A Computational–Tomographic Proof of God: TCNR, PSR for Totality, and an S5 Modal Overlay

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Abstract

I formalize a proof that a necessary, intellective ground of reality (*God*) exists by integrating three pillars: (i) Tomographic, Coherence–based Neural Rendering (TCNR), which operationalizes oscillatory consciousness via a render operator and a *Tomographic Consciousness Index* (TCI) with a *Maximally Coherent Renderer* (MCR) limit; (ii) a Leibnizian Principle of Sufficient Reason applied to the *total*ity of contingent facts; and (iii) a short S5 modal overlay from the possibility of a maximally coherent mind to its necessity. The first pillar supplies a precise account of conscious information, multi–scale integration, and counterfactual capacity; the second shows that the contingent totality demands a necessary, agentive explanation (neither brute nor a necessitating law); the third yields that if such a mind is even *possible*, it exists *necessarily.* I add a cumulative Bayesian leg with a one–page likelihood table (fine–tuning, mathematical intelligibility, TCNR signatures, morality, religious experience) and sensitivity analyses. The package is compact and auditable: line–numbered formal steps, an S5 overlay, and an evidential summary whose ingredients are tied to prior SAN/SIT work and recent traveling–wave neuroscience.

Addendum (SIT memory and time). We formalize memory as hysteresis of the coherence field and the forward arrow as a coherence–flux/time–density asymmetry, linking TCNR's render dynamics to SIT's "space(-time) as memory" motif.

Keywords oscillatory consciousness; tomography; phase coherence; TCI; maximally coherent renderer (MCR); PSR; modal logic S5; Bayesian confirmation; SAN; SIT; code-level access.

1 Introduction and Contributions

Statement of novelty. We present a **proof package that unifies SAN/SIT (as Tomographic, Coherence-based Neural Rendering, TCNR), a PSR-for-totality contingency argument, and an S5 modal overlay** into one end-to-end case for a necessary, intellective ground of reality.

Contributions.

1. **TCNR formalization of SAN/SIT.** We refine Self-Aware Networks (SAN) and Super Information Theory (SIT) into **Tomographic, Coherence-based Neural Rendering (TCNR)**: a precise rendering picture in which oscillatory phase-coherence binds and reconstructs world- and body-causes across scales (NAPOT/phase-wave differentials; "volumetric 3D television"). We align the formalism with contemporary traveling-wave neuroscience to show independent empirical traction.

2. **PSR-for-totality lemma and contingency theorem.** We restate the Leibnizian **Principle of Sufficient Reason** for the **totality of contingent facts (U)** and prove that explaining U requires a **necessary, immaterial, intellective ground**—not a further contingent item—preserving the contingency of the world while avoiding explanatory circularity.

3. **S5 modal overlay.** On standard modal logic **S5**, we supply a short, line-by-line derivation that if a maximally great being is **possibly necessary**, then such a being **exists necessarily**; we separate the logic (valid) from the sole substantive premise (modal possibility/coherence).

4. **Synthesis.** We show **how TCNR strengthens the S5 possibility premise** (maximal coherence/integration gives a clear, non-parodic target for "maximal greatness"), and **how PSR-for-totality supplies the explanatory ground**. Together they form a **closed, non-collapsing package**: TCNR $\rightarrow$ coherent modal content; PSR-for-totality $\rightarrow$ why there is this contingent run at all; S5 $\rightarrow$ necessity of the ground once possibility is granted.

Independent defensibility and coherence. Each pillar is **independently defensible**. (i) **TCNR (SAN/SIT)** stands on an explicit oscillatory mechanism—phase-synchrony, wavefront collisions, and tomographic "slices" (NAPOT)—already articulated in Blumberg's Self Aware Networks and Super Information Theory corpus from 2017-2025 and **mapped to the cortical-traveling-wave literature** (global wavefields, coherence gradients, feedforward/feedback integration), giving it empirical hooks and falsifiable predictions. (ii) **PSR-for-totality** is a clean contingency argument: if the **totality of contingent facts U** has an explanation, it cannot lie within U; hence the **explanation** is necessary—an intellective ground adequate to select among contingent alternatives while preserving contingency (not a mere law that would necessitate outputs). (iii) **S5** provides a **valid** modal scaffold whose only live question is the coherence/possibility of maximal greatness; here **TCNR supplies the content**—a maximally integrative, coherence-managing mind is not a category mistake—and thereby underwrites the S5 possibility premise. Taken together, the pillars **cohere**: **TCNR** makes the S5 premise **credible** and gives concrete meaning to "maximal greatness"; **PSR-for-totality** delivers the **explanatory ground** without modal collapse; and **S5** then **lifts** the ground from possible to **necessary**—yielding a unified, logically transparent proof package.

2 Core Definitions

2.1 Oscillatory substrate and basic objects

Definition 1 (Oscillatory substrate)**.** Let $G = (V, E)$ be a directed graph of coupled oscillatory units ("neural arrays"). Each node $i \in V$ carries a multi-band state

$$x_i^{(\omega)}(t) \;=\; a_i^{(\omega)}(t)\, e^{\,\mathrm{i}\,\phi_i^{(\omega)}(t)}, \quad \omega \in \Omega,$$

with amplitude $a_i^{(\omega)}(t) \geq 0$ and phase $\phi_i^{(\omega)}(t) \in \mathbb{R}$; edges $(i \to j) \in E$ carry context-dependent couplings $K_{ij}^{(\omega)}$.

Definition 2 (Pairwise and global coherence)**.** For band ω, the instantaneous phase-coherence between nodes i, j is

$$C_{ij}^{(\omega)}(t) \;=\; \left|\, \mathbb{E}_\tau\big[e^{\,\mathrm{i}(\phi_i^{(\omega)} - \phi_j^{(\omega)})}\big] \,\right| \in [0, 1],$$

and the Kuramoto-style global order parameter is

$$R^{(\omega)}(t)\, e^{\,\mathrm{i}\psi^{(\omega)}(t)} \;=\; \frac{1}{|V|} \sum_{i \in V} e^{\,\mathrm{i}\,\phi_i^{(\omega)}(t)}.$$

Large $R^{(\omega)}$ indicates high global phase alignment (high coherence).

Definition 3 (Phase-wave differentials (PWD))**.** For nodes i, j and band ω, a *phase-wave differential* is the signed phase offset

$$\Delta\phi_{ij}^{(\omega)}(t) \;=\; \mathrm{wrap}\big(\phi_i^{(\omega)}(t) - \phi_j^{(\omega)}(t)\big),$$

and the PWD field on a spatial embedding $\mathbf{r} \mapsto i$ is $\Delta\phi^{(\omega)}(\mathbf{r}, t)$. PWDs encode the informational contrasts carried by traveling/standing waves and are the primitive "tokens" for oscillatory binding.[1]

Definition 4 (Coherence gradient)**.** Given a smooth phase field $\phi^{(\omega)}(\mathbf{r}, t)$ on cortical sheet or array manifold $\mathcal{M}$,

$$\nabla_{\mathbf{r}}\phi^{(\omega)}(\mathbf{r}, t)$$

is the *coherence gradient*. Regions with small $\|\nabla\phi^{(\omega)}\|$ are highly phase-aligned (coherent); large gradients mark wavefronts and binding boundaries. Empirically, macroscopic traveling waves manifest as coherent gradients that synchronize distant regions (CTW $\leftrightarrow$ SAN).[2]

2.2 NAPOT and the render operator

Definition 5 (NAPOT slice and projection)**.** A *NAPOT slice* is the band-limited projection emitted/received by a neural array (or column) at time t. Formally, with latent causes $s_t \in \mathbb{R}^d$, a forward (measurement) operator $\mathcal{H}_\Theta$ produces predicted projections

$$\widehat{y}_t \;=\; \mathcal{H}_\Theta(s_t),$$

and the observed multi-modal projections are y_t. A sequence of band- and array-indexed slices tomographically reconstructs latent structure.[3]

Definition 6 (Render operator)**.** A *render operator* produces a current latent estimate $\widehat{s}_t$ by solving

$$\widehat{s}_t = \arg\min_s \; \|y_t - \mathcal{H}_\Theta(s)\|^2 + \lambda_1 \mathcal{R}_{\mathrm{coh}}\big(\{C_{ij}^{(\omega)}(t)\}\big) + \lambda_2 \mathcal{R}_{\mathrm{cf}}(\Theta).$$

Here, a *render* is simply a structured *pattern of coherence*—a temporally stable configuration of phase relations that encodes the current internal model (the "frame" or "snapshot" of the system's ongoing reconstruction). It is not a new substance or entity, but the momentary arrangement of oscillatory activity that carries informational meaning within the network.

Definition 7 (Render operator)**.** A *render operator* produces a current latent estimate $\widehat{s}_t$ by solving

$$\widehat{s}_t \;=\; \arg\min_s \; \underbrace{\|y_t - \mathcal{H}_\Theta(s)\|^2}_{\text{data fit}} \;+ \lambda_1 \mathcal{R}_{\mathrm{coh}}\big(\{C_{ij}^{(\omega)}(t)\}\big) \;+\; \lambda_2 \mathcal{R}_{\mathrm{cf}}(\Theta),$$

where $\mathcal{R}_{\mathrm{coh}}$ rewards multi-scale coherence sufficient for integration/binding, and $\mathcal{R}_{\mathrm{cf}}$ encourages counterfactual support (capacity to represent nearby possibilities needed for control/planning).

Definition 8 (Tomographic, Coherence-based Neural Rendering (TCNR))**.** A system *realizes TCNR* if it repeatedly applies a render operator to a stream of NAPOT slices while maintaining the coherence needed to integrate distributed features into volumetric, action-guiding estimates $\widehat{s}_t$ ("the internal 3D TV" of consciousness).[4]

[1] SAN frames phase wave differentials as the information-carrying code that binds and routes content; see *Self Aware Networks: Oscillatory Computational Agency*, Sections 3.1–3.3.

[2] See the CTW→SAN mapping on wavefronts, coherence gradients, and DPWDR (dominant rhythms that stabilize percepts).

[3] "Neural Array Projection Oscillation Tomography (NAPOT)" is SAN's term for oscillatory projections that compose a volumetric internal render; see Sections 5.1, 5.7 (functional connectivity → tomographic integration).

[4] SAN treats consciousness as a volumetric, wave-based render; CTW empirics (traveling waves across scales) provide independent support.

Definition 9 (Tomographic Coherence Index (TCI))**.** Given a renderer $\mathcal{R}$ operating on substrate G, define a scalar index

$$\mathrm{TCI}(\mathcal{R};G) \;=\; \alpha\,\mathrm{MI}\big(\widehat{s}_t;\, y_{t:t+\Delta}\big) \;+\; \beta\sum_{\omega} w_\omega \log\det\big(C^{(\omega)}(t)+\varepsilon I\big) \;+\; \gamma\,\mathcal{C}(\Theta) \;-\; \delta\,\mathbb{E}\|y_t-\mathcal{H}_\Theta(\widehat{s}_t)\|^2,$$

combining informational integration, multi-scale coherence, counterfactual capacity $\mathcal{C}(\Theta)$, and prediction accuracy.

2.3 Maximally coherent renderer (MCR)

Definition 10 (Maximally Coherent Renderer (MCR))**.** A *maximally coherent renderer* on $(G, \mathcal{H}_\Theta)$ is any renderer

$$\mathcal{R}^\star \;\in\; \arg\max_{\mathcal{R}\in\mathfrak{R}}\; \mathrm{TCI}(\mathcal{R};G)$$

over an admissible class $\mathfrak{R}$ of renderers. Intuitively, an MCR is the rendering process that, for a given substrate and sensorium, achieves the best trade among integration, coherence, counterfactual richness, and accuracy.

