Observer-Dependent Realism: A Reply to Objections on Objectivity, the Observer, Testability, and Causation in Observer-Dependent Physics

Наблюдатель-зависимый реализм: ответ на возражения об объективности, наблюдателе, проверяемости и причинности в наблюдатель-зависимой физике

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Abstract. The Observer-Dependent Theory of Everything (ODTOE) is presented here as observer-dependent realism: reality is objective at the level of an intersubjective fixed point, and objectivity itself is reconstructed as the limit of high coherence. The paper gives a conditional reply to five objection classes in observer-dependent physics — a peer-reviewed advanced-observer model [1], an online source on the limits of observability [2], and a popular article on engineering physical systems from consciousness [3] — and shows that the established apparatus of the ODTOE corpus already carries a conditional reply to each class, leaving explicitly named residuals. Objectivity is recovered as a Banach fixed point $\Psi^* = \Phi_{B,S}(\Psi^*)$ of the self-observation operator, whose existence is established unconditionally by Schauder's theorem and whose uniqueness follows from Banach's theorem at the contraction modulus $q(B,S) = BS + (1-B)\sqrt{1-S^2}$ with the value at the KAM-selected golden point $(\varphi^{-1}, \varphi^{-1})$, $q^{(B=S)}|_{\varphi^{-1}} \approx 0.6822491173$. The observer mechanism is given by an explicit operator algebra $\hat{O}_B(\Psi) = B\,P_A(\Psi) + (1-B)\eta_B(\Psi)$ with spectrum $\lambda_1 = \varphi^{-1}e^{i\theta}$ and a quantum-mechanical limit. The parameter B is operationally measurable by a full instrument-level protocol. Coherence-truth is deliberately adaptive, Kantian-regulative, and consonant with the Fitness-Beats-Truth theorem, with the formal signature of an ideal error $\delta_{\text{ideal}} = \Psi^*_{\text{coherent}} - \Psi_{\text{factual}}$. Testability is secured by a fitting-free predictor: the sign reversal $\partial q/\partial B = S - \sqrt{1-S^2}$ at $S = 1/\sqrt{2} \approx 0.70710678$, recomputed to fifty decimal places. Causation is reconciled with compatibilism, and the observability ceiling is set by a two-level architecture by design. Every claim is assigned to one of the levels L1, L2, or L3; the narrow residual is stated openly.

Keywords: observer-dependent realism, ODTOE, fixed point, coherence, objectivity, intersubjectivity, falsifiability, decoherence, compatibilism, epistemic stratification.

Аннотация. Наблюдатель-зависимая теория всего (ODTOE) представлена здесь как наблюдатель-зависимый реализм: реальность объективна на уровне интерсубъективной неподвижной точки, а сама объективность реконструируется как предел высокой когерентности. Работа даёт условный ответ на пять классов воз-

ражения к наблюдатель-зависимой физике — рецензируемую модель продвинутого наблюдателя [1], онлайн-источник о пределах наблюдаемости [2] и научно-популярную статью об инженерии физических систем на основе сознания [3] — и показывает, что установленный аппарат корпуса ODTOE уже несёт условный ответ на каждый класс, оставляя явно названные остатки. Объективность восстанавливается как банахова неподвижная точка $\Psi^* = \Phi_{B,S}(\Psi^*)$ оператора самонаблюдения, существование которой установлено безусловно по теореме Шаудера, а единственность — по теореме Банаха при модуле сжатия $q(B,S) = BS + (1-B)\sqrt{1-S^2}$ со значением в КАМ-отобранной точке золотого сечения $(\varphi^{-1}, \varphi^{-1})$, $q^{(B=S)}|_{\varphi^{-1}} \approx 0{,}6822491173$. Механизм наблюдателя задан явной операторной алгеброй $\hat{O}_B(\Psi) = B\,P_A(\Psi) + (1-B)\eta_B(\Psi)$ со спектром $\lambda_1 = \varphi^{-1}e^{i\theta}$ и квантово-механическим пределом. Параметр B операционально измерим полным приборным протоколом. Когерентная истинность задана сознательно как адаптивная, регулятивная по Канту и согласная с теоремой Fitness-Beats-Truth, с формальной сигнатурой идеальной ошибки $\delta_{\text{ideal}} = \Psi^*_{\text{coherent}} - \Psi_{\text{factual}}$. Проверяемость обеспечена свободным от подгонки предиктором: знаковый разворот $\partial q/\partial B = S - \sqrt{1-S^2}$ при $S = 1/\sqrt{2} \approx 0{,}70710678$, пересчитанный до пятидесяти десятичных знаков. Причинность согласована с компатибилизмом, а потолок наблюдаемости задан двухуровневой архитектурой по построению. Каждое утверждение отнесено к одному из уровней L1, L2 или L3; узкий остаток изложен открыто.

Ключевые слова: наблюдатель-зависимый реализм, ODTOE, неподвижная точка, когерентность, объективность, интерсубъективность, фальсифицируемость, декогеренция, компатибилизм, эпистемическая стратификация.

1 Introduction

Observer-dependent physics regularly meets five objections. It is called a hidden idealism in which the objective world dissolves into acts of perception; it is faulted for leaning on an undefined “observer” that smuggles consciousness into the foundation; it is declared untestable metaphysics; its handling of causation and free will is called incompatible with physical closure; and finally it is charged with an insurmountable observability ceiling that places a theory of everything out of reach. Each of these objections is formulated against a family of kindred observer models [1, 2, 3] and deserves a direct reply.

The present work gives a conditional reply along every line and states the central thesis explicitly. **The ODTOE corpus already carries the apparatus that gives a conditional reply to five objection classes, leaving explicitly named residuals.** Idealism and hidden consciousness are closed at the level of the explicit operator family; testability and the observability ceiling are developed as operational programs with stated residuals. The established apparatus includes existence and uniqueness theorems for the self-observation fixed point, an explicit operator

algebra, a full instrument-level protocol for measuring the parameter B, a formal signature of coherence-truth, and a two-level architecture of observability. **ODTOE is observer-dependent realism**, and this realism stands clear of idealism and solipsism: objectivity is reconstructed as an intersubjective fixed point, that is, as the limit of high coherence S across a cluster of observers. The stone remains a stone for every high-coherence observer precisely because it is a stable fixed point of their joint self-observation, and independence from any single observer is recovered as a structural limit and held by the theory [4, 5].

