A resolution and signal-propagation model of human cognition

Abstract

Cognitive Sight Theory models cognition as a **field of resolution** rather than a scalar capacity. Individuals possess a focal operating center, a finite range of direct perception (**cognitive sight**), a wider but limited range of reconstructable understanding (**cognitive sound**), and an outer region where cognition and communication collapse into noise. This framework attempts to explain persistent miscommunication, coordination failure, and the structural isolation observed at higher sigma distances.

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1. Core Definitions (Operational)

Cognitive sight
The ability to **directly perceive, manipulate, and reason over a structure without external scaffolding**.
Sight implies internal availability of variables, constraints, relationships, and consequence simulation.

Loss of cognitive sight results in:

- collapse of structure into steps or examples,
- reliance on procedures, authority, or imitation,
- inability to adapt when constraints change.

Cognitive sound
The ability to **reconstruct a structure that cannot be directly operated on**, using language, analogy, or scaffolding.

Sound implies:

- comprehension without immediate execution,
- approximate internal modeling,

- learning via explanation.

Loss of cognitive sound results in:

- explanations arriving as noise,
- inability to distinguish signal from verbosity,
- learning failure despite motivation.

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2. Degradation Order (Critical)

As cognitive distance increases, degradation occurs in a fixed order:

1. **Loss of cognitive sight** — “I can’t see how this works.”
2. **Then loss of cognitive sound** — “I can’t understand what you’re saying.”

This ordering explains why people can understand things they cannot yet do, but not indefinitely.

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3. Sigma Reference Bands (Capability-Based, Neutral)

The following bands describe **observable operational capabilities** within each range. They do **not** claim subjective experience or internal phenomenology outside the author’s cognitive sight.

- **0σ — Local Operator**
  Demonstrates stable operation within a narrow, familiar domain.
  Capable of executing known actions and responding to immediate conditions.
  Reliable performance is observed when context remains within previously encountered boundaries.

- **1σ — Procedural Operator**
  Demonstrates consistent execution of established procedures.
  Capable of following, combining, and modestly optimizing known processes.

Performs effectively when success criteria and rules are externally defined.

- **2σ — Structural Operator**
  Demonstrates ability to model systems, constraints, and relationships.
  Capable of reframing problems, adapting to changing conditions, and reconstructing structure from partial descriptions.
  Operates effectively under ambiguity with limited external guidance.

- **3σ — Generative Operator**
  Demonstrates ability to derive or redefine objective functions, axioms, or system boundaries.
  Capable of constructing new frames of operation and converting ambiguity into optionality.
  Often operates outside commonly shared communication ranges.

These bands describe **where cognition is effective**, not how it feels internally.

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4. Cognitive Depth of Field

For an individual with focal center at σ_0:

- **Sight range:** $\sim\sigma_0 \pm 1$
  Direct operation and manipulation possible.

- **Sound range:** $\sim\sigma_0 \pm 2$
  Indirect reconstruction possible via explanation.

- **Beyond ±2σ:**
  Neither operation nor reconstruction is reliable. Communication collapses into noise.

This is **resolution falloff**, not error, ignorance, or lack of intelligence.

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5. Hollingworth–Towers Communication Gap (Formalized)

The Hollingworth–Towers gap corresponds precisely to the boundary where:

- cognitive sight is absent,
- cognitive sound still exists briefly,
- then collapses entirely.

Predictions:

- 2σ individuals can learn from 3σ with scaffolding.
- 3σ individuals are understood episodically, not continuously.
- Explanation quality ceases to matter beyond the cognitive sound horizon $\sigma_0 \pm 2$.

5.1 Additional perspective

This section explicitly invokes **Shannon's information theory** (entropy, signal-to-noise, and channel capacity) as a formal analogy to strengthen the Hollingworth–Towers **Communication Gap**: at sufficient cognitive distance, communication fails for the same reason noisy channels fail—**capacity is exceeded**.

Model communication across cognitive distance as transmission over a noisy channel. The sender is an information source emitting structured content shaped by what they can directly perceive and manipulate (their **cognitive sight**). The channel is the shared **cognitive sound** substrate: common vocabulary, shared axioms, and compatible compression schemes. The receiver attempts to reconstruct the sender's structure using their internal decoders.