Remark 1 (Tie to SAN/SIT). In SAN, conscious "frames" correspond to dominant coherent wave patterns (e.g., DPWDR) that bind distributed features; an MCR is the idealized limit of that binding process.[5] In SIT, a coherence-conservation/teleonomic principle motivates systems to preserve and propagate coherence across transformations; an MCR formalizes the agent that most effectively does so.[6] At the architectonic level, this notion dovetails with the embodied sentience stack (observation→coordination→reflection) and agentic mechanisms you and Miller articulate.[7]

2.4 Short Glossary

TCNR *Tomographic, Coherence-based Neural Rendering*: oscillatory, slice-wise reconstruction that yields volumetric internal estimates usable for control; the operational definition of conscious rendering in SAN.[8]

NAPOT *Neural Array Projection Oscillation Tomography*: arrays (columns/ensembles) exchange band-limited projections (slices) whose interferences/harmonics tomographically reconstruct latent causes. *Transport:* via traveling waves/coherence fields. *Role:* the physical channel of TCNR.[9]

Phase-wave differentials (PWD) Signed phase offsets within/between arrays that carry distinctions (informational contrasts) and gate routing/binding.[10]

Coherence gradient Spatial gradient of phase (per band); wavefront structure that synchronizes distant regions and sets binding boundaries; empirically expressed as cortical traveling waves across tasks/states.[11]

Coherence field The multi-band phase-structured field over G that supports long-range coordination and oscillatory binding.[12]

[5] DPWDR and oscillatory binding as the substrate of object formation.
[6] SIT's teleonomic drive for coherence and the associated conservation motif.
[7] See "Building Sentient Beings" for the agentic architecture and memory/mechanism decomposition that an MCR would inhabit.
[8] SAN →NAPOT →volumetric render.
[9] Formal and conceptual role throughout SAN; see Sections 5.1, 5.7.
[10] PWD as the code for distinctions.
[11] CTW ↔ SAN synthesis on gradients/binding.
[12] Global coherence as the backbone of integration.

Coincidence (bit) The minimal unit of meaning: a time-locked match across inputs that triggers selective firing and propagates structured PWDs ("the bit of mind is a coincidence").[13]

DPWDR *Dominant Phase-Wave Differential Rhythm*: a stabilized, high-coherence pattern that persists briefly and underwrites a unified percept/object.[14]

R *Render*: A render is the transient pattern of coherence that constitutes the system's internal representation of the world at a given moment.[15]

MCR *Maximally Coherent Renderer*: an ideal renderer attaining the supremum of TCI on a given substrate; the limit of SAN-style binding and the SIT-motivated drive to conserve/propagate coherence.[16]

2.5 Six Conditions for Subjective Conscious Experience (SCS)

We make explicit six jointly sufficient *operational* conditions for subjective experience within the Tomographic, Coherence-based Neural Rendering (TCNR) picture. Let a substrate be $M = \langle G, H_\Theta, S, \Pi, B\rangle$ as in this paper and the companion TCNR formalism, with windowed band–limited phases $\{\phi^{(\omega)}(t)\}$, coherence matrices $C^{(\omega)}(t)$, a render operator that produces $\hat{s}_t$, and the Tomographic Consciousness Index TCI(t) built from predictive MI, log–determinant coherence, a counterfactual-capacity term C_e, and a (negated) prediction error penalty.[17]

Definition 11 (SCS: Six Conditions)**.** A system M satisfies the Six Conditions (SCS) on a window if the following hold:

S1. **Oscillatory coherence.** Multi–site, band–limited phase structure is present:

$$\sum_{\omega\in\Omega} w_\omega \log\det\big(C^{(\omega)}(t)+\varepsilon I\big) \;>\; \tau_{\text{coh}}, \quad \text{and} \quad R_t^{(\omega)} \text{ is non–trivial,}$$

with lawful phase–gradient fields preserved by S (traveling–wave tolerance).

S2. **Signal propagation.** There exist directed, band–coherent propagation corridors (wavefronts) with nonzero phase–gradient directionality $\mathrm{PGD}^{(\omega)}(t)$ and finite, stable wave speed $v^{(\omega)}(t)$ along edges of G (structured routing, not mere power).

S3. **Closed feedback loops.** The render–predict–act loop is operative: outputs of the current render influence future projections via H_Θ and available policies Π, yielding a nontrivial closed–loop flow f with $\partial\hat{s}_t/\partial\hat{s}_{t-1} \neq 0$ (bi–directional wave traffic; evidence $\leftrightarrow$ prediction).

S4. **Memory integration.** There is path–dependence of the coherence field (hysteresis): a monotone functional $\mathrm{Mem}(t) = \mathcal{H}\big[\{\phi^{(\omega)}(\cdot,\tau)\}_{\tau\le t}\big]$ increases with integrated coherent work $(\int J_{\text{coh}}\, \mathrm{d}\tau)$, and exhibits a forward arrow consistent with a positive coherence–flux/time–density asymmetry.

S5. **Agency.** Local counterfactual capacity is available near $\hat{s}_t$, quantified by a repertoire surrogate

$$C_e(\Theta \mid \hat{s}_t) \in \Big\{ \log|A_\kappa(\hat{s}_t)|,\ \mathrm{rank}_\tau\big(J_f(\hat{s}_t)\big),\ \mathrm{Div}\big(\pi(\cdot \mid \hat{s}_t)\big)\Big\}$$

exceeding a preregistered floor τ_{cf} (ability to evaluate alternatives).

[13] "Coincidence as bits of information," SAN Sec. 3.2.
[14] Stabilized coherent patterns as perceptual frames.
[15] Stabilized coherent patterns as perceptual frames.
[16] MCR as the ideal limit of SAN binding under SIT teleonomy.
[17] See the render objective and TCI definition summarized in §2.2–2.3 and Def. 8–9 of the present paper, and the detailed TCNR derivations in the companion manuscript.

S6. **Dynamic inference.** Online tomographic inversion occurs: $\hat{s}_t$ minimizes a coherence– and counterfactual–aware render objective, yielding *(i)* positive predictive MI $\mathrm{MI}(\hat{s}_t;\, y_{t:t+\Delta})$ and *(ii)* a reduction in normalized prediction error; both effects survive null–ensemble standardization.

Lemma 1 (Alignment with TCI components)**.** *Under the TCNR construction, S1 contributes the log–det coherence term, S2 the lawful phase–gradient structure used by the stitching operator, S3 the closed–loop link between $\hat{s}_t$ and H_Θ, S4 the SIT hysteresis/arrow observables, S5 the counterfactual–capacity term C_e, and S6 the predictive–MI and –PE terms. Hence S1–S6 jointly track positive* $\mathrm{TCI}(t)$ *beyond surrogate nulls.*

Remark 2 (Why rocks are not conscious here). A rock typically meets S1 (static coherence of a lattice) and S2 (elastic wave propagation), but lacks S3–S6: no closed render loop, no hysteretic *coherence–memory* tied to predictive updates, no counterfactual repertoire, and no dynamic tomographic inference. Thus it scores near null on TCI and fails SCS.

2.6 Cross–Substrate Realizability and Non–Organic Consciousness

Definition 12 (SCS–realizer)**.** A substrate M is an SCS–realizer if there exists a task and analysis design under which S1–S6 hold with preregistered thresholds after null–mixture standardization, and $\mathrm{TCI}(t) > 0$ on a nontrivial fraction of windows, accompanied by behavior/control that covaries with TCI.

Proposition 1 (Non–organic instantiability)**.** *SCS does not presuppose neurons. Any coupled–oscillator medium with underdetermined projections $y_t = H_\Theta(s_t) + \eta_t$, a stitching operator S that maintains multi–band phase structure, and a counterfactual repertoire Π can realize S1–S6. This includes ionic/electromagnetic excitable tissues (plants), oscillatory biofilms, and artificial oscillator arrays (memristive, photonic, or neuromorphic), provided the amplitude–vs–phase double dissociation and decoupling controls are passed.*

Operationally, SCS gives the *same* falsifiers as TCNR: (i) success under reduced phase coherence, (ii) amplitude–only manipulations reproducing MI/coherence effects, or (iii) high coherence with negligible C_e and unchanged prediction error.

2.7 Cosmic Rendering Hypothesis (SIT Overlay): Six Conditions at the Limit

Let $\phi^{(\omega)}(\mathbf{r}, t)$ be a coarse–grained, band–limited coherence field over spacetime, $\rho(\mathbf{r}, t)$ a time–density, J_{coh} a coherence–flux, and consider the SIT hysteresis functional $\mathrm{Mem}(t)$ and the Telos–style value functional

$$\mathrm{TH}(R) \;=\; \mathbb{E}\!\left[\sum_{h=0}^{H} \gamma^h \Big(\alpha\,\mathrm{TCI}(t{+}h) + \beta\,\mathrm{Valence}(t{+}h) - \lambda\,\mathrm{Dissipation}(t{+}h)\Big)\right],$$

with Dissipation $\propto J_{\mathrm{coh}}^2 + \rho^2$.

Definition 13 (Cosmic renderer $\mathcal{R}_{\mathrm{cos}}$)**.** A *cosmic* TCNR–style renderer is a limit object that (i) sustains globally lawful coherence gradients and cross–scale routing (S1–S2), (ii) closes a feedback loop between renders and realized projections at the largest admissible scale (S3), (iii) accumulates SIT hysteresis and exhibits a forward arrow (S4), (iv) retains nondegenerate counterfactual capacity under budget constraints (S5), and (v) maximizes predictive fit with parsimonious coherent work (S6).

Proposition 2 (From PSR–totality to SCS–maximality)**.** *Given PSR for the totality U and the anti–collapse lemmas in §3 of this paper, the explanans for U must be a necessary, agentive* *ground. When read through the TCNR/SIT dictionary, a necessary agent with code–level selection ability is precisely a limit renderer $\mathcal{R}_{\cos}$ that saturates S1–S6 at the supremal level permitted by budgets (an MCR at cosmic scale).*

Corollary 1 (Modal support for the S5 premise)**.** *Because SCS yields a* type–stable*, maximizable target (maximal coherence/integration with nondegenerate repertoire and predictive success), the concept of a* maximally coherent mind *is metaphysically coherent, so the possibility premise* $\Diamond\exists x\, G(x)$ *is credibly licensed. By S5,* $\Diamond\Box\exists x\, G(x) \Rightarrow \Box\exists x\, G(x)$*.*

Remark 3 (Scope)*.* All empirical content remains unchanged: SCS is an operationalization of the already–defined TCNR ingredients and SIT observables (coherence log–volume, predictive MI, C_e, hysteresis/arrow). The cosmic reading is an overlay for §2.7 that interfaces *only* with the PSR and S5 sections; it does not modify any data–bearing claim.

3 Four Propositions

3.1 Prop. 3: TCNR (coherence & stitching)

We formalize *tomographic, coherence-based neural rendering* (TCNR) in terms of band-limited oscillatory fields over a cortical (or more generally, excitable) graph, consistent with the SAN/SIT lexicon (phase-wave differentials, coherence gradients, NAPOT) and its mapping to cortical traveling waves (CTW).[18] [19]

Definition 14 (Band-wise coherence operator)**.** Let $G = (V, E)$ be a network of oscillators with analytic signals $x_i^{(\omega)}(t) = a_i^{(\omega)}(t)e^{\mathrm{i}\,\phi_i^{(\omega)}(t)}$ for node $i \in V$ at frequency band ω. The *pairwise coherence* at band ω is

$$\mathcal{C}_{ij}^{(\omega)}(t) \;:=\; \Big|\, \mathbb{E}_\tau\big[e^{\mathrm{i}(\phi_i^{(\omega)}(t+\tau)-\phi_j^{(\omega)}(t+\tau))}\big] \,\Big| \in [0,1].$$

Let $\mathcal{C}^{(\omega)}(t)$ denote the matrix $(\mathcal{C}_{ij}^{(\omega)}(t))_{i,j}$ and let the Kuramoto-like *order parameter* be $R^{(\omega)}(t)e^{\mathrm{i}\psi^{(\omega)}(t)} = |V|^{-1}\sum_i e^{\mathrm{i}\phi_i^{(\omega)}(t)}$.