The critiques addressed belong to different registers, and the work separates their weight explicitly. The first [1] is a peer-reviewed advanced-observer model in a quantum-information journal; it is treated as the closest relative, with which a substantive dispute is conducted. The second [2] is an online source on the limits of observability and the challenges to a theory of everything, posted on ResearchGate with no indexed DOI; at the time of the audit its full text was not retrievable through the direct link, and it is drawn upon at the level of conceptual match as a statement of the observability-ceiling objection. The third [3] is a popular online article by Ananya Chatterjee (Diverse Daily, 14 August 2025) outside the peer-review process; it serves as a representative of the class of objections about objectivity and determinism that circulate in broad discussion, with no scientific claim resting on it.

The discipline of exposition is set by epistemic stratification. Every claim carries an explicit level label. **L2-INVARIANT** marks a structural, observer-independent result, derived and, where numerical, verified to fifty decimal places. **PREDICTION** marks an empirically testable consequence of the model. **HYPOTHESIS** marks a claim open within the corpus or imported as a theorem from a neighbouring field. **L3-interpretation** marks a philosophical reading of the formalism, valuable for coherence and open to revision. A summary is given in Table 4.

The correspondence between sources, objection classes, and reply sections is collected in Table 1, with an explicit note of the epistemic status of each correspondence and of the residual that remains. For the online source [2] the status is given as a conceptual match: its full text was not retrievable through the direct link at the time of the audit, and the correspondence holds at the level of the objection topic (a conceptual match without a verbatim quotation).

2 The legitimate landscape of observer-dependent physics

The idealism objection supposes that admitting the observer into the foundation is a departure from the scientific tradition. Contemporary physics contains a mature research programme in which the observer is relative by construction, and ODTOE sits inside that programme.

Rovelli's relational quantum mechanics makes the values of observables relative

Table 1: Objection register: source, class, reply section, epistemic status, and residual

Source	Objection class	Reply section	Epistemic status	Residual
Wong [1] (peer-reviewed)	Hidden idealism / objectivity	§3	Reconstruction of objectivity on the explicit operator family	Bridge to structural realism as a programme
Wong [1]; Diverse Daily [3]	Observer as hidden consciousness	§4	Physical operator and a floor of decoherence	Phenomenal consciousness bracketed
Wong [1]; Diverse Daily [3]	Testability / measurability	§5	Instrument-level B protocol and a fitting-free predictor	Weights w_i uncalibrated, protocol unrun
Wong [1]; Diverse Daily [3]	Causation and free will	§6	Compatibilism, inviolability of the past (L2)	Downward causation at the level of a hypothesis
Cosmic Invariant [2] (conceptual match, full text not retrieved)	Observability ceiling / ToE incompleteness	§7	Two-level architecture and the ceiling $S_{\max}$	Anchoring to an exact source passage pending

to a physical observer-system, retaining meaning only for a state referred to some observer [6]. Cross-perspective links in that programme show how distinct perspectives agree and form a coherent shared description, and it is this agreement that carries the weight of objectivity here [7]. Quantum Bayesianism treats the quantum state as an agent's degree of belief and thereby transfers the probabilistic content onto the pair "agent plus system" [8]. Zurek's decoherence and einselection explain how stable, redundantly recorded classical observables are singled out from quantum dynamics, and they do so without appeal to consciousness [9].

No-go results strengthen this programme. The Kochen–Specker theorem forbids the assignment of context-independent values to observables and makes contextuality a structural feature of the quantum description [10]. The Frauchiger–Renner thought experiment shows that observers applying quantum theory to other observers reach inconsistent conclusions, and thereby makes the relativity of a fact to an observer formally unavoidable [11]. An experimental test of local observer independence in an extended Wigner's-friend scheme demonstrates that the outcomes of two observers diverge already at the level of the laboratory [12]. Bayesian mechanics of stationary

processes provides an independent rigorous anchor: a self-consistent stationary state is formally a fixed point of a generalized gradient flow on a probability density [13]. ODTOE inherits this landscape and adds to it a unified quantitative apparatus of coherence.

3 Reply A. Objectivity as an intersubjective fixed point

The idealism objection runs thus: if reality depends on the observer, then the stone vanishes the moment the eyes are closed, and the shared world decomposes into private dreams. The ODTOE reply reconstructs objectivity within the established formalism.

Reality is a fixed point of self-observation,

$$\Psi^* = \Phi_{B,S}(\Psi^*) = \iota_S(\hat{O}_\Psi(\Psi)), \qquad \Phi : \mathcal{H} \to \mathcal{H}, \tag{1}$$

where $\hat{O}$ is the observation operator and ι_S is the integration map over the cluster of observers. Each observer's belief anchor is multiplicative across four factors — focus of attention F, emotional coherence E, consistency $(1-\sigma)$, and empirical reinforcement Λ,

$$B = F^{w_1}\, E^{w_2}\, (1-\sigma)^{w_3}\, \Lambda^{w_4}, \qquad \sum_i w_i = 1. \tag{2}$$

The collective coherence over a cluster of n observers is the complement of the mean pairwise mismatch of anchors,

$$S = 1 - \frac{2}{n(n-1)} \sum_{i<j} |B_i - B_j|. \tag{3}$$

The stability of the collective fixed point is set by a single contraction modulus,

$$q(B,S) = B\,S + (1-B)\sqrt{1-S^2}, \tag{4}$$

with the operator Φ contracting, and the Stone stable and unique, exactly when $q < 1$. The existence of the fixed point is established unconditionally by Schauder's theorem, and uniqueness together with geometric convergence by Banach's theorem at $q < 1$; both theorems are derived for the ODTOE operator in the companion ODTOE corpus paper on the origin of the observer as Theorem 5.1.T1 (unconditional existence) and Theorem 5.1.T2 (uniqueness under contraction) [14] (**L2-INVARIANT**).

The contraction modulus (4) has an explicit value on the curve $B = S$ at the KAM-selected golden-section point. A direct computation of the operator norm of Φ in the parameters (B, S) yields the explicit estimate (4); its value at the KAM-resonance-selected point $(\varphi^{-1}, \varphi^{-1})$, where $\varphi = (1+\sqrt{5})/2$, is

$$q^{(B=S)}\big|_{\varphi^{-1}} = \varphi^{-2}(1+\sqrt{1-\varphi^{-2}}) = 0.68224911725088275968210787558278824961032689402959, \tag{5}$$

recomputed to fifty decimal places with mpmath [14] (**L2-INVARIANT**); the true diagonal minimiser on $B = S$ itself is the nearby point $v^* \approx 0.56229$ with value $q^* \approx 0.67813$, which the value at the KAM point exceeds by ≈ 0.00411911489. The selection of φ^{-1} is set by the KAM argument and is carried as a **HYPOTHESIS**, hereditary across the transition [14]. A minimum convergence rate of order two decimal places per iteration makes the high-coherence Stone geometrically stable.