In Shannon's terms, the sender's message has an effective information rate and an associated entropy: the more novel, abstract, or non-shared the primitives, the higher the effective uncertainty from the receiver's perspective. The channel has finite capacity determined by effective bandwidth (shared primitives) and signal-to-noise ratio (representation alignment). As cognitive distance ($\Delta\sigma$) increases, representational mismatch rises, the receiver's uncertainty increases, and the effective noise floor rises rapidly—reducing usable capacity.

Communication succeeds only when the sender's effective rate remains below the channel's capacity. When Δσ is roughly ≤ 1, alignment is high: the receiver can correct errors via shared grounding and overlapping sight. When Δσ approaches ~2, the system reaches a critical regime: noise becomes comparable to signal. Decoding is still possible, but only with maximal scaffolding, heavy compression, and careful pacing; the receiver is operating near their theoretical reconstruction limit.

Beyond Δσ ≈ 2, the receiver's noise floor exceeds the effective signal. In information-theoretic terms, the message becomes non-decodable: the receiver lacks the internal codecs required to separate structured signal from what appears statistically indistinguishable from high-entropy variation. At that point, failure is not "lack of effort" or "poor explanation," but **decoder mismatch under finite channel capacity**—a direct analogue of Shannon-limited communication.

Prediction: beyond the ~2σ cognitive sound horizon, the sender's structured message becomes operationally indistinguishable from high-entropy randomness to the receiver, even if it remains highly structured at the source.

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6. Discussion: Institutional Equilibrium and Structural Alignment

The formalization of communication failure has historically been impeded by the **sociopolitical attrition** associated with measuring general cognitive ability. This friction often prevents institutions from acknowledging the structural nature of miscommunication. By introducing **Cognitive Sight Theory**, we provide a neutral, resolution-based vocabulary that pivots the focus from individual "merit" to **signal-propagation mechanics**.

The Mitigation of Structural Loss

The primary objective of this framework is the preservation of value within complex systems. When 3\sigma (Generative) operators are integrated into environments optimized for 1\sigma or 2\sigma (Procedural/Structural) resolution, the resulting **signal collapse** leads to systemic value loss. This is not a failure of agency, but a failure of **topological alignment**.

By mapping cognitive horizons, institutions can preemptively identify potential "dead zones" in communication. Rather than forcing direct transmission across a

\Delta\sigma > 2 gap—where information inevitably degrades into noise—organizations can utilize **successive cognitive relaying**:

- **Resolution Cascading:** Position 2\sigma operators as high-fidelity bridges. They possess the *Sound* range to reconstruct 3\sigma output and the *Sight* range to translate it into executable procedures for 1\sigma operators.
- **Neutral Scaffolding:** This approach moves beyond the "pedagogical fallacy." It acknowledges that certain gaps cannot be bridged by mere effort, but require **structural relay points** to maintain signal integrity.

Objective: Proximity, Not Hierarchy

It is critical to distinguish this model from deterministic or exclusionary social theories. The goal of mapping cognitive resolution is strictly **operational optimization**. By organizing cognitive horizons within reach of one another, we minimize the psychological and economic costs of miscommunication. This is a strategy of **cognitive ergonomics**: designing systems that respect the natural resolution boundaries of human cognition to ensure that every agent—regardless of their focal center—operates in an environment of maximum clarity and minimum friction.

7. Unknown Space

Beyond the sound boundary lies **cognitively inaccessible space**:

- no sight,
- no sound,
- only indirect inference via artifacts, tools, or collective systems.

This space cannot be accessed by pedagogy alone.

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8. Conclusion

Cognitive sight defines what you can operate on.
Cognitive sound defines what you can learn from others.
Beyond sound, meaning does not fail — transmission does.

Addendum A — Epistemic zones

- **Sight zone (≈±1σ from author): direct observation valid.**
- **Sound-only zone (≈±2σ): reconstruction plausible; treat as provisional.**
- **Beyond sound (>±2σ): treat as unknown; no claims beyond behavior-level outcomes.**

Addendum B — Methodology note

- **First-person claims: only about the author's sight/sound zones.**
- **Outside zones: only capability descriptions; no phenomenology; mark as "requires external validation." Needs <u>much</u> more research. Sigma 0.**