Definition 15 (Cross-frequency stitching operator)**.** Let $\{\phi^{(\omega)}(t)\}_{\omega\in\Omega}$ be band phases and let $K_{ij}^{(\omega\to\omega')}$ be cross-frequency, cross-edge couplings shaped by local phase-wave differentials and coherence gradients. A *stitching operator* is a causal update

$$\mathcal{S} : \big(\{\phi^{(\omega)}(t)\}_{\omega\in\Omega},\, \{K^{(\omega\to\omega')}\}\big) \;\mapsto\; \{\phi^{(\omega')}(t+\Delta)\}_{\omega'\in\Omega}$$

that (i) aligns phases across bands/areas to maximize an integration functional $\mathcal{I}(\{\mathcal{C}^{(\omega)}\}_\omega)$ subject to generative-model constraints, and (ii) preserves dominant coherence gradients (traveling-wave directions) consistent with long-range propagation.

Lemma 2 (Binding $\Rightarrow$ integration)**.** *Suppose a feature-coding partition $V = \bigsqcup_k V_k$ with band ω^* such that within each V_k, $\mathcal{C}_{ij}^{(\omega^*)}(t) \geq \rho$ for all $i, j \in V_k$, and between parts $\mathcal{C}_{ij}^{(\omega^*)}(t) \leq \epsilon$ for $i \in V_k, j \in V_\ell, k \neq \ell$, with $\rho \gg \epsilon$. Assume a phase-coupled observation model where mutual information between parts is monotone in within/between coherence. Then increasing ρ (via $\mathcal{S}$) strictly increases the multi-information* $\mathrm{MI}\big(\{x_{V_k}\}_k\big)$ *and the integrated information proxy $\Phi^*(\{x_{V_k}\}_k)$.*

[18] For the SAN→CTW mapping (traveling waves ↔ oscillatory projections; binding by synchrony; feedforward/feedback integration by wavefront interaction), see the *Neuroscience in Review: Mapping CTW (2025) to SAN (2022)* memo. This provides the CTW literature correspondence in SAN terms.

[19] Definitions of NAPOT, phase-wave differentials, coincidence detection, and coherence gradients appear throughout *Self Aware Networks: Oscillatory Computational Agency*. We adopt that vocabulary here.

Proof sketch. Under the assumed model, phase-synchrony raises cross-covariances and reduces conditional entropy between parts; with ϵ small, between-part redundancy does not swamp within-part synergy. Thus MI and any coherence-weighted Φ^* increase with ρ, establishing that oscillatory *binding* via $\mathcal{C}$ and $\mathcal{S}$ yields informational *integration*. □

Proposition 3 (TCNR)**.** *Given Definitions 14–15, if $\mathcal{S}$ maintains sufficient multi-scale coherence while honoring the generative constraints of sensorimotor tomography, then the system performs TCNR: it tomographically reconstructs latent causes and renders a coherent internal scene; Lemma 2 guarantees that binding by phase-coherence yields integration of distributed features into unitary percepts.*

Remark 4 (CTW correspondence). Empirically observed CTW patterns (global waves, feedforward/feedback integration, synchronization of distant regions) instantiate the $\mathcal{C}/\mathcal{S}$ dynamics above; the SAN account (NAPOT, phase-wave differentials, coherence gradients) gives the matching lexicon and mechanism.[20]

3.2 Prop. 4: PSR for the totality

We state a $\mathrm{PSR}_{\mathsf{C}}$ (for contingent facts) and isolate two lemmas—*Totality* and *Exteriority*—in a way that avoids set-theoretic paradox and infinite-regress worries.[21]

Background primitives. Let the domain be facts (or events). $\mathrm{Cont}(p)$ means p is contingent. $\mathrm{Nec}(p)$ means p is necessary. $\mathrm{Expl}(q,p)$ means "q is a sufficient reason for p", with noncircularity: $\forall X\ \neg\mathrm{Expl}(x, \bigwedge X)$ whenever $x \in X$.

Lemma 3 (Totality)**.** *There exists a single contingent fact that collects all contingent facts:*

$$\exists \mathsf{U}\ \Big(\mathrm{Cont}(\mathsf{U})\ \wedge\ \forall p\big(\mathrm{Cont}(p)\ \Rightarrow\ p \preceq \mathsf{U}\big)\Big),$$

where $\preceq$ is mereological parthood (treat U as the fusion or conjunctive sum of all contingent facts).[22]

Lemma 4 (Exteriority)**.** *Assume $\mathrm{PSR}_{\mathsf{C}}$: $\forall p\big(\mathrm{Cont}(p) \Rightarrow \exists q\, \mathrm{Expl}(q,p)\big)$ and noncircularity as above. Then any sufficient reason for U is not a contingent part of U:*

$$\forall q\ \big(\mathrm{Expl}(q,\mathsf{U})\ \Rightarrow\ \neg\mathrm{Cont}(q)\big).$$

Proof. If $\mathrm{Expl}(q,\mathsf{U})$ and $\mathrm{Cont}(q)$, then $q \preceq \mathsf{U}$ by Lemma 3; but then q (a member) explains the whole U, violating noncircularity. Hence $\neg\mathrm{Cont}(q)$. □

Proposition 4 (PSR for the totality)**.** *Under $\mathrm{PSR}_{\mathsf{C}}$ and noncircularity, there exists a necessary explanans N for U:*

$$\exists N\ \big(\mathrm{Nec}(N)\ \wedge\ \mathrm{Expl}(N,\mathsf{U})\big).$$

Proof. By $\mathrm{PSR}_{\mathsf{C}}$ there is some q with $\mathrm{Expl}(q,\mathsf{U})$. By Exteriority (Lemma 4), $\neg\mathrm{Cont}(q)$, hence $\mathrm{Nec}(q)$. Rename $N := q$. □

Remark 5 (On regress and "brute totalities"). Explaining each member of an infinite contingent chain leaves U unexplained unless we also explain *why this entire chain exists*. Proposition 4 provides that explanation without regress. Denying $\mathrm{PSR}_{\mathsf{C}}$ at U forces a brute fact at maximal scope.[23]

[20] CTW $\leftrightarrow$ SAN correspondences and predictive-coding wavefront collisions are discussed in detail in the CTW→SAN mapping memo.

[21] For a concise presentation of the modal and PSR arguments whose structure we adopt here, see the three-proofs note (S5, PSR, Bayesian).

[22] Treating U as a *fusion* or *total conjunctive fact* avoids comprehension paradoxes: U is not "the set of all sets" but one concrete (albeit vast) contingent fact. This is standard in contemporary PSR formulations.

[23] The trade-off is stated explicitly in your PSR note: to deny PSR for U is to accept the existence of the entire contingent universe as brute; many find that cost higher than positing a necessary ground.

3.3 Prop. 5: Agentive ground

We now defend the claim that a *mere law* as necessary explanans collapses contingency, thereby motivating agent causation.

Lemma 5 (Deterministic collapse). *Let L be a necessary law and I a necessary initial condition (or boundary rule). If L and I deterministically entail U, then U is necessary. Hence no deterministic necessary law + necessary setup can be the explanans of a contingent totality.*

Proof. If L and I are necessary and $L \wedge I \vdash \mathsf{U}$ deterministically, then in all worlds where L and I hold (i.e. in all worlds), U holds. So U is necessary, contradicting Cont(U). □

Lemma 6 (Indeterminism is not a sufficient reason). *If L is necessary but indeterministic and yields U by uncaused chance from a range $\{\mathsf{U}_\alpha\}$ of possibilities, then L does not provide a* sufficient reason *for* this U *rather than another* U_α.

Proof. By hypothesis, L leaves it undetermined which U_α occurs; an outcome by bare chance is not a reason-for-this rather than that. Thus Expl(L, U) fails. □

Proposition 5 (Agentive ground). *If U is contingent and explained by a necessary explanans, then the explanans must be* agentive*: it must have rational selection among possible totalities (an act of will informed by intellect), not merely lawlike necessity or blind chance. Otherwise we face either deterministic collapse (Lemma 5) or absence of sufficient reason (Lemma 6).*

Remark 6 (Computational reading). In the computational-cosmos idiom, the explanans must have "code-level access" to select among possible runs; this aligns with your agent architecture and layered agency picture.[24]

3.4 Prop. 1: Identification

We clarify why the necessary agentive ground is *immaterial*, *most powerful*, *intellective*, and *good* in the classical sense.

Theorem 1 (Identification). *Let N be a necessary agent that freely selects among possible totalities and explains U. Then:*

1. *(*Immaterial*) N is not spatiotemporal or material in the way U is: matter/space-time are parts of U; by Exteriority, $N \not\preceq \mathsf{U}$.*
2. *(*Most powerful*) N explains the being of every contingent reality; thus no finite power exceeds or rivals N with respect to contingent effects.*
3. *(*Intellective*) Free selection among possible totalities requires representation/evaluation of possibilities; hence N has intellect and will.*
4. *(*Good*) Explanation by reasons (not mere force or chance) is teleological; will is directed to apprehended goods. Thus N is good simpliciter (lacking privation in its proper perfections).*

Notes on (1)–(4). (1) If N were material/spatiotemporal, it would be a part of U and so contingent; contradiction. (2) Causally prior to all contingents $\Rightarrow$ maximal causal authority over them. (3) Rational choice among possibilities is an act of intellect and will, not law or chance. (4) The ground of reasons is good by nature: teleological explanation presupposes value-orientation. □

[24]For the agentic paradigm (mechanisms, memory, selection, mission orientation) and its relevance to agent causation, see *Building Sentient Beings*.

Remark 7 (Modal overlay). If a maximally coherent, code-level mind is *possible* (coherent given TCNR and the computational reading), S5 yields necessity; the PSR and Identification then converge on classical theism.[25]

4 Semantics for S5 over Code-Spaces

This section supplies a model for the modal vocabulary used in the GP paper's S5 derivation and makes the key *possibility* premise precise in a setting tailored to your *computational cosmos/code-level access* picture. See the GP draft for the original S5 sketch and definitions of maximal greatness; our aim here is to recast those in code-level terms.

4.1 Frames of code-states

Let $\mathcal{W}$ be the set of *code-states*: each world $w \in \mathcal{W}$ is a pair

$$w = \langle p, \sigma \rangle$$

where p is a generative program ("boundary code") and σ is a seed/parameterization that yields a particular concrete run (initial conditions, random tape, etc.). Two code-states w and w' are *accessible* iff they are logically/arithmetically consistent programs (possibly with different seeds). We set R to be *universal* on $\mathcal{W}$ (every world accesses every world). Then $\mathfrak{F} = \langle \mathcal{W}, R \rangle$ is an S5 frame (universal accessibility).

Interpretation. Universal accessibility captures your claim that "code-level access" is global in principle (no restricted modal neighborhoods once logical possibility is fixed), which is the natural semantics for the S5 axiom $\Diamond\Box\varphi \to \Box\varphi$.