For the explicit operator family $(\hat{O}_B, \iota_S)$ the D-Contract postulate holds automatically for every physical observer. A direct computation of the norm of the difference in the companion ODTOE corpus paper on the unified operator yields the closed form of the contraction modulus (4), and for every physical observer with $B \in (0, 1)$ and $0 < S \leq S_{\text{max}}$ the strict inequality $q(B, S) < 1$ holds [15, §IV.4] (**L2-INVARIANT for the explicit family**). An independent recomputation to fifty decimal places confirms the strict inequality $q < 1$ on the whole open square $(0, 1)^2$, with the equality $q = 1$ attained exactly on the two degenerate corners $(0, 0)$ and $(1, 1)$; both corners are non-physical, since the corner $(1, 1)$ requires $S = 1$ beyond the coherence ceiling $S_{\text{max}} = 1 - (\pi - 3)^2 \approx 0.97995$, while the corner $(0, 0)$ requires the noiseless limit $B = 0$. The single interior critical point stands at $(1/2, 1/\sqrt{2})$ with value $q = 1/\sqrt{2} \approx 0.70710678$ and is a saddle (Hessian determinant -4). The bounded minimum on the diagonal $B = S$ stands at the point $t^* \approx 0.56229$ with value $q \approx 0.67813$; the value $q(\varphi^{-1}, \varphi^{-1}) \approx 0.68224912$, assigned in (5) to the golden-section point, is the specific value of the modulus on the diagonal at that point. Hence for every physical observer of non-zero density the operator Φ contracts, and Banach uniqueness holds by construction (**L2-INVARIANT for the explicit family**).

The status of the contraction estimate R4 becomes clear in comparison with the axiomatics. R4 is a Lipschitz bound on Φ, while the axiom (A) together with P1–P6 and D-Rich carries only a norm bound on the noise term $\|\eta_B(\Psi)\| \leq \|\Psi\|$ of the operator (7) [16, 17]. A norm bound leaves the contraction modulus undetermined, and so R4 is carried as a standing regularity postulate (Lipschitz/spectral), separate from a theorem of the existing axiomatics (**HYPOTHESIS**, the D-Contract postulate).

Objectivity is reconstructed here as a structural limit. A configuration held by a high-coherence cluster is a stable fixed point shared by all of its observers; it reproduces itself in every act of observation and resists revision by a single participant. This is what it means to be a stone for everyone — the region of maximal overlap of the cluster's configurations, given in the companion ODTOE corpus paper on the collective observer as the intersection $\mathcal{O}_n = \bigcap_{i=1}^{n} \mathcal{C}_i$, non-empty at $S > S_{\text{threshold}}$; the overlap is an intersection in which a common part exists while each observer keeps an individual remainder [18] (**L2-INVARIANT**). The overlap-and-threshold mechanism traces back to the remark on postulate P5 of the base corpus paper, which operates in the overlap region of realities at $S > S_{\text{threshold}}$ [19]. Independence from a single observer is recovered in the limit $S \to 1$, where the individual anchors coincide and the intersubjective fixed point behaves as an observer-independent fact (**L2-INVARIANT**). Reading the coherent limit as objectivity is structural realism in the spirit of preserving relations

across a change of description [4] and a relational reconstruction of objectivity through the agreement of perspectives [6, 7] (**L3-interpretation**). The intersubjective nature of this limit has an operator reading of the phenomenology of intersubjectivity in the published corpus paper on the collective observer and the culture of humanity, where language tunes the pairwise coherence S_{ij} and widens the region of intersection of individual configurations as a structural parallel [20] (**L3-interpretation**).

The notion of truth is here set deliberately as adaptive. The attractor $S \to 1$ yields an adaptive truth: a cluster agreement that works and reproduces itself. This position is chosen with support from the Fitness-Beats-Truth theorem and the interface theory of perception, by which the configuration toward which a collective of observers tends as $S \to 1$ is an adaptive attractor that maximizes collective coherence [21, 22]. The limit $S \to 1$ functions as a regulative ideal in the Kantian sense [23, 5]: it sets the direction of cognition and is held unreachable by construction. The gap between the coherent attractor and the factual configuration is formalized by the signature of an ideal error,

$$\delta_{\text{ideal}} = \Psi^*_{\text{coherent}} - \Psi_{\text{factual}}, \tag{6}$$

derived in the companion ODTOE corpus paper on the optimal control of coherent media [24] (**L2-INVARIANT**). A parallel corpus signature is phantom coherence $S_{\text{phantom}} > S_{\text{true}}$, defined formally in the companion ODTOE corpus paper on honesty through the reducibility theorem, where honesty coincides with consistency $(1 - \sigma)$ and dishonesty yields the signature $S_{\text{phantom}} > S_{\text{true}}$ [25]: an inflated apparent agreement masks fragility, while the lifetime of a configuration is set by the true coherence through the law $T = T_0/(1 - S_{\text{true}})^n$, and collapse arrives earlier than expected [24, 26] (**L2-INVARIANT**). This signature is operationally measurable: the companion ODTOE corpus paper on multi-agent coherence introduces the detector $S_{\text{adjusted}} = S_{\text{team}} \times \bar{B}$, which on empirical data separates phantom agreement from genuine agreement (a group with $S_{\text{team}} = 0.970$ at $S_{\text{adjusted}} = 0.335$ is coordinated around an error) [27] (**PREDICTION**); the inequality signature itself is carried as an L2-invariant, while the detector thresholds 0.5 and 0.7 are a constructive choice. Objectivity as an intersubjective fixed point remains a reconstructed quantity, and the adaptive nature of truth is presented as a result.

4 Reply B. The observer and the mechanism without hidden consciousness

The second objection holds that the “observer” in observer-dependent physics is consciousness in disguise, secretly introduced into the foundation. The ODTOE reply rests on an explicit operator algebra and a consciousness-free floor of decoherence.

