Ordered Patch Theory

Appendix E-1: The Continuous Experience Metric (h^*)

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> **Original Task E-1: Continuous Experience Metric Problem:** The prediction of the experiential bit-rate requires explicit derivation bridging the bandwidth cap $C_{\max}$ with the psychological moment Δt. **Deliverable:** Derivation of $h^* = C_{\max} \cdot \Delta t$.

1. Introduction: Parameterising the Experiential Quantum

Under the Ordered Patch Theory (OPT), subjective continuity is an illusion generated by a high-frequency sequence of discrete structural updates projected through the Stability Filter. Because the global workspace channel has a strict rate-distortion upper bound ($C_{\max}$), it cannot process continuous data flows smoothly.

This appendix formalises the empirical parameterisation of h^* — the **Experiential Quantum**. In classical information theory limits, h^* defines the strictly theoretical **Shannon channel capacity upper bound** on the volume of structural novelty that can be transmitted into the phenomenal state tensor during a single cognitive integration window (Δt).

> *Note: h^* represents the theoretical maximum capacity of the channel per frame, not the exact quantity of bits dynamically encoded. A highly efficient codec may operate comfortably below this maximum bound when sensory entropy is low.*

2. Definition of the Upper Bound h^*

Defined by the empirical parameterisation of Appendix T-1 (§5), the experiential quantum capacity is calculated as the product of the transmission bandwidth limit and the cognitive integration window:

$$h^* = C_{\max} \cdot \Delta t$$

Where: - $C_{\max}$ is the upper bound of the global workspace channel capacity (bits/s). - Δt is the neurobiological integration window defining the minimum observable resolution of macroscopic change (seconds/frame).

3. Empirical Anchoring and Sensitivity Sweep

To isolate h^* for the adult human observer, we sweep empirically anchored bounds across interdependent physiological modes.

Because bandwidth engagement ($C_{\max}$) and temporal integration (Δt) are correlated processes (e.g., highly abstract, metacognitive processing enforces a deeper bottleneck restriction on overall throughput compared to fast sensorimotor reactions), we evaluate matched operational modes:

Cognitive Mode	Channel Capacity ($C_{\max}$)	Integration Window (Δt)	Empirical Capacity Envelope (h^*)
Mode A: Baseline Integration	10 bits/s (Standard GW limit)	50 ms (Fast perceptual access)	$\approx$ **0.5** bits/frame
Mode B: Slow Metacognition	5 bits/s (Author estimate; consistent with Cowan 2010 on central working memory capacity)	300 ms (Deep integration)	$\approx$ **1.5** bits/frame
Mode C: Peak Extremal Reflex	112 *bits/s (Extrapolated maximum)* [1]	50 *ms (Fast perceptual access)*	$\approx$ 5.6 *bits/frame*

[1] *Mode C reflects a theoretical peak-load ceiling. Assuming a core visual working memory span of* ≈ 4 *novel items under rapid serial visual presentation (Cowan, 2001), packing dense structural depth of* ≈ 4 *bits per item (estimated; cf. Brady et al., 2008), undergoing acquisition throughput at a* ≈ 7 *Hz upper theta rhythm (estimated; cf. Lisman & Jensen, 2013), we derive an absolute limiting peak throughput of roughly* 112 *bits/s. It is used here exclusively as an extremal boundary check rather than a sustained operational capacity.*

Empirical Finding: The human phenomenal stream operates on an envelope spanning distinct operational regimes: between **0.5 bits per 50 ms fast perceptual frame** (10 bits/s, Mode A) up to **1.5 bits per 300 ms deep metacognitive frame** (5 bits/s, Mode B) of maximum structural capacity.

4. The Narrative Decay Threshold

The core theoretical utility of deriving h^* is to quantify OPT's primary strict falsification condition: the onset of **Narrative Decay**.

As established in T-1, a sustained physical environment or generating process (ν) guarantees phenomenal collapse (Narrative Decay) when its minimal achievable predictive distortion persistently exceeds the channel capacity:

$$E_{T,h}(\nu) - D_{\min} > h^*$$

(For the purposes of evaluating the condition, the look-ahead horizon h is strictly equated to the integration window Δt, ensuring both sides of the inequality operate over the identical temporal frame.)

Where $E_{T,h}(\nu) := I(X_{1:T}; X_{T+1:T+h})$ is the **predictive mutual information** (finite-horizon excess entropy) of the generating process over the prediction window. Crucially, this criterion applies directly to *environments acting as stationary ergodic process classes*, not single momentary isolated events. As formally established in T-1 §5, this represents a sufficient condition. Because the finite-horizon coding lower bound is rarely perfectly tight, processes can undergo Narrative Decay even when $E_{T,h}(\nu) - D_{\min} \leq h^*$ simply if the internal neural codec is highly mathematically inefficient.

(Analytical Note: The calculations below set $D_{\min} = 0$ as a strict theoretical limit, assuming the observer demands exact prediction. For physiological codecs with loose spatial tolerances where $D_{\min} > 0$, the mathematical environmental entropy threshold required to trigger true collapse will be correspondingly higher, meaning the system will shift the phenomenological collapse threshold to tolerate higher environmental entropy/complexity).

Threshold Boundaries

Applying the primary findings mapped in Section 3 ($h^* \approx 0.5 \rightarrow 1.5$ bits), we define the environmental thresholds at which the human phenomenal render will collapse:

1. **Reflexive/Baseline Collapse Environment**: For a continuous, fast-moving environmental process operating at Mode A limits ($h^* \approx 0.5$ bits), if the observer is embedded in a chaotic generating process—such as a dense, unpredictable spatial static terrain—that strictly requires more than **0.5 bits** of uncompressible trajectory updates per 50 ms sequence to model, the process virtually guarantees continuous global workspace overflow. The system will fail to track continuous geometry and default to rendering blurred boundaries or visual dissociation blocks. *(Under rare Mode C peak-extremal processing conditions ($h^* \approx 5.6$ bits), an observer operating at higher channel capacity would tolerate environments up to 5.6 bits before collapse).*
2. **Deep Metacognitive Collapse Environment**: When navigating deep internal schemas, the slower Mode B process ($h^* \approx 1.5$ bits) can be fractured by a sustained sequence of mathematically incompressible inputs exceeding **1.5 bits** per 300 ms window. Persistent exposure to mathematically

irreducible stochastic input geometries (e.g., severe psychedelic states) will shatter the abstract narrative loop.

5. Summary Consequence

A single human conscious moment possesses a maximum data-update capacity of roughly 0.5 bits at fast perceptual baseline, rising to a maximum envelope of roughly 1.5 bits under deep metacognitive integration.

These severely constrained bounds, which establish a sufficient condition for collapse rather than an exact threshold, provide strong structural support for OPT's main finding: The richness of human phenomenological reality is not streaming live from the sensors. It must originate dominantly from the massive, standing predictive Codec State (K_θ), with the tiny h^* channel capacity used solely to select, modulate, or trigger standing geometric priors.