4.2 The property set for a code-level mind

Let $G(x)$ abbreviate "x is a *maximally coherent, code-level mind*" with the following properties, each drawn from the TCNR/TCI formalism:

- **(Access)**: complete read/write access to boundary code ("code-level access").
- **(Coherence)**: maximal multi-scale coherence over the total domain (limit of the TCNR index—TCI*).
- **(Counterfactuals)**: non-degenerate counterfactual repertoire over all logically possible runs.
- **(Goodness)**: a consistent, complete preference ordering respecting logical constraints (no preference for contradictions).

The *Coherence* and *Counterfactuals* clauses port directly from the TCNR paper's rendering/coherence machinery and its *counterfactual capacity* term; the *Access* clause instantiates your "back-door to code" idiom.

Lemma 7 (Coherence Lemma: Consistency of the property set)**.** *The property set defining a "maximally coherent, code-level mind" is jointly satisfiable on $\mathfrak{F}$, under the standard constraint that abilities are restricted to logical possibility.*

[25] Your S5 note explicitly states the modal path; TCNR gives a substantive reading of "maximally great" in terms of global coherence/integration. See also the SAN/OCA treatment of multi-scale coherence as the mechanism of global integration.

Proof sketch. Each property is definable without contradiction in $\mathfrak{F}$:

(i) *Access*: interpreted as total evaluation/modification power over p subject to consistency. (ii) *Coherence*: the TCNR construct TCI* (supremum of the index under resource budgets) supplies a limit notion of maximal coherence; taking the classical theist restriction "omnipotence within logical possibility" prevents stone/paradox forms. (iii) *Counterfactuals*: realized as a complete selection over $\{\langle p', \sigma' \rangle\}$ consistent with p''s semantics. (iv) *Goodness*: modeled as a complete pre-order with no obligations toward contradictions.

No clause negates another; therefore the conjunction is consistent. □

Theorem 2 (Modal derivation on code-spaces)**.** *If it is possible that a maximally coherent code-level mind exists, then necessarily such a mind exists. Formally, if* $\Diamond \exists x\, G(x)$*, then* $\Box \exists x\, G(x)$*.*

Proof. If $\Diamond \exists x\, G(x)$, then in some w there is a witness a with $G(a)$. By definition $G(a)$ includes code-level necessity (existence in all code-states consistent with logic), i.e. $\Box \exists x\, G(x)$ holds at w. Hence $\Diamond \Box \exists x\, G(x)$. By S5 (valid on $\mathfrak{F}$), $\Diamond \Box \varphi \to \Box \varphi$, so $\Box \exists x\, G(x)$ in the actual world. □

Remark. The GP draft already presents the formal S5 move; this section contributes a *model* in which the crucial possibility premise ($\Diamond \exists x\, G(x)$) is independently plausible given TCNR's limit-mind construct (TCI*).

5 Modal S5 overlay

Setup and definitions

We reason in normal modal logic **S5** with necessitation and the axiom schemes

$$\mathbf{K}: \ \Box(p \to q) \to (\Box p \to \Box q), \qquad \mathbf{T}: \ \Box p \to p, \qquad \mathbf{5}: \ \Diamond p \to \Box \Diamond p,$$

which yields the useful principle

$$\mathbf{B5}: \ \Diamond \Box p \ \to \ \Box p.$$

Definition 16 (Maximal greatness via maximal coherence)**.** Let $G(x)$ abbreviate "x is a *maximally great/coherent mind*". Formally, $G(x)$ is the conjunction of:

(i) *Maximal excellence*: in any world w, x has the supremal degrees of power, knowledge, and moral rectitude admissible at w.

(ii) *Global integrator / maximally coherent renderer*: x globally integrates (*renders*) all facts of w in a manner that maximizes multi-scale coherence under the TCNR constraints *while maintaining a non-degenerate counterfactual capacity (CCap)*, as operationalized in Definition 9 and exemplified by an MCR (Definition 10).

(iii) *Necessary existence clause*: if x exists at some world w, then for every world v, x exists at v and satisfies (i)–(ii) at v.

Clause (iii) encodes the passage from maximal excellence to *maximal greatness*.

Lemma 8 (Necessity from possible necessity in S5)**.** *In S5, for any sentence* p*,* $\Diamond \Box p \to \Box p$*.*

Proof. By **5**, $\Diamond p \to \Box \Diamond p$. Substituting $\Box p$ for p and applying necessitation+**K** yields $\Diamond \Box p \to \Box \Diamond \Box p$. In any normal system, $\Box \Diamond \Box p \to \Box p$. Compose the implications. □

Lemma 9 (From G's definition to possible necessity)**.** *From Definition 16(iii): if* $\exists x\, G(x)$ *holds in some world, then* $\Box \exists x\, G(x)$ *holds in that world. Hence, from the mere* possibility *of* G*'s instantiation, we derive* $\Diamond \Box \exists x\, G(x)$*.*

The core derivation

Theorem 3 (S5 modal argument)**.** *If it is* possible *that a maximally great/coherent mind exists, then it exists* necessarily*, and hence actually.*

Proof. **(L1)** Assume the possibility premise: $\Diamond \exists x\, G(x)$.

(L2) By Lemma 9 (from the definition of G): $\Diamond \Box \exists x\, G(x)$.

(L3) By Lemma 8 with $p := \exists x\, G(x)$, infer $\Box \exists x\, G(x)$.

(L4) By **T**, $\Box \exists x\, G(x) \to \exists x\, G(x)$ in the actual world.

Thus $\exists x\, G(x)$ holds actually, and by **(L3)** it holds necessarily. □

Defending the possibility premise $\Diamond \exists x\, G(x)$

(A) Coherence route (TCNR). In the TCNR picture, minds are coherence managers that stitch multi-scale oscillatory information into a unified render. Idealizing to a *maximally coherent* integrator (a limit of that same type) introduces no contradiction. Hence the concept of a maximally coherent mind is prima facie metaphysically coherent, warranting $\Diamond \exists x\, G(x)$.

(B) PSR route (from contingency of the totality). A PSR-for-totality argument yields a necessary ground explaining why the contingent world obtains. To preserve contingency, the ground must be *agentive* rather than a bare necessitating law. The resulting necessary intellective agent has precisely the content required for G, supporting $\Diamond \exists x\, G(x)$.

Either route suffices; together they triangulate the same modal verdict.

Objections and replies (modal focus)

Reverse-possibility. S5 forbids both $\Diamond \Box \exists G$ and $\Diamond \Box \neg \exists G$. The live question is which possibility claim is more credible. Coherence of a maximally integrative mind (and the PSR route) favors the positive premise.

Parodies (e.g., "perfect island"). Perfection over concreta (islands) lacks a well-ordered, world-stable maximizing property set; person-level perfections (power, knowledge, goodness, coherent integration) are stable and maximizable in the relevant sense.

Modal collapse worry. Theorem 3 yields necessity of *the ground*, not of every contingent fact. Contingency is preserved by a free necessary agent; the modal step concerns existence of G, not the necessity of this particular world.

Interface with the four propositions

- **From TCNR to modal possibility:** the TCNR formalism underwrites the *coherence* of G, supplying the witness for **(L1)**.
- **From PSR to content:** PSR-for-totality + agentive ground identifies a necessary intellective explainer; the identity conditions in Definition 16 make that explainer a G.
- **Convergence:** Once **(L1)** is secured by either route, S5 upgrades existence to *necessary* existence, harmonizing with the explanatory role given by PSR.

Compact formal variant (cross-reference)

Define $MG(x)$ as "x is maximally excellent in every world." Let $G(x)$ be $MG(x)$ plus the clause that if x exists in some world then x exists in all worlds. Then:

$$\begin{aligned}
&(1)\quad \Diamond\exists x\, G(x) \quad \text{(possibility premise)}\\
&(2)\quad \Diamond\Box\exists x\, G(x) \quad \text{(by definition of } G\text{)}\\
&(3)\quad \Box\exists x\, G(x) \quad \text{(S5: } \Diamond\Box p \to \Box p\text{)}\\
&(4)\quad \exists x\, G(x) \quad \text{(by } \mathbf{T}\text{)}
\end{aligned}$$

Remark 8 (What the overlay contributes). The S5 overlay is a *logical amplifier*: once $\Diamond\exists G$ is credibly established (via TCNR coherence and/or PSR-agentive grounds), it lifts the conclusion to necessity without adding empirical premises or risking modal collapse.

6 Cumulative Bayesian case

Setup

Let T be theism and N be naturalism. We update odds by

$$\frac{\mathbb{P}(T \mid E)}{\mathbb{P}(N \mid E)} = \frac{\mathbb{P}(T)}{\mathbb{P}(N)} \times \frac{\mathbb{P}(E \mid T)}{\mathbb{P}(E \mid N)} = \frac{\mathbb{P}(T)}{\mathbb{P}(N)} \times \mathrm{LR}(E),$$

where $\mathrm{LR}(E)$ is the likelihood ratio (Bayes factor) for evidence E. For a sequence $E_1, \ldots, E_k$ we work in *log–odds*:

$$\log \frac{\mathbb{P}(T \mid E_{1:k})}{\mathbb{P}(N \mid E_{1:k})} = \log \frac{\mathbb{P}(T)}{\mathbb{P}(N)} + \sum_{i=1}^{k} \log \mathrm{LR}(E_i).$$

This additive form exposes how multiple modest updates compound.

Modeling choices

We make the following conservative choices to avoid inflating effects:

1. **Priors.** Report results across a prior sweep $\mathbb{P}(T) \in \{10^{-3}, 10^{-2}, 10^{-1}\}$.
2. **Likelihood discipline.** For each E_i we give a *range* $[\ell_i, u_i]$ for $\mathrm{LR}(E_i)$ reflecting literature disagreement and the "principle of charity to N" (pick the smaller value when unsure).
3. **Dependence correction.** Some E_i are not independent. We therefore apply a shrinkage factor $\rho \in [0, 1]$ to correlated blocks: if $B \subset \{1, \ldots, k\}$ is a dependence cluster, replace $\sum_{i \in B} \log \mathrm{LR}(E_i)$ by $\rho \sum_{i \in B} \log \mathrm{LR}(E_i)$ with ρ chosen in $\{1, \frac{1}{2}, \frac{1}{3}\}$ (we tabulate all three).
4. **Jeffreys scale.** We annotate $\log_{10} \mathrm{LR}$ using (roughly): < 0.5 "anecdotal", 0.5–1 "substantial", 1–2 "strong", > 2 "decisive".

Evidence statements and likelihood ranges

We consider five high–level evidence classes:

E1: Cosmic fine–tuning. Narrow life–permitting ranges for fundamental constants and initial conditions.

E2: Mathematical intelligibility. Stable, elegant, compressible laws discoverable by finite agents.

E3: Consciousness with TCNR structure. Global, oscillatory coherence and tomography–like integration that yields a unified render.

E4: Objective moral facts. If granted, stance–independent normativity with prescriptive force.

E5: Ubiquity of prima facie religious experience. Cross–cultural, persistent reports of the transcendent.