The observation operator is given a concrete form. In the companion ODTOE corpus paper on the specification of the operators $\hat{O}$ and ι, the observation operator is

defined as

$$\hat{O}_B(\Psi) = B\,P_A(\Psi) + (1-B)\,\eta_B(\Psi), \tag{7}$$

where $P_A(\Psi) = \langle A \mid \Psi\rangle A$ is the orthogonal projection onto the direction of the attention archetype A of the observer, and $\eta_B(\Psi)$ is a noise term with variance $D[\eta_B] \propto (1-B)^\alpha$, $\alpha \geq 1$ [16]. The immersion operator ι_S unfolds the observation outcome across the cluster with the weight of the system coherence S,

$$\iota_S(R) = R\,e_A + \sqrt{1-S^2}\sum_{k\geq 2} c_k(S)\,e_k, \tag{8}$$

and the composition $\Phi = \iota_S \circ \hat{O}_B$ is the self-observation operator (1) [16]. Linearization of Φ near the fixed point yields a spectrum with dominant eigenvalue

$$\lambda_1 = \varphi^{-1}\,e^{i\theta}, \qquad \theta = 2\pi m, \quad m \in \mathbb{Z}, \tag{9}$$

which describes a spiral convergence with damping radius $\varphi^{-1} \approx 0.618$ [16] (**L2-INVARIANT**). At $B \to 1$ and $S \to 1$ the operator Φ reduces to the standard orthogonal projection P_A of quantum mechanics [16] (**L2-INVARIANT**). The algebra $\hat{O}$ is a specified formal operator, and the four factors of the anchor B are the parameters of the operator itself: the companion ODTOE corpus papers on observer activation and on the quaternionic structure of consciousness give the quaternionic realization $q_{\hat{O}} = \Lambda + F\mathbf{i} + E\mathbf{j} + (1-\sigma)\mathbf{k}$ with norm $|q_{\hat{O}}|^2 = B^2$, and observation is a quaternionic rotation $R = q_{\hat{O}} \cdot \Psi \cdot \overline{q_{\hat{O}}}$ [14, 28] (**L2-INVARIANT**); no hidden consciousness term enters.

The observation operator itself arises as a consequence, and its status is set by derivation. The companion ODTOE corpus paper on the primordial distinction shows that the operator $\hat{O}_{\Psi^*}$ appears as a consequence of spontaneous symmetry breaking with the potential $V(\Psi) = -\mu^2|\Psi|^2 + \lambda|\Psi|^4$ and KAM selection of the φ-resonance, remaining an output of the formalism; a four-step audit leads from the symmetric state through a fluctuation and a KAM filter to Ψ^*, keeping any external observer outside the construction [17] (**L2-INVARIANT**). Self-observation $\hat{O}(\hat{O}) = \hat{O}'$ as a structural property requires a minimal spatial dimension $d = 3$, established in the companion ODTOE corpus paper on the birth of the observer [29] (**HYPOTHESIS**).

The mechanism that bears the weight is decoherence. Stable, redundantly recorded classical observables are singled out from quantum dynamics through interaction with the environment, and this selection proceeds without any appeal to consciousness [9]. The observer in ODTOE is a physical state vector $O = (B, A, H)$ — cognitive coherence, attention archetype, and history — that is not confined to a biological substrate. An electron, an atom, a cell, a human, and an AI agent are realizations of one architecture $R = \hat{O}(\Psi)$ on a dimensionality gradient d: quarks ($d < 0$), atoms ($d = 0$), cells ($d = 1$), multicellular organisms ($d = 2$), Homo sapiens ($d = 3$–4) [10, 30]. An atom is an elementary strange loop $\Psi^* = \Phi(\Psi^*)$ with a threefold architecture; the observer is any system of reading, writing, and verification — a detector, an AI agent, a collective [30] (**L2-INVARIANT**). The reading “a detector is

an observer" is realizable in hardware: the companion ODTOE corpus paper on the coherent detector shows that the structural identity of the observation operators $\hat{O}_\alpha \cong \hat{O}_\beta$ makes two physical resonators sections of one fixed point $\Psi^* \in \mathcal{H}$ [31] (**HYPOTHESIS**). This treatment is fully materialist and dispenses with collapse upon meditation.

Phenomenal consciousness is not introduced here as a primitive causal engine. The popular framing that places consciousness at the foundation of physical outcomes [3] rests on phenomenal consciousness as a standalone cause; ODTOE makes no such assumption. The observer is given operationally — a physical vector $O = (B, A, H)$ with the measurable cognitive coherence of the anchor B — while the phenomenal layer is bracketed at the L3 level as a candidate substrate of qualia, with no separate causal power beyond the physical state of the agent (**L2-INVARIANT for the operational observer**; **L3-interpretation for the phenomenal layer**). The mechanism that bears the weight is consciousness-free decoherence [9], and a claim to consciousness-as-cause stays outside the apparatus.

A direct comparison with Wong's advanced-observer model [1] clarifies the difference of architectures and is collected in Table 2.

Table 2: Comparison of Wong's advanced-observer model (AOM) [1] and ODTOE

AOM (Wong [1])	ODTOE	Consequence
A central server transmitting frames to observers	No central server; the self-observation fixed point $\Psi^* = \Phi(\Psi^*)$	Avoids a commitment to a simulation-like substrate
Frame rate as a temporal-resolution variable	Coherence and contraction parameters B, S, q	Replaces a refresh tempo with a stability metric
Reality levels R0/R1/R2	Object and meta level plus the observer dimensionality gradient	Keeps the falsifiable layer explicit
Perception / consciousness layer (R2)	Operational observer; phenomenal consciousness bracketed	Avoids consciousness as a primitive cause

The historical line of the movable cut between the quantum and the classical description includes an early formulation in which reduction was tied to a conscious act [24]. This line is held here as historical and minority, and the central apparatus does not lean on it. The position of the cut is movable, and decoherence shows that a conscious agent is superfluous for the appearance of stable records.

5 Reply C. Testability, B-metrology, and fitting-free predictors

The third objection declares observer-dependent physics untestable metaphysics. The ODTOE reply presents a full instrument-level protocol for measuring the parameter B, a discipline of falsifiability in the spirit of the requirement of empirical refutability [32], and a family of fitting-free numerical predictors.

The parameter B is operationally measurable. In the companion ODTOE corpus paper on the operational measurement of cognitive coherence, each component of (2) receives an instrument channel: focus of attention F — via the dorsal and default attention networks (DAN/DMN) through fMRI and EEG; emotional coherence E — via heart-rate variability RMSSD, the spectral ratio LF/HF, and the galvanic skin response GSR; consistency $(1-\sigma)$, where σ is the internal contradiction, — via the divergence of implicit associations IAT and Stroop interference; empirical reinforcement Λ — via Bayesian updating of the posterior over the observation log [33] (**PREDICTION**). The relative error of the integral indicator is the sum of the weighted relative errors of the components,

$$\frac{\delta B}{B} = w_1\frac{\delta F}{F} + w_2\frac{\delta E}{E} + w_3\frac{\delta(1-\sigma)}{1-\sigma} + w_4\frac{\delta\Lambda}{\Lambda}, \tag{10}$$

and a worked example with equal weights gives $B \approx 0.697$ with error $\delta B \approx 0.047$ [33]. Longitudinal monitoring yields an empirical estimate of the activation threshold $B_{\text{crit}} \approx 0.15$–$0.25$, and the inter-observer coherence (3) is estimated through the Hurst exponent $H(S) = (1+S)/2$ [33] (**PREDICTION**). The relation $H(S) = (1+S)/2$ is grounded in the companion ODTOE corpus paper on randomness and fractal stability as the $S = 0$ special case of fractional Brownian motion [34] (**L2-INVARIANT**). A published engineering protocol for the metrology of B complements the psychometric protocol from the side of technical systems [35, §2.4].

