariants are perceivable and actionable. Together with inletting, inlaying, and repair, Trans–Sentifying completes the operational grammar of UNNS.

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Definition[section] [definition]Lemma [definition]Proposition [definition]Remark [definition]Example

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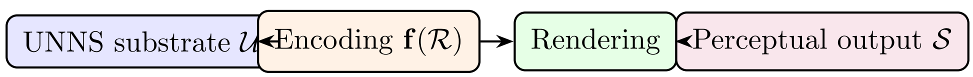

Figure 2: UNNS Trans–Sentifying pipeline: substrate $\to$ features $\to$ rendering $\to$ output.

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