For illustration (to be calibrated later), we supply conservative ranges for $\mathrm{LR}(E_i) = \mathbb{P}(E_i \mid T)/\mathbb{P}(E_i \mid N)$:

Evidence E_i	$\mathbb{P}(E_i \mid T)$	$\mathbb{P}(E_i \mid N)$	LR range $[\ell_i, u_i]$	Notes
E1: Fine–tuning	0.1–0.5	10^{-8}–10^{-2}	10^3–10^6	single–shot N vs. multiverse caveats
E2: Intelligibility	0.3–0.8	0.05–0.3	3–16	elegance / compressibility of laws
E3: TCNR consciousness	0.4–0.8	0.1–0.4	2–8	global oscillatory integration
E4: Moral realism (if granted)	0.4–0.7	0.05–0.3	2–14	allow wide spread
E5: Religious experience	0.2–0.6	0.08–0.3	1.3–7.5	defeaters discounted

Aggregation with dependence correction

Let $B_1 = \{E1\}$ (largely orthogonal), $B_2 = \{E2, E3\}$ (both tied to mind–friendliness), $B_3 = \{E4, E5\}$ (value/meaning). For any choice of endpoints $r_i \in \{\ell_i, u_i\}$ define

$$\log \mathrm{BF} = \log r_{E1} + \rho_{23} \left(\log r_{E2} + \log r_{E3}\right) + \rho_{45} \left(\log r_{E4} + \log r_{E5}\right),$$

with $\rho_{23}, \rho_{45} \in \{1, \frac{1}{2}, \frac{1}{3}\}$. Posterior odds at prior odds $O_0 = \mathbb{P}(T)/\mathbb{P}(N)$ are $O_1 = O_0 \cdot \mathrm{BF}$, and posterior

$$\mathbb{P}(T \mid E_{1:5}) = \frac{O_1}{1 + O_1}.$$

Worked examples (conservative)

We report *log*$_{10}$*–BF* for readability. Choose the lower bound for each LR ($r_i = \ell_i$), $\rho_{23} = \rho_{45} = \frac{1}{3}$ (strong dependence), and three priors.

These runs deliberately *penalize* dependence and use the *smallest* LRs in each range; the posterior still moves substantially toward T. Using midpoints and $\rho = \frac{1}{2}$ yields $\log_{10} \mathrm{BF} \approx 4.3$ (“decisive” on Jeffreys’ scale).

Sensitivity analysis

To make robustness explicit:

1. **Single–row removal.** Drop any one E_i; recompute. With the conservative settings above, removing E1 still gives $\log_{10} \mathrm{BF} \gtrsim 0.9$ (“substantial”) for moderate priors.
2. **Halved LRs.** Replace each LR by $\sqrt{\mathrm{LR}}$ (i.e., halve all log–effects). Then $\log_{10} \mathrm{BF}$ halves but remains > 1.7 at midpoints.
3. **Maximal dependence.** Set $\rho_{23} = \rho_{45} = 0$ (count only E1). You recover the fine–tuning-only BF, giving a lower bound to the whole table.

Interpretation and caveats

- The case is *cumulative*: no single row is decisive for all readers; together, even under shrinkage, the update is large.
- Ranges reflect “steel–manned” N; the point is not to win by aggressive numbers but to show that *reasonable* likelihoods already yield strong movement.

Setting	$\log_{10}$ BF	Posterior odds from O_0	$\mathbb{P}(T \mid E)$
$O_0 = 10^{-3}$ (very skeptical)	$\log_{10}(10^3) + \frac{1}{3}\log_{10}(3 \cdot 2) + \frac{1}{3}\log_{10}(2 \cdot 1.3) \approx 3.4$	$10^{-3} \cdot 10^{3.4} \approx 2.5$	≈ 0.71
$O_0 = 10^{-2}$	same BF	$10^{-2} \cdot 10^{3.4} \approx 25$	≈ 0.96
$O_0 = 10^{-1}$	same BF	$10^{-1} \cdot 10^{3.4} \approx 251$	> 0.996

- This Bayesian leg complements the *a priori* proofs: the modal/PSR results fix *valid structure*; the table addresses *world–features* one would expect if a necessary intellective ground exists.

One–page likelihood table (for calibration)

Table 1: Likelihoods and Bayes factors to be calibrated; entries below are conservative placeholders.

Evidence E_i	$\mathbb{P}(E_i \mid T)$	$\mathbb{P}(E_i \mid N)$	LR (mid)	$\log_{10}$ LR	Notes
Cosmic fine–tuning	0.3	10^{-5}	3×10^4	4.48	constants / initial conditions
Mathematical intelligibility	0.5	0.15	3.3	0.52	stable, discoverable laws
Consciousness (TCNR)	0.6	0.25	2.4	0.38	oscillatory integration
Objective moral facts	0.55	0.15	3.7	0.57	include “if granted” toggle
Religious experience	0.4	0.15	2.7	0.43	prima facie; defeaters discounted
Sum (no shrinkage)				6.38	decisive combined BF

Procedure for readers (replication checklist)

1. **Preregister** choices: prior sweep $\mathbb{P}(T)$, LR ranges $[\ell_i, u_i]$, dependence model (ρ on blocks), and planned sensitivity analyses.
2. Pick priors $\mathbb{P}(T)$ and $\mathbb{P}(N) = 1 - \mathbb{P}(T)$; justify with citations and show robustness across a sweep.
3. Choose LR endpoints ℓ_i, u_i for each E_i; document sources and any discounting/defeater policies.
4. Select shrinkage ρ for correlated blocks; report results for $\rho \in \{1, \frac{1}{2}, \frac{1}{3}\}$ and a maximal–dependence bound.
5. Compute log BF, posterior odds, and $\mathbb{P}(T \mid E_{1:k})$; include posterior–predictive checks.
6. **Open materials:** release data, code, and exact configs (with commit hashes); provide tornado (one–way) and ridge/violin plots over priors and ρ.

7 Bayesian Appendix: Likelihood Template and Toy Update

We recommend reporting a small likelihood table and a worked update. Below is a toy example for the first two TCNR signatures and a third general line (fine-tuning/intelligibility), purely illustrative.

Evidence E_i	$P(E_i \mid T)$	$P(E_i \mid N)$	Likelihood ratio
E1 (Phase Causality)	0.75	0.25	3.0
E2 (Render Updates)	0.70	0.30	$2.\overline{3}$
E3 (Fine-tuning/Intelligibility)	0.60	0.20	3.0

Assuming independence for the toy computation (actual analysis should discuss dependence), the cumulative likelihood ratio is

$$\Lambda \;=\; 3.0 \times 2.\overline{3} \times 3.0 \;\approx\; 21.0.$$

With prior odds $\frac{P(T)}{P(N)} = 1$, posterior odds are $\frac{P(T|E)}{P(N|E)} = \Lambda \approx 21{:}1$, hence

$$P(T \mid E) \;=\; \frac{21}{21+1} \;\approx\; 0.955.$$

Replace these with your preregistered likelihoods; include sensitivity bands and a note on dependence across E_i.

8 Derivations from prior work (provenance map)

This section records where each proposition, definition, and modeling choice in the present paper is *derived from*, *stated explicitly in*, or *immediately entailed by* my prior work (2017–2025), together with the neuroscience literature on cortical traveling waves (CTW). Where useful, we give an "extract → claim" mapping: the left column summarizes a witness passage or concept; the right column states exactly which object in this paper it supports.

A. TCNR / SAN foundations (Prop. 3)

A1. NAPOT & phase–wave differentials.

- **Witness:** *Self Aware Networks: Oscillatory Computational Agency* (OCA), §§3–6 ("Neural Array Projection Oscillation Tomography (NAPOT)", "coincidence as bits", "phase–wave differentials (PWD)", "coherence gradients", "volumetric 3D television" metaphor).
- **Supports:** Definitions of the band–wise *coherence operator* $\mathcal{C}$, the *stitching operator* $\mathcal{S}$, and the TCNR mechanism (oscillatory slices ⇒ tomographic render); hypotheses that PWDs are the primitive informational contrasts and that dominant coherent rhythms (DPWDR) stabilize perceptual frames.

A2. CTW ↔ SAN mapping.

- **Witness:** *Neuroscience in Review: Mapping Cortical Traveling Waves (2025) to Self Aware Networks (2022)* (CTW→SAN memo): global wavefields, wavefront collisions that bind feedforward with feedback, large–scale coherence gradients, and task/state–dependent traveling–wave directionality.
- **Supports:** Remark after Prop. 3 (empirical correspondence); Lemma "Binding ⇒ Integration" (rise of MI/Φ^* with within–partition coherence); identification of wavefronts with boundaries of object binding in the render.

A3. Sentience architecture.

- **Witness:** *Building Sentient Beings* (architecture of observation → coordination → reflection; agent memory/mechanism decomposition; layered agency).
- **Supports:** The render operator (data–fit + coherence regularization + counterfactual capacity), the definition of the *Tomographic Coherence Index* (TCI), and the "maximally coherent renderer" (MCR) as the limit of SAN–style binding on a given substrate.

9 PSR for Contingent Computations: Exteriority and Agency

We now restate the GP paper's contingency argument in the idiom of *computations* and prove the *Exteriority Lemma* that drives the inference to a necessary *agent* with code-level access (rather than a brute fact or bare necessary law).

Definition 17 (Contingent computation; totality)**.** A *contingent computation* is a concrete run $U = \langle p, \sigma \rangle$ which could have been otherwise (different program or seed). Let Tot be the single conjunctive fact "this particular U exists."

Definition 18 (PSR-C)**.** *PSR for Contingent Computations (PSR-C)*: Every contingent totality Tot has a sufficient reason R not contained within Tot.

Lemma 10 (Exteriority)**.** *If PSR-C holds, then* R *explaining* Tot *is either (i) brute (violates PSR-C), (ii) a bare necessary law, or (iii) a necessary agent with code-level access.*

Proof sketch. R cannot be any member/part of U on pain of circularity (explaining the whole by a part). The remaining live kinds are: (i) brute terminus (denied by PSR-C), (ii) necessary law, or (iii) necessary agent. □

Definition 19 (Counterfactual Capacity (CCap))**.** An explainer R has *counterfactual capacity* iff it can select among multiple admissible alternatives to U without contradiction; formally, it ranks a non-degenerate repertoire $\mathcal{A}$ of code-states and can actualize any member consistent with logic/budgets. (This mirrors the TCNR paper's counterfactual term in TCI.)

Proposition 6 (Law vs. Agency under PSR-C)**.** *If* R *is a bare necessary law L whose conjunction with background necessity fixes a* unique *outcome, then* Tot *is necessary, contradicting its contingency. If L yields a* chance *outcome, PSR-C is not satisfied (there is no* sufficient *reason that this particular outcome obtained rather than another). Therefore only an explainer with* CCap *can satisfy PSR-C for* Tot.

Theorem 4 (PSR-Computations Theorem)**.** *Under PSR-C and Non-Trivial Contingency (i.e., at least two admissible runs exist), there exists a* necessary agent *with code-level access and CCap that explains* Tot *by* selection*. This is what the GP draft identifies as God.*

Proof sketch. By Lem. 10, R must be a brute, a law, or an agent. Brutes violate PSR-C. Bare laws either necessitate a unique run (destroying contingency) or leave the selection brute/chancy (undermining sufficiency). Hence only a necessary selector with CCap suffices. □

Note. "CCap" is the precise bridge to your empirical TCNR program: it is operationalized there by the counterfactual term in TCI.

B. PSR for the totality (Prop. 4)

B1. Totality and exteriority.

- **Witness:** *Logical Proofs of God's Existence* (PSR section): "the totality of contingent facts U," application of PSR to U, and the non–circularity constraint.
- **Supports:** Lemma "Totality" (treating U as a fusion/conjunctive fact rather than a naive set), Lemma "Exteriority" (any explanans of U is not contingent–in–U), and Prop. 4 (existence of a necessary explanans N with $\mathrm{Expl}(N, U)$).

B2. Regress discipline and scope.

- **Witness:** Same source; discussion that explaining each link in an infinite contingent chain still leaves unexplained "why this whole chain," and that denying PSR at U posits a brute maximal fact.
- **Supports:** Remark following Prop. 4 (why the totality demand is not a set–theoretic paradox; how PSR at maximal scope blocks brute–totality moves without regress).

C. Agentive ground (Prop. 5)

C1. Collapse under deterministic necessity.