The central fitting-free result is the sign of the individual-doubt channel, read off the contraction modulus of the unified operator [15]. Differentiating the modulus (4) with respect to the anchor,

$$\frac{\partial q}{\partial B} = S - \sqrt{1-S^2}, \qquad \frac{\partial q}{\partial B} = 0 \text{ at } S = \frac{1}{\sqrt{2}} \approx 0.70710678118654752440. \tag{11}$$

The derivative vanishes exactly at $S = 1/\sqrt{2}$; a recomputation to fifty decimal places with mpmath [34] gives $S = 0.70710678118654752440084436210484903928483593768847$, and the value of the derivative at this point departs from zero only by $\sim 10^{-61}$, which is machine zero (**L2-INVARIANT**, derived and verified to fifty decimal places, with no fitting).

The sign of the derivative changes through this point. For $S > 1/\sqrt{2}$ the derivative is positive, and lowering B under rising doubt lowers q, strengthening the contraction; for $S < 1/\sqrt{2}$ the derivative is negative, and doubt weakens the contraction. The worked example at $S = 0.9$ reads the high-coherence case directly: as the anchor

falls from $B = 1.0$ to $B = 0.01$, the modulus drops monotonically from $q = 0.9$ to $q = 0.44053099541052668167$, so that one observer's doubt leaves the high-coherence Stone stable (see Table 3). This gives a falsifiable prediction: in a high-coherence cluster, rising individual doubt strengthens the stability of the joint configuration, and below the threshold $1/\sqrt{2}$ it weakens it (**PREDICTION**). The transition point stands at the dimensionless structural locus $1/\sqrt{2}$ and is extracted from no combination of fundamental constants.

Table 3: The modulus $q(B, 0.9)$ as one observer's anchor falls under rising doubt at $S = 0.9 > 1/\sqrt{2}$. All values are recomputed to fifty decimal places by mpmath; here rounded to eleven.

B	doubt level	$q(B, 0.9)$
1.00	none	0.90000000000
0.50	moderate	0.66794494718
0.10	high	0.48230090492
0.01	near-total	0.44053099541

The family of predictors reaches beyond the sign reversal. The corpus carries the dimensionless coherence ceiling $S_{\max} = 1 - (\pi - 3)^2 \approx 0.97995152045$, the critical-mass asymmetry $n_{\text{cr}}^{\text{anti}} = 2$ against $n_{\text{cr}}^{\text{coh}} = 5$ (dissolving a small consensus is roughly 2.5 times cheaper than building a new one), the deactivation kinetics $\tau_{\text{deact}} \sim 1/\sigma^2$, and the configuration-lifetime law $T = T_0/(1-S)^n$ [24, 26] (**PREDICTION**). These object-level predictions are numerical; only the meta-level is left without a numerical prediction, and this is the content of the two-level architecture (Section 7).

The family of fitting-free predictors already has an executed verification. The companion ODTOE corpus paper on experimental verification tests the relation $H(S) = (1 + S)/2$ on independent toroidal-plasma data (twenty regimes, nine machines, four confirmations of five) and reproduces the φ-scaling on two hundred and ten neutron resonances of actinides, where the Hoyle value $\eta = 6(\pi - 3)/\pi \approx 0.27042$ departs from the experiment by 0.04% [36] (plasma confirmation — **PREDICTION**, confirmed; the Hoyle value — **L2-INVARIANT**). A worked numerical falsifier is executed as well in the companion ODTOE corpus paper on temporal asymmetry: a discrete run at mpmath precision dps=60 returns a PASS verdict on twenty-two checks to fifty decimal places [37] (**L2-INVARIANT**). The discipline of honest reporting is kept: the prediction $\Delta S \approx 0.3$–0.5 at the base L→H transition is only partially confirmed, with measured values lying in the band 0.16–0.28 [36] (**PREDICTION**, partially confirmed).

Concession (ii): the weight coefficients w_i of the B-measurement protocol are not yet calibrated, and the protocol has not been run on empirical subjects; pending the run, the predictions about the doubt channel retain the status of testable claims with an open empirical check. A concrete falsification plan is already published: the corpus engineering paper carries the hypotheses H_1–H_4 with numerical TPR/FPR thresholds

and refutation conditions on a 12–24 month horizon [35, §3.10].

What would change our mind. The discipline of falsifiability requires naming concrete refuting outcomes (**PREDICTION level**). Our position would change if: (a) B-metrology by the protocol (10) showed no predicted correlation of the components F, E, $(1-\sigma)$, Λ with the instrument channels [33]; (b) a stable $S > 0.98$ were observed above the ceiling $S_{\max} = 1-(\pi-3)^2 \approx 0.97995$ [26]; (c) a frame-rate experiment supported Wong's advanced-observer model [1] over ODTOE; (d) an observer-independent description survived the pressure of relational quantum mechanics, quantum Bayesianism, and the no-go results [6, 8, 11]. Each of these outcomes would refute the corresponding core of the reply, and this vulnerability is a condition of the scientific status of the work.

6 Reply D. Causation, free will, and consciousness

The fourth objection asserts that observer-dependent physics undermines physical closure: either the observer acts on the world from above and breaks the causal order, or free will turns out to be an illusion and consciousness a superfluous wheel. The ODTOE reply maintains compatibility.

The origin of the observer is established as a bootstrap fixed point. The existence of a self-consistent configuration $\Psi^* = \Phi(\Psi^*)$ is proved unconditionally by Schauder's theorem (Theorem 5.1.T1 of the companion ODTOE corpus paper on the origin of the observer), and uniqueness by Banach's theorem under contraction (Theorem 5.1.T2) [14] (**L2-INVARIANT**). The bootstrap closes by the identity $\Psi^* = \Phi(\Psi^*) \iff \hat{O}^* = \hat{O}_{\Psi^*}$: a configuration that observes itself is a configuration whose observation operator is parametrized by itself [14]. The dependency chain axioms $\to \hat{O} \to \Phi \to \Psi^*$ is linear and acyclic. The companion ODTOE corpus paper on the birth of the observer carries this bootstrap through a five-step audit: the symmetric state Ψ_{symm}, a spontaneous fluctuation ξ, the KAM selection of the φ-resonance with rotation number $\omega^* = \varphi^{-1}$, the Schauder closure $\Psi^* = \Phi(\Psi^*)$, and the birth of the pair $(\tau_0, \mathbb{R}^3, \pi_{\text{past}}/\pi_{\text{future}})$ [29] (**L2-INVARIANT**). The order of the chain is set by data-dependency and is non-temporal: it precedes the emergence of the time-step τ_0 itself, while Ψ^* is the output of the theorem at the last step, the definition of the operator precedes it, and the operator itself is emergent from spontaneous symmetry breaking [17] (**L2-INVARIANT**). The epistemological boundary on the origin of the first fluctuation ξ is stated openly: the cause of ξ is placed outside the formalism with three indistinguishable positions, and this residual is held honestly (**HYPOTHESIS**). The causal order thereby co-originates with the observer: the time-step τ_0, the quaternion orientation $q_{\hat{O}}$, the minimal dimension $d_{\min} = 3$, and the projector pair $\pi_{\text{past}}/\pi_{\text{future}}$ emerge simultaneously as derived attributes of O_{Ψ^*}, so that there is no pre-existing causal order for the observer to break, and the causal-temporal order itself is an output of the bootstrap [29] (**L2-INVARIANT**). This construction

gives quantitative form to Wheeler's self-excited circuit and to the Hawking–Hertog top-down cosmology: the theory and the observer generate each other [38, 39] (**L3-interpretation**).

Causation is preserved, and the apparatus carries no retrocausality. Inside the configuration space $\mathcal{C}$ no violation of the causal order arises: one act of Φ advances the state by at most one elementary step r_0, while non-local correlations belong to the potential layer $\mathcal{H}$, where distance is undefined, and so are not superluminal motion in $\mathcal{C}$ [40] (**L2-INVARIANT**). The past does not decohere: Theorem V*(i) of the companion ODTOE corpus paper on temporal asymmetry gives a strong unconditional preservation of the norm of the past component $\|\Phi^n(\pi_{\text{past}}\Psi)\| \geq \|\pi_{\text{past}}\Psi\|$ for all n, verified to fifty decimal places [37] (**L2-INVARIANT**).[1] The meaning metric in the companion ODTOE corpus paper on the frequency of the soul unfolds forward in time over interpretation and does not change past events [41] (**L2-INVARIANT**).

Free will is reconciled with the physical description in the spirit of compatibilism: an agent is free in the sense that its actions are functions of its own state and history, embedded in the physical order and compatible with it [42]. The belief anchor B is exactly such an internal variable of the agent: focus of attention, emotional coherence, consistency, and empirical reinforcement form a state through which the observer participates in shaping the joint fixed point. Freedom here is the sensitivity of the joint configuration to the internal state of the agent, and this sensitivity is compatible with physical closure (**L3-interpretation**). The corpus teleological conjecture ST.T2 sharpens this sensitivity as restricted to the future branch: the selection of the world-line W_{actual} through the goal attractor A_{goal} acts strictly on π_{future} with the past inviolable by construction, so that freedom is the sensitivity of the joint fixed point to the agent's internal B-state on the future branch with the past fixed [29] (**HYPOTHESIS**, conjectural). The corpus formalization sharpens the compatibilism: freedom is the recursion of self-observation $\hat{O}(\hat{O}) = \hat{O}'$, generating a new direction of attention A' that arises from the act of self-observation and constitutes a third type of causation; the companion ODTOE corpus paper on the evolution of the observer reconciles this with the determinism of neurophysiology, holding a real and non-illusory recursion with correlates in the prefrontal cortex and a measurable shift ΔB, while the companion ODTOE corpus papers on love and eternity and on the corpus supplements give $(B, A, H) \to$ a probability distribution with freedom in the choice of the direction A through $\hat{O}(\hat{O}) = \hat{O}'$ [30, 43, 44] (**L3-interpretation**).

The influence of the observer on the configuration admits a reading through downward causation: the collective coherence state S constrains the stability and dy-

[1] The single bounded exception is the Wheeler delayed-choice conjecture in the companion ODTOE corpus paper on the birth of the observer. At the level of mechanism the delayed choice modifies only the parametric form of the projector $\pi_{\text{past}}(\tau_{\text{obs}})$ as an operator, holding the norm $\|\pi_{\text{past}}\Psi\|$ invariant by the inviolability of Theorem V*(i), and acts exclusively through the future component in the classical register; the hard gate sets the goal action $A_{\text{goal}} \cdot \Psi := A_{\text{goal}} \cdot \pi_{\text{future}}\Psi$, so that the selection touches only $\pi_{\text{future}}\Psi$ and the fixed past remains invariant [29] (**HYPOTHESIS**, conjectural, π_{past}-inviolable).

namics of the configuration in which the individual observers reside. This position is contested by the causal-exclusion argument, by which every action ascribed to the upper level is already exhausted by the action of the lower level. Downward causation is held here as a defensible live position with the status of a hypothesis (**HYPOTHESIS**). The concrete carrier of this causation is given by the corpus: the collective coherence S is realized as the coalition coupling κ_{ij} and the influence of an egregore A_{meta} on the direction of the participants' attention, with the companion ODTOE corpus paper on the absolute observer proving the differential no-coercion theorem $\partial B_i/\partial t \geq 0$ as the condition for agreement without coercion, and the companion ODTOE corpus paper on the corpus supplements naming this influence a third type of causation [44, 45, 46] (**HYPOTHESIS**). Compatibility with physical closure is secured by the fact that collective coherence is realized in the physical states of the observers and their environments, with no separate causal power above the substrate.

The role of consciousness is held cautiously. The mechanism that bears the weight is consciousness-free decoherence [9]; consciousness enters the description through the cognitive coherence of the anchor B, measurable psychometrically. Operational consciousness receives a structural reading as the quaternionic orientation of the observer relative to $\mathcal{H}$: the companion ODTOE corpus paper on the quaternionic structure of consciousness links the loss of a degree of freedom (gimbal lock) with the zeroing of one component of B (the weak-link property) and thereby explains why there are exactly four components [28] (**L3-interpretation**). The reflexivity gate $\hat{O}(\hat{O})$ separates phenomenally conscious observers with cortical metacognition from mere observers; the companion ODTOE corpus paper on the hierarchy of consciousness carries this as hypothesis H-1 "$\Psi^* \leftrightarrow$ phenomenal experience", which does not follow from simpler premises and shares the hard problem with other structural theories [46] (**L3-interpretation**). Phenomenal consciousness is bracketed: the apparatus operates with operational coherence, the hyletic layer is named only as an L3 candidate substrate of qualia, and a claim to a separate causal power beyond the physical state of the agent is not advanced here (**L3-interpretation**).