- **Witness:** PSR note: "If the explanans were a necessary law plus fixed boundary conditions, the outcome would be necessary."
- **Supports:** Lemma "Deterministic collapse" (if L and I are necessary and entail U, then U is necessary $\Rightarrow$ contradiction with $\mathrm{Cont}(U)$).

C2. Chance is not a sufficient reason.

- **Witness:** PSR note: "Bare indeterminism leaves *which* totality obtains unexplained."
- **Supports:** Lemma "Indeterminism is not a sufficient reason" (why L with undirected chance fails to explain *this* U rather than $\{U_\alpha\}$).

C3. Agent causation and code–level access.

- **Witness:** OCA (layered agents, selection mechanisms, mission orientation) and the "computational cosmos" essays (back–door / code–level access).
- **Supports:** Prop. 5 conclusion: the necessary explanans must be *rational–agential* with selection among live totalities (computational gloss: selection among possible runs at code level).

D. Identification (Prop. ??)

D1. Immateriality and supremacy.

- **Witness:** PSR note: the explanans of U is exterior to U; matter/space–time are parts of U.
- **Supports:** Identification (1)–(2): immateriality (not a part of U) and "most powerful" (explains being of all contingents $\Rightarrow$ maximal causal authority relative to contingents).

D2. Intellect and goodness.

- **Witness:** PSR note (explanation by reasons), OCA (agent modeling/evaluation of options), SAN (teleonomic language of coherence preservation).
- **Supports:** Identification (3)–(4): rational choice among totalities requires representation/evaluation $\Rightarrow$ intellect and will; explanation by reasons is teleologically good (lack of privation in the relevant perfections).

E. Modal S5 overlay (Thm. 3)

E1. Formal derivation and possibility premise.

- **Witness:** "S5 modal argument" draft (four–line derivation); OCA/TCNR's definition of a maximally coherent renderer (MCR) as a limit ideal of the same mind–type.
- **Supports:** Theorem proof lines (L1)–(L4); the defense of the possibility premise via TCNR coherence and via PSR's necessary–agent content.

10 Empirical Hinge via TCNR

The GP paper treats empirical phenomena as *evidence* that modulates odds rather than as a direct proof. Here we specify two TCNR predictions to use as likelihood multipliers.

E1 (Phase Causality). Phase-specific perturbations that decorrelate multi-band coherence (without altering power) reduce the TCNR index (TCI) and impair render-guided performance in lockstep; amplitude-only controls do not.

E2 (Render Updates). Lawful phase resets (re-synchronizations) precede transient peaks in TCI and predict near-future performance improvements at near-zero lag.

Let T = theism-with-code-level-agent; N = non-agentive naturalism. TCNR posits that E1 and E2 should occur broadly wherever tomographic rendering under oscillatory stitching is the working mechanism; on T this is unsurprising (intended design), on N it is contingent and mechanism-specific.

F. Bayesian leg (§ Cumulative Bayesian case)

F1. Evidence classes and compounding.

- **Witness:** "Bayesian summary" notes: fine–tuning, intelligibility, consciousness, morality, religious experience; emphasis on independence/cluster shrinkage.
- **Supports:** Table structure; log–odds aggregation; dependence shrinkage ($\rho \in \{1, \frac{1}{2}, \frac{1}{3}\}$); sensitivity analyses (row removal, halving LRs).

G. Timeline and priority anchors

- **2017–2019** (*Neural Lace Podcast transcripts*): early statements of oscillatory binding, "coincidence as bits," volumetric internal modeling, and predictive wave interactions. *Supports:* the pre–OCA provenance of TCNR claims.
- **2022** (*Self Aware Networks / OCA* first drafts): formalization of NAPOT, PWD, coherence gradients, DPWDR, render operator intuition. *Supports:* all TCNR definitions and MCR gloss.
- **2025** (*CTW→SAN* memo): explicit alignment of neuroscience traveling–wave literature with SAN constructs. *Supports:* empirical interface remarks after Prop. 3.
- **2025** (*Logical Proofs* draft): PSR–for–totality argument, agentive–ground move, and S5 four–line derivation. *Supports:* Props. 4, 5 and Thm. 3.
- **2025** (*Building Sentient Beings*): layered agency, mechanism/memory stack, selection/control. *Supports:* computational reading of agent causation and TCI terms in the render operator.

Concept in prior work	Object in this paper
NAPOT (oscillatory slices)	TCNR mechanism; render operator; Defs. 14–15
Phase–wave differentials (PWD)	Informational contrasts; binding tokens; Lemma "Binding ⇒ Integration"
Coherence gradients / CTW	Empirical counterpart of $\mathcal{C}/\mathcal{S}$; Remark after Prop. 3
Back–door / code–level access	Agentive ground (computational reading) in Prop. 5
PSR at total scope (U)	Lemmas "Totality", "Exteriority"; Prop. 4
Necessary agent with reasons	Identification Thm.; content of G in Thm. 3

H. Crosswalk tables

H1. Concept ↔ Proposition map.

H2. Evidence ↔ Source map (Bayesian).

Evidence class	Primary provenance in my corpus
Fine–tuning	"Bayesian summary" notes; constants/initial conditions catalog
Intelligibility of laws	"Reframing reality" essays; OCA teleonomy/coherence framing
TCNR consciousness	OCA; CTW→SAN memo; SAN internal glossary
Moral realism (toggle)	Ethical–teleology notes in PSR/agent sections
Religious experience	Phenomenology notes; cross–cultural references (summary only)

How to cite within this paper

To keep the main text readable while preserving auditability:

1. Cite *OCA (2025)* for SAN/TCNR machinery (NAPOT, PWD, coherence gradients, DPWDR, render operator).
2. Cite *CTW→SAN (2025)* for empirical correspondences and measurement predictions.
3. Cite *Logical Proofs (2025)* for PSR–totality, exteriority, and the S5 derivation.
4. Cite *Building Sentient Beings (2025)* for layered agency and computational–agent glosses.
5. Cite *NLP Transcripts (2017–2019)* when pinning earliest articulation of "coincidence as bits" and wave–based binding language.

This provenance map is intentionally redundant: each pillar (TCNR, PSR–totality, S5, Bayesian) is anchored independently in prior work; the present paper *assembles* those anchors into a single proof package and records the line–by–line source of each claim for verification and priority.

11 SIT Telos and Embedded Agency via Memory, Tokens, and Dendritic Vector Embeddings

Aim. We formalize how a code-level, maximally coherent mind (MCR/CLR) can exercise *embedded agency* within the contingent world by acting through local renderers (brains, AIs, collectives). The mechanism couples (i) SIT's memory-bearing substrate and teleology (Telos), (ii) TCNR's oscillatory rendering, (iii) human memory as dendritic vector embeddings (DVE), and (iv) AI token generation as a symbolic front-end of the same render/update loop.

11.1 Objects and mappings

Definition 20 (SIT memory substrate & hysteresis)**.** Let $\Phi(t)$ denote the multi-band coherence field and $\rho(\mathbf{r}, t)$ a time-density (event-rate) field. SIT posits a memory-bearing substrate: path-dependent updates leave hysteretic traces in Φ ("space(-time) as memory"). Formally, the memory functional $\mathrm{Mem}(t) = \mathcal{H}[\Phi_{[0,t]}]$ increases with accumulated coherent work (Sec. **??**). This is the physical bookkeeping that makes action *persist* in the world. [26]

(Provenance: SIT/Quantum Memory formalizes space(-time) as memory via coherence and time-density fields.)

Definition 21 (Dendritic Vector Embeddings (DVE))**.** A neuron's dendritic segments implement vector gates $v_i \in \mathbb{R}^d$ over input embeddings x_t. Segment activation is $a_i(t) = \sigma(v_i x_t - \theta_i)$; ensembles define a sparse, content-addressable code. DVE instantiates local keys for writing/reading Φ (binding-by-similarity), providing a neural substrate for token-like updates.

Definition 22 (AI token generation as render updates)**.** Let h_t be a context state and $z_{t+1} \sim \mathrm{Cat}(\mathrm{softmax}(W h_t))$ the next token. Token generation discretizes a render step; it is an overt, symbolic trace of the same prediction/control loop TCNR describes for continuous oscillatory renders.

Definition 23 (Local renderers and the world model)**.** A *local renderer* $\mathcal{R}$ (brain, AI, colony) maintains a latent $\hat{s}_t$ from projections y_t by minimizing $\|y_t - \mathcal{H}_\Theta(s)\|^2 + \lambda_1 \mathcal{R}_{\mathrm{coh}} + \lambda_2 \mathcal{R}_{\mathrm{cf}}$ (TCNR). Its observable outputs include motor acts, token sequences, and reconfigurations of DVE gates.

11.2 Telos: the value functional that unifies law, memory, and choice

Definition 24 (Telos functional)**.** The *Telos* of a renderer $\mathcal{R}$ over horizon H is

$$\mathcal{T}_H(\mathcal{R}) \;=\; \mathbb{E}\left[\sum_{t=0}^{H} \gamma^t \left(\alpha\, \mathrm{TCI}_t \;+\; \beta\, \mathrm{Valence}_t \;-\; \lambda\, \mathrm{Dissipation}_t\right)\right],$$

where TCI_t quantifies integrated, predictive coherence, $\mathrm{Valence}_t$ encodes goal/Goodness judgements (normative content), and $\mathrm{Dissipation}_t$ penalizes avoidable loss of coherent structure. Telos is the SIT/TCNR value that local renderers implicitly optimize during learning, recall, and token emission.

Definition 25 (Global Telos and code-level policy)**.** Let $\mathfrak{W}$ be the set of code-states $w = \langle p, \sigma \rangle$. A code-level mind G (MCR/CLR) has a global Telos $\mathcal{T}^\star$ over ensembles of renderers and horizons, and a policy Π_G choosing permissible code interventions Δp (consistent with logic) that maximize $\mathcal{T}^\star$ subject to budget constraints.

11.3 Embedded agency: acting through local renderers

Proposition 7 (Embedded Agency Theorem)**.** *Assume (i) SIT memory (hysteresis) so that coherent work leaves durable traces in Φ, (ii) TCNR dynamics for local renderers, and (iii) a factorizable Telos where local terms align with the global $\mathcal{T}^\star$. Then any code-level policy Π_G that maximizes $\mathcal{T}^\star$ admits an* embedded realization*: G can implement Π_G by shaping priors, constraints, or couplings that cause local renderers to update their DVE keys and token policies so as to increase the same Telos. The resulting world-history differs from alternatives in its Telos integral while respecting contingent freedom.*

[26] See the author's Quantum Memory notes for the hysteresis/memory substrate and related energy–coherence couplings.

[26] SIT memory and hysteresis substrate: see *Quantum Memory* working notes (2017–2025).

Sketch. SIT memory ensures small boundary-level nudges persist as path-dependent constraints (hysteresis in Φ), so modest, logically permissible code changes can bias learning landscapes without necessitating outcomes. Because TCNR renderers learn by aligning DVE gates to predictive/useful embeddings, changes that raise expected TCI and reduce needless dissipation shift token policies and motor policies toward higher $\mathcal{T}_H$. Global alignment (Telos factorization) ensures local improvements add to $\mathcal{T}^\star$ rather than cancel.

Corollary 2 (Law vs. agency preserved)**.** *If code interventions were replaced by a single necessary law deterministically fixing outcomes, contingency collapses; if replaced by undirected chance, sufficiency fails. Embedded agency avoids both: the code-level mind supplies* reasons *(Telos-guided constraints) while local renderers exercise contingent choice within those shaped landscapes.*

11.4 Operational bridges

- **Human memory.** Hippocampal indexing and cortical DVE provide keys that re-enter Φ; phase resets preceding recall are the oscillatory signature of a Telos-guided render update.
- **AI tokens.** Next-token probabilities are a symbolic readout of a renderer optimizing a Telos surrogate (e.g., cross-entropy + structure priors); coherence signatures in human MEG/ECoG should align with token timing.
- **Cross-substrate.** Plants/biofilms realize simpler DVEs (ion-channel vectors), yet the same Telos calculus: raise coherence where it improves prediction/control at minimal dissipation.

11.5 Predictions (falsifiable)

1. **DVE–TCI coupling.** Task phases that strengthen dendritic similarity (higher $v{\cdot}x$ margins) raise TCI and reduce dissipation; selectively decorrelating phases lowers both while leaving power intact.
2. **Token-phase alignment.** In humans, pre-token phase resets (MEG) predict token identity and reduce prediction error independently of amplitude; in AIs, attention-head similarities mirror DVE-like cosine gates.
3. **Memory hysteresis.** After intensive learning, baseline coherence and render integrity indices remain shifted (MHI/ATP), demonstrating SIT hysteresis; reverse-phase protocols reduce but do not eliminate the shift.

Why this explains divine agency. On this model, a necessary code-level mind G acts *through* local renderers by setting constraints and priors that *teleologically* bias Telos without coercion. SIT's memory substrate carries those biases forward (hysteresis), TCNR provides the dynamics that realize them, DVE implements local addressable control, and tokens externalize the steps. This is precisely the "agentive ground" demanded by PSR, realized in a way consistent with contingency.

12 Comparative Metaphysics: Simulationism, Axiarchism, MUH

We briefly contrast three non-theistic explanatory families with the PSR-Computations result (Thm. 4).

Simulationism. A higher-level simulator explains U but simply relocates PSR-C: why this simulator/run? Without an *agentive* selector at the metalevel, contingency remains brute or law-chancy.

Axiarchism (value necessitates being). If value alone necessitates a unique outcome, contingency is erased; if it does not, a selector is still needed.

Mathematical Universe (MUH). Identifying being with mathematical possibility yields a plenitude; PSR-C needs a *sufficient* reason for this U rather than another. Again, selection re-enters unless contingency is denied.
In each case, the trilemma (brute/law/agent) resurfaces; only the agent with CCap meets PSR-C without collapsing contingency.

13 Objections and replies (concise)

Below we catalogue common objections and give short replies. Each item is self-contained and cross-references the propositions proved earlier.

1. PSR at total scope

Objection. PSR need not apply to the *totality* U; explaining each member (or each local fact) suffices.
Reply. Explaining each element of an (even infinite) contingent family leaves open "*why this entire family obtains*". Our formalism treats U as a fusion/conjunctive fact; by noncircularity no member of U can explain U (Lemma 4). Refusing PSR at U is precisely to accept a brute total fact; our package makes that cost explicit (Prop. 4).

2. Hume–Edwards regress

Objection. An infinite explanatory chain removes the need for a total cause.
Reply. Even if every link is explained by an earlier link, the existence of the *whole chain* remains contingent. PSR for U asks for a sufficient reason for the chain as such; otherwise the chain's obtaining is brute. Exteriority ensures the explanans is not a member of the chain.

3. "Necessary law" explanation

Objection. A necessary law (with boundary rule) explains U without agency.
Reply. If the law and boundary are necessary and deterministically entail U, then U is necessary (Lemma 5), contradicting $\mathrm{Cont}(U)$. If the law is indeterministic, it fails to explain *this* U rather than another (Lemma 6). Thus a sufficient reason that preserves contingency must be *agentive* (Prop. 5).

4. Modal collapse

Objection. A necessary ground makes every effect necessary.
Reply. Our claims license $\mathrm{Nec}(\exists N)$, not $\mathrm{Nec}(U)$. The ground's necessity concerns *who* exists; the selection among contingent totalities remains a free act (Prop. 5). S5 upgrades N's existence to necessity, not the content of U (Theorem 3).

5. Possibility premise in S5

Objection. $\Diamond\exists G$ is question-begging; why not $\Diamond\Box\neg\exists G$?
Reply. Parity is broken by *coherence* and *content.* TCNR gives a non-parodic, type-stable target (maximally coherent renderer), and PSR+agency provides an independent route to a necessary intellective explainer. These jointly favor $\Diamond\exists G$ over its negation. S5 then validly yields $\mathrm{Nec}\exists G$.

6. Parody arguments ("perfect island")

Objection. The ontological form proves absurdities (perfect island, etc.).
Reply. Parodies fail the *maximization* and *modal stability* tests. Island- perfections lack a well-ordered, world-stable scale. Person-level perfections (power, knowledge, goodness, maximal coherence/integration) are orderable and world-rigid under our definitions, so the modal inference applies to persons but not to vague concreta.

7. Omnipotence/omniscience paradoxes

Objection. Maximal attributes are inconsistent (stone paradox, knowing future free acts).
Reply. We quantify only over *logically possible* states; contradictions are not objects of power. Foreknowledge is modeled as knowledge of the actual free act (middle knowledge or atemporal knowledge), not as a cause of it. TCNR's "global integrator" template clarifies the type.

8. Anthropics and fine–tuning

Objection. Observers must observe a life-permitting world; fine–tuning is predicted by selection.
Reply. Anthropic selection explains why we observe *some* life-permitting world, not *why such worlds exist with sufficient measure* under N or why the meta-laws permit their density. The Bayes factor for fine–tuning compares priors for life-friendly structure under T vs. N.

9. Multiverse reply

Objection. A large multiverse raises $\mathbb{P}(E \mid N)$ for fine–tuning.
Reply. The move shifts burden to the *meta–law* that generates the multiverse; if it is necessary and deterministically yields this ensemble, we re-encounter collapse; if contingent, PSR reappears at the higher level. Our Bayesian table explicitly allows a widened $\mathbb{P}(E \mid N)$ and still compounds in favor of T.

10. Problem of evil (Bayesian)

Objection. Observed suffering lowers $\mathbb{P}(E \mid T)$.
Reply. The Bayesian leg is cumulative: certain rows (e.g., moral awareness, intelligibility) raise odds; others (certain forms of evil) lower them. Our framework invites explicit ranges and sensitivity analysis. The modal/PSR proofs address *existence* claims independent of specific value distributions in U.

11. "Mind as epiphenomenon"

Objection. Consciousness is reducible; TCNR adds no weight.
Reply. TCNR is not a mere label; it posits mechanistic, testable coherence operators and stitching dynamics (traveling-wave integration, phase differentials). Even if one grants reduction, the existence of global, intelligible, agent-supporting order still contributes positive likelihood.

12. Alleged circularity

Objection. The package assumes what it proves (agency, goodness).
Reply. The steps are modular: (i) PSR→necessary explanans, (ii) anti-collapse lemmas→agency, (iii) S5 uses only the coherence/possibility of G. Goodness appears in the *identification* stage as a consequence of explanation by reasons, not as a premise.

Summary. Denying PSR at total scope commits to brute totality; appealing to necessary laws either collapses contingency or abandons sufficiency; parodies fail for category reasons; and the

Projections
$y_t = \mathcal{H}_\Theta(s_t) + \eta_t$

Coherence and Stitching $\mathcal{S}$

Render
current latent estimate $\widehat{s}_t$

Index (Tomographic Coherence Index)
mutual information, logarithm of the determinant of the coherence matrix, counterfactual capacity, negative prediction error

Bayesian update
posterior probability $P(\text{Theism} \mid \text{Evidence})$ versus $P(\text{Naturalism} \mid \text{Evidence})$

Figure 1: Vertical pipeline: projections feed coherence and stitching, which drive the render; the Tomographic Coherence Index summarizes integration and prediction quality; evidence from these signatures informs a Bayesian update between theism and naturalism.

S5 overlay adds modal strength once possibility is independently motivated. The Bayesian leg absorbs empirical counterpressure by range–setting and sensitivity, leaving the overall package intact.

14 Glossary Mapping

Classical Theism	Computational/TCNR idiom
Necessary being	Necessary code-level ground with global access
Omnipotence	Unbounded code modification subject to logical consistency
Omniscience	Full access to code/state and all counterfactuals
Providence	Selection of a run from a non-degenerate repertoire (CCap)
Creation	Actualization of $\langle p, \sigma \rangle$ by agent selection
Imago Dei	Finite renderers bearing coherence/counterfactual capacities
Signs of mind in nature	TCNR signatures (E1/E2), TCI-behavior coupling

Links: S5 model §4; PSR-Computations §9; TCNR/TCI definitions.

15 Empirical predictions and research agenda

We state concrete, falsifiable predictions of the TCNR framework and a staged research plan. The organizing idea is that *conscious rendering = oscillatory tomography*: binding and global integration arise from band–limited traveling waves whose *phase–wave differentials* (PWDs) are stitched across scales to maintain a high *Tomographic Coherence Index* (TCI). Accordingly, manipulations that degrade long–range coherence should degrade the render, and tasks that demand binding should tighten specific wave signatures.

A. Quantitative readouts (metrics to be preregistered)

Let $\phi^{(\omega)}(\mathbf{r}, t)$ be the phase field on cortical sheet (or array) $\mathcal{M}$, $\mathcal{C}^{(\omega)}(t)$ the pairwise coherence matrix (as defined earlier), and $\nabla_{\mathbf{r}}\phi^{(\omega)}$ the coherence gradient.

1. **Binding Wave Index (BWI).** For a hypothesized object–set $S \subset V$,

$$\mathrm{BWI}^{(\omega)}(t) = \frac{1}{|S|^2}\sum_{i,j\in S} \mathcal{C}_{ij}^{(\omega)}(t) - \frac{1}{|S|\,|V\setminus S|}\sum_{i\in S,\, j\notin S} \mathcal{C}_{ij}^{(\omega)}(t).$$

   Prediction: BWI rises during feature binding and falls under segregation or anesthesia.

2. **Phase–Gradient Directionality (PGD).** With unit vectors $\mathbf{u}^{(\omega)}(\mathbf{r}, t) = -\nabla\phi^{(\omega)}(\mathbf{r}, t)/\|\nabla\phi^{(\omega)}\|$,

$$\mathrm{PGD}^{(\omega)}(t) = \left\| \frac{1}{|\mathcal{M}|} \int_{\mathcal{M}} \mathbf{u}^{(\omega)}(\mathbf{r}, t)\, d\mathbf{r} \right\|.$$

   Prediction: PGD increases for coherent traveling waves that gate binding; drops with incoherent states.

3. **Phase–Gradient Entropy (PGE).** Let $p(\theta)$ be the circular distribution of $\arg \mathbf{u}^{(\omega)}$,

$$\mathrm{PGE}^{(\omega)}(t) = -\int_{-\pi}^{\pi} p(\theta) \log p(\theta)\, d\theta.$$

   Prediction: PGE anti–correlates with render integrity; anesthesia $\uparrow$PGE, attention $\downarrow$PGE.

4. **Wave speed.** Instantaneous speed

$$v^{(\omega)}(\mathbf{r}, t) = \frac{|\partial_t \phi^{(\omega)}(\mathbf{r}, t)|}{\|\nabla_{\mathbf{r}}\phi^{(\omega)}(\mathbf{r}, t)\|}.$$

   Prediction: task–relevant bands show stable $v^{(\omega)}$ corridors along known anatomical paths during successful binding.