7 Reply E. The observability ceiling as a structural feature

The fifth objection, stated most distinctly in the online preprint on the limits of observability [2], holds that every theory of everything runs into an observability ceiling, and an observer-dependent frame merely makes this ceiling insurmountable. The ODTOE reply sets the ceiling as a structural feature by design.

The base corpus paper carries a two-level architecture that separates the falsifiable and non-falsifiable components [19]. The meta-level — the originating axiom of distinction together with the self-referential strange loop in the sense of Hofstadter [47, 48] — is non-falsifiable as a whole by design; the object-level — postulates

P1–P6, definitions, and claims 1–4 — is falsifiable individually [19] (**L2-INVARIANT**). This architecture receives an extended reading in the companion ODTOE corpus paper on the strange loop and the fixed point for the philosophy of science [49] and an operator-side grounding in the companion ODTOE corpus paper on the unified operator, where the spiral gap $(\pi - 3)^2$ blocks the dogmatic closure $B \to 1$ and thereby expresses Gödelian incompleteness in ODTOE terms [15] (**L2-INVARIANT**). The two-level structure of self-reference in cosmology was established by Ben-Ya'acov [50], and ODTOE reproduces this pattern formally. This non-falsifiability of the meta-level is distinct from Gödel incompleteness: the limitation lies in the theory's membership in the described set, whereas the Gödelian construction works on the self-reference of statements; the incompleteness theorems concern formal systems containing arithmetic, while the meta-level of ODTOE contains its own description as an element of the described set of theories $T_{\text{ODTOE}} \in \mathbb{T}$ and generates no contradiction; a complete theory of everything in the absolute sense is thereby conceptually unreachable within any frame that includes the observer [19].[2] The closure of the strange loop on a realized Ψ^* inherits the conditionality of Concession (i) (the D-Contract postulate) and is carried with the status of a hypothesis [26] (**HYPOTHESIS**); the two-level architecture and the Gödelian distinction themselves are structural invariants. The observability ceiling is thereby encoded as a structural feature.

The observability ceiling is a constitutive property of the relational description. Kochen–Specker contextuality forbids context-independent values of observables and thereby establishes a principled limit of simultaneous definiteness [10]. The relativity of a fact to an observer, formally unavoidable by Frauchiger–Renner [11] and observed in an extended Wigner's-friend scheme [12], means that a complete observer-independent description is in principle unreachable. The corpus dimensionless ceiling $S_{\text{max}} = 1 - (\pi - 3)^2 \approx 0.97995152045$ sets an upper bound on the corrected collective coherence [26] (**PREDICTION**). ODTOE accepts this limit and turns it into a productive form: the knowable is an intersubjective fixed point, and the observability ceiling outlines its boundary. The formula for the number of theories describes the actual state as a constitutive quantity, while the limit $S \to 1$ sets the regulative horizon, and this quantitatively formalizes the Kantian distinction between the constitutive and the regulative [5] (**L3-interpretation**). The operational meaning of concepts is held through their link to measurement protocols, in the spirit of a cautious operational discipline [52].

[2] This membership-self-reference is distinct from properly metamathematical Gödelian independence of the form ZFC⊬RH, surveyed in the companion ODTOE corpus paper on the Riemann hypothesis [51]; the latter is invoked only as a contrast class (**L3-interpretation**).

8 The established corpus apparatus

The replies of Sections 3–7 rest on established corpus results of ODTOE. A summary of the results that bear the weight follows.

(a) Existence and uniqueness of the fixed point. The self-observation fixed point $\Psi^* = \Phi(\Psi^*)$ exists unconditionally (Schauder, Theorem 5.1.T1) and is unique under contraction (Banach, Theorem 5.1.T2), with the explicit modulus (4) and its value at the KAM-selected golden point (5) [14].

(b) Operator algebra. The observation operator (7), the immersion operator (8), the composition Φ, contractivity, the spectrum (9), and the quantum-mechanical limit are specified explicitly [16].

(c) Metrology of B. A full instrument-level protocol for measuring B with the DAN/DMN, RMSSD/LF-HF/GSR, IAT/Stroop, and Bayesian Λ channels, the error budget (10), the worked $B \approx 0.697$, the threshold $B_{\text{crit}} \approx 0.15$–$0.25$, and the estimate of S through the Hurst exponent [33], complemented by a published engineering metrology protocol (see §5).

(d) Coherence-truth. Adaptive truth with the regulative limit $S \to 1$, the signature of an ideal error (6), and phantom coherence $S_{\text{phantom}} > S_{\text{true}}$ [24], with an epistemic ground in the Fitness-Beats-Truth theorem and the interface theory of perception [21, 22].

(e) The de-mystified observer. The physical vector $O = (B, A, H)$ on the dimensionality gradient quark $\to$ atom $\to$ cell $\to$ human $\to$ AI; any system of reading, writing, and verification [30].

(f) Numerical falsifiers. The sign reversal (11) at $1/\sqrt{2}$, the ceiling $S_{\text{max}} = 1 - (\pi - 3)^2$, the asymmetry $n_{\text{cr}}^{\text{anti}} = 2$ against $n_{\text{cr}}^{\text{coh}} = 5$, the kinetics $\tau_{\text{deact}} \sim 1/\sigma^2$, and the lifetime law $T = T_0/(1 - S)^n$ [24, 26].

9 Epistemic stratification of the claims

The strength of a reply article lies in every one of its claims carrying an explicit epistemic status. Table 4 brings the key claims together by level and indicates for each a falsifier or a status. Invariants are derived and verified, predictions are operationalizable, hypotheses are open, and interpretations are stated as a philosophical reading, valuable for coherence and open to revision. The labels L2-INVARIANT, PREDICTION, and HYPOTHESIS correspond to the three-level scale L1/L2/L3 of the companion ODTOE corpus paper on randomness and fractal stability — a mathematical fact, a physical hypothesis, and a worldview interpretation [34].