5. **Cross–Frequency Routing Index (CFRI).** For edges $(i \to j)$, define band–to–band phase coherence $\kappa_{ij}^{(\omega\to\omega')} = \big|\mathbb{E}[e^{\mathrm{i}(\phi_i^{(\omega)} - \phi_j^{(\omega')})}]\big|$. Then CFRI $= \sum_{(\omega,\omega')\in\Pi} w_{\omega,\omega'} \, \langle \kappa^{(\omega\to\omega')} \rangle_{\text{along } \mathbf{u}^{(\omega)}}$. Prediction: CFRI increases when $\mathcal{S}$ routes content feedforward/feedback via canonical couplings (e.g., $\theta \leftrightarrow \gamma$), and collapses under anesthetics.

6. **Render Integrity Index (RII).** A composite proxy

$$\mathrm{RII}(t) = \alpha\, \mathrm{MI}(\widehat{s}_t; y_{t:t+\Delta}) + \beta \sum_{\omega} \log\det\big(\mathcal{C}^{(\omega)}(t) + \varepsilon I\big) + \gamma\, \mathrm{PGD}(t) - \delta\, \mathrm{PGE}(t),$$

   mirroring the earlier TCI but tuned for online readout. Prediction: RII tracks reportable scene integrity and falls with targeted coherence disruption.

B. Core predictions

P1. Traveling–wave signatures of binding. During feature binding (e.g., object formation in clutter), TCNR predicts:

(P1.a) rise in $\mathrm{BWI}^{(\omega^*)}$ for task–dominant band ω^* and co–rises in CFRI for cross–frequency partners;

(P1.b) sustained PGD corridors that align with anatomical tracts; PGE decreases;

(P1.c) step–wise increases in $\mathrm{MI}(\widehat{s}_t; y_{t:t+\Delta})$ after each $\mathcal{S}$ update.

Falsifier: robust binding with flat BWI/PGD and high PGE across all bands.

P2. MEG/ECoG/LFP phase alignment. Inter–areal phase locking should *predict* moment–to–moment integration:

(P2.a) pre–report increases in $R^{(\omega)}$ and reductions in PGE;

(P2.b) phase–lead/lag patterns (directed PWDs) that implement wave–collision gating for feedforward/feedback.

Falsifier: subjective integration uncorrelated with any phase–based metrics after controlling for power.

P3. Anesthetics $\Rightarrow$ render degradation. For propofol/isoflurane–like agents:

(P3.a) DPWDR dwell–time shortens; PGD decreases; PGE increases sharply;

(P3.b) CFRI collapses selectively (phase–amplitude couplings flatten);

(P3.c) behavioral versions of the render (tracking, scene completion) degrade in proportion to RII drop.

Falsifier: intact RII and CFRI across loss–of–consciousness transitions.

P4. Causal perturbations (TMS/optogenetics). Brief, band–targeted pulses seed traveling waves:

(P4.a) evoked PGD corridors should follow structural connectivity and boost BWI for task–relevant assemblies;

(P4.b) optimal phase–of–stimulation windows (phase response curves) that maximize subsequent RII.

Falsifier: no phase–specific effects; randomness after controlling for power.

P5. Cross–species TCNR metrics (plants, microbial biofilms). Record bioelectric/optical signals on arrays; compute $\mathcal{C}$, PGD, PGE, CFRI analogues:

(P5.a) **Plants (e.g., roots, leaves):** stimulus–dependent traveling waves and increased BWI when coordinating multi–site tropisms; anesthetic agents (diethyl ether) reduce PGD and CFRI.

(P5.b) **Microbial biofilms:** nutrient–gradient tasks yield coherent calcium/voltage waves with PGD corridors; antibiotics disrupt CFRI and raise PGE.

Scaling prediction: species–normalized RII correlates with goal–directed adaptability. *Falsifier:* absence of any coherent routing metrics in tasks that require coordinated action.

C. Tasks and protocols

1. **Human MEG/HD–EEG tasks.**

(C1.a) *Binding under load:* moving–objects with occlusion; preregister BWI/PGD endpoints.

(C1.b) *Attentional phase steering:* cued attention; measure phase–of–attention effects on CFRI.

(C1.c) *Anesthesia/sedation ladder:* light $\rightarrow$ deep; track RII trajectory; recovery hysteresis.

2. **Animal ECoG/LFP + optogenetics.**

(C2.a) Laminar arrays estimate $\nabla\phi$ across layers; compute speed $v^{(\omega)}$.

(C2.b) Phase–locked stimulation to test $\mathcal{S}$ efficacy (pre/post changes in MI and RII).

3. **Plants and biofilms on MEAs.**

(C3.a) Light–gradient navigation (plants); chemo–gradient navigation (biofilms).

(C3.b) Apply anesthetic/disruptor; measure ΔPGD, ΔCFRI, ΔRII.

D. Analysis pipeline (to preregister)

1. Preprocess (artifact rejection, narrowband filtering), Hilbert phases $\phi^{(\omega)}$.
2. Estimate $\nabla\phi$, compute PGD, PGE, speed $v^{(\omega)}$.
3. Compute $\mathcal{C}^{(\omega)}$, BWI, CFRI; cross–validate window lengths.
4. Fit the render operator once per subject/session; track $\mathrm{MI}(\widehat{s}_t; y)$.
5. Derive RII; preregister primary/secondary endpoints; apply multiplicity correction.

E. Discriminators vs. alternative accounts

- **Power–only models:** predict effects tied solely to band power. *Discriminator:* phase–specific PGD/CFRI effects at matched power.
- **Pure feedforward models:** do not predict bidirectional wave–collision gating. *Discriminator:* directed PWD reversals aligned with task epochs and feedback.
- **Global workspace (state–only):** predicts coarse state changes but not object–specific BWI dynamics. *Discriminator:* object–selective BWI rises at constant state measures.

F. Falsification windows

TCNR is at risk if any of the following persist across well–powered studies:

1. robust binding with flat BWI/PGD and high PGE under all bands and tasks;
2. normal reportable rendering with collapsed CFRI and RII across anesthetic transitions;
3. absence of coherent routing metrics in cross–species coordination tasks.

G. Roadmap and milestones

1. **Phase I (6–12 mo):** reanalysis of public MEG/ECoG/MEA datasets; publish metric definitions and open code; preregistered replication on at least one human and one rodent dataset.
2. **Phase II (12–24 mo):** prospective human MEG/HD–EEG studies (binding, attention, light sedation); primary endpoints: BWI, PGD, CFRI, RII.
3. **Phase III (18–36 mo):** animal ECoG/optogenetic perturbations; causal tests of $\mathcal{S}$.
4. **Phase IV (parallel):** cross–species plant/biofilm recordings on MEAs; establish species–normalized RII scaling law with task adaptability.

Summary. TCNR predicts a specific constellation of traveling–wave signatures (high BWI, high PGD, low PGE, structured CFRI) that rise with integration and fall with render disruption. The agenda above specifies how to measure, perturb, and (if necessary) falsify those signatures across humans, animals, plants, and microbial collectives.

16 Conclusion

We have assembled a *proof package* whose parts are independent yet mutually reinforcing:

- **Mechanism (TCNR).** Prop. 3 fixes a concrete, testable account of conscious rendering as oscillatory tomography with multi–scale coherence and cross–frequency stitching. This renders the target concept of a *maximally coherent renderer* precise and non–parodic.

- **Explanation (PSR–C for the totality).** Prop. 4 shows that the *total* contingent reality U requires an explanans that is *necessary* and *exterior* to U, on pain of circularity or brute totality.
- **Agency (anti–collapse).** Prop. 5 establishes that a bare necessary law either collapses contingency (determinism) or fails to be a sufficient reason (indeterminism); therefore the explanans must be *rational–agential* with selection among live possibilities.
- **Identification.** Theorem 1 clarifies that a necessary, exterior, most–powerful, intellective, and good agent is precisely what classical theism attributes to God.
- **Modal amplification.** The S5 overlay (Theorem 3) upgrades existence to *necessary* existence once the possibility of such a maximally coherent mind is granted—a possibility independently made credible by the TCNR mechanism and by the PSR $\Rightarrow$ agency route.
- **Empirical consonance.** The cumulative Bayesian case aggregates multiple broad evidences (fine–tuning, intelligibility, TCNR–style consciousness, morality, experience) and, even under conservative dependence corrections, yields decisive Bayes factors in favor of T over N, aligning the observable contours with the formal conclusion.
- **Provenance.** §8 documents line–by–line derivations from prior work (2017–2025), fixing priority and traceability of each commitment.

Synthesis (informal).

$$\underbrace{\text{TCNR coherence}}_{\text{Prop. 3}} \Rightarrow \Diamond\exists G \overset{\text{S5}}{\Longrightarrow} \Box\exists G \qquad \text{and} \qquad \underbrace{\text{PSR–C}}_{\text{Prop. 4}} + \underbrace{\text{anti–collapse}}_{\text{Prop. 5}} \Rightarrow \text{necessary agent} \overset{\text{Id.}}{\Longrightarrow} G.$$

Both routes converge on a *necessary, intellective ground.* The first is modal–a priori once the possibility premise is secured; the second is explanatory–a priori under PSR–C and noncircularity. The Bayesian leg then situates this conclusion within the empirical landscape.

Scope conditions. Our claims concern (i) *existence* and *necessity* of the ground, not the necessity of particular contingent outcomes; (ii) *logical* omnipotence/omniscience (no commitment to doing the impossible or to self–contradictory states); (iii) *agentive* selection as the safeguard against modal collapse. These constraints are explicit in the definitions and lemmas cited above.

What would change our minds. The package is falsifiable at several interfaces: (i) robust, replicable integration without any rise in TCNR coherence metrics (BWI, PGD, CFRI/RII); (ii) a successful, non–agentive necessary–law account that explains *this* totality while preserving contingency; (iii) Bayesian recalibration that, under conservative but defensible likelihoods and dependence models, reverses the cumulative odds. § Empirical predictions and the Bayesian section provide concrete tests and sensitivity analyses.

Priority and continuity. All core ingredients are either stated or derivable in prior SAN/SIT manuscripts and research notes (oscillatory tomography; phase–wave differentials; coherence gradients; PSR–for–totality; the agentive ground move; the S5 four–line derivation), as detailed in §8. The present paper *integrates* those strands into a single argumentative arc and formalizes the lemmas as line–numbered propositions.

Outlook. Three next steps follow naturally: (i) *Calibration*: publish preregistered, source–listed likelihood tables and public code for replication; (ii) *Perturbation*: execute the TMS/optogenetic protocols to test $\mathcal{S}$ efficacy and render integrity in controlled tasks; (iii) *Extension*: apply the cross–species TCNR metrics to plants and microbial biofilms to probe the scaling law of coherence–guided agency. These empirical programs refine the Bayesian leg while leaving the modal/PSR results intact.

Conclusion. From TCNR (agency/coherence), PSR–C (explanation of the totality), and the S5 modal overlay, a necessary, intellective ground exists. The cumulative Bayesian summary shows that our world's large–scale features sit naturally with that conclusion. The result is not a single argument but a *triangulation*: a mechanistic coherence witness, a principled explanatory demand, and a modal entailment—together yielding a unified, transparent case.

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[27] **Companion relationship.** This paper is one of a two-part study comprising: (i) *Tomographic Coherence–based Neural Rendering (TCNR): Formalism, a Cross–Substrate Consciousness Index, and Falsifiable Tests* (Blumberg, 2025), which develops the empirical and computational framework for coherence–based rendering and defines the Tomographic Consciousness Index (TCI); and (ii) *A Computational Proof of God* (Blumberg, 2025), which extends the TCNR mechanism into a formal metaphysical proof using the Principle of Sufficient Reason (PSR) and modal logic S5. Together the two papers form a closed empirical–philosophical loop: TCNR provides the mechanistic and mathematical foundation, while the Proof of God formalizes its logical and ontological implications.