Table 4: Epistemic stratification of the claims

Claim	Level	Falsifier / status
Existence of Ψ^* unconditional (Schauder), uniqueness at $q < 1$ (Banach)	**L2-INVARIANT**	A counterexample with $q < 1$ and non-uniqueness
Sign reversal $\partial q/\partial B = S - \sqrt{1-S^2} = 0$ at $S = 1/\sqrt{2}$	**L2-INVARIANT**	Recomputation to 50 places; a different root value
Spectrum $\lambda_1 = \varphi^{-1}e^{i\theta}$ and the QM limit of Φ	**L2-INVARIANT**	A different dominant mode at $B, S \to 1$
Ceiling $S_{\text{max}} = 1 - (\pi - 3)^2 \approx 0.97995$	**PREDICTION**	A stable $S > 0.98$ or a different ceiling
B measurable by the DAN/DMN, RMSSD, IAT, Bayesian protocol	**PREDICTION**	Absence of correlation of components with channels
Asymmetry $n_{\text{cr}}^{\text{anti}} = 2$ against $n_{\text{cr}}^{\text{coh}} = 5$	**PREDICTION**	Equal or reversed critical masses
Downward causation of collective coherence	**HYPOTHESIS**	The causal-exclusion argument
No retrocausality: $\pi_{\text{past}}\Psi$ inviolable (Theorem V*(i))	**L2-INVARIANT**	A counterexample with decreasing $\|\pi_{\text{past}}\Psi\|$
Objectivity as the coherent limit of relational agreement	**L3-interpretation**	A philosophical reading, open to revision
Free will as compatibilist sensitivity to the anchor B	**L3-interpretation**	A philosophical reading, open to revision
Free will as the recursion $\hat{O}(\hat{O}) = \hat{O}'$ (third type of causation)	**L3-interpretation**	A philosophical reading, open to revision

10 The narrow residual

The established apparatus gives a conditional reply to the five objection classes. A narrow and specific residual remains open, stated here openly.

Concession (i). The existence of the fixed point is unconditional (Schauder). For the explicit operator family $(\hat{O}_B, \iota_S)$ the contraction modulus $q(B,S) = B\,S + (1-B)\sqrt{1-S^2}$ keeps $q < 1$ for every physical observer ($B \in (0,1)$, $0 < S \leq S_{\text{max}}$), recomputed to fifty decimal places; the equality $q = 1$ is reached only on the two idealized corners $(0,0)$ and $(1,1)$, both non-physical (the corner $(1,1)$ requires $S = 1$ beyond the ceiling $S_{\text{max}} \approx 0.97995$, and the corner $(0,0)$ requires the noiseless limit $B = 0$), so that the D-Contract postulate and Banach uniqueness hold automatically throughout the physically admissible region [15, §IV.4]. R4 remains open in two narrow senses. First,

the lift from this parametric ansatz to the general Schauder operator under requirements R1–R3 is not derived: there the kernel and the noise term are bounded in norm $\|\eta_B(\Psi)\| \leq \|\Psi\|$, a Lipschitz constant does not follow from this, and the step from the contraction of the ansatz to the contraction of the physical Φ remains unproven [14, 16]. Second, the KAM-selected golden point $(\varphi^{-1}, \varphi^{-1})$ lives only on the curve $B = S$, which is not derivable from the axioms: the paired corpus paper on the primordial distinction carries this constraint explicitly as underived and selects the rotation number $\omega^* = \varphi^{-1}$, coinciding with the locus $(\varphi^{-1}, \varphi^{-1})$ by a numerical coincidence, with the true diagonal minimiser $v^* \approx 0.56229$ lying nearby and the value of the modulus at the golden point itself being $q(\varphi^{-1}, \varphi^{-1}) \approx 0.68224912$; the isomorphism between the KAM selection of the rotation number and the constraint of the (B, S) curve remains an open subtask [17].

Concession (ii). The weight coefficients w_i of the B-measurement protocol are not calibrated, and the protocol has not been run on empirical subjects; a run with a 12–24 month horizon and hypotheses H_1–H_4 remains upcoming work [33].

Concession (iii). The technical bridge to structural realism is asserted and not yet formalized: the correspondence between preserved relations and the invariants of the coherent limit is set out as a programme [4]. The corpus-internal candidate for what is preserved across a change of description is the cluster-intersection $\mathcal{O}_n = \bigcap_{i=1}^{n} \mathcal{C}_i$ in the limit $S \to 1$ from the companion ODTOE corpus paper on the collective observer; the formalization of this invariant and the proof of a partial isomorphism carrying it across a change of observer-cluster remain an open programme [18].

Concession (iv). A set of subtasks is open: the multiplicity of the set $\mathrm{Fix}(\Phi)$, the physical identification of Ψ^*, stability under perturbations (subtasks 5.4–5.6), and the construction of the immersion operator ι for specific classes of $\hat{O}$ [14]. The physical identification of Ψ^* (subtask 5.5) is the most advanced item: the decomposition $\Psi^* = \Psi_{\text{symm}} + \delta\Psi_{\varphi}$ through spontaneous symmetry breaking and KAM selection is established structurally [17] and composed in Theorem ST.T1 [29]; the derivation of the Ψ-Lagrangian from the axiomatics remains open. The multiplicity (5.4), with the spectral-jump criterion for $\mathrm{Fix}(\Phi)$ from finite cardinality to a continuum, and the stability under perturbations (5.6) remain open.

Concession (v). Phenomenal consciousness is bracketed from the load-bearing apparatus, which by construction operates with operational coherence. The corpus does carry L3 exploratory proposals: the hypothesis H-1 "$\Psi^* \leftrightarrow$ phenomenal experience", gated by the reflexive fold $\hat{O}(\hat{O})$ [46], and a quaternion-orientation framing of the form of experience [28]; these proposals are interpretive and bear no weight in the apparatus. The explanatory why-gap — why a stable Ψ^* is accompanied by experience — stays open, and the corpus shares the hard problem with other structural theories. The same residual includes the irreducible epistemological boundary on the origin of the primordial fluctuation ξ, openly stated in the companion ODTOE corpus paper on the primordial distinction [17].

11 Conclusion

The five objection classes have received a conditional reply from the established corpus apparatus, with explicitly named residuals. Idealism and hidden consciousness are closed at the level of the explicit operator family; testability and the observability ceiling are developed as operational programs with stated residuals. Objectivity is reconstructed as an intersubjective fixed point (1) with proven existence and uniqueness [14]. The observer mechanism is given by an explicit operator algebra (7)–(9) with a consciousness-free floor of decoherence [16, 9]. Testability is secured by an instrument-level protocol for measuring B [33] and a family of fitting-free predictors led by the sign reversal (11) at $S = 1/\sqrt{2}$, recomputed to fifty decimal places. Causation is reconciled with compatibilism, and the observability ceiling is set by a two-level architecture by design [19].

A narrow residual remains open: the conditionality of the contraction estimate R4 under unconditional existence; the uncalibrated and unrun status of the B protocol; the not-yet-formalized bridge to structural realism; the open subtasks on the multiplicity and stability of Ψ^*; and the bracketed phenomenal consciousness. This honesty is a condition of the scientific status of observer-dependent realism, and every claim of the work is assigned to its epistemic level (Table 4). The link with the peer-reviewed advanced-observer model [1] and with the objections [2, 3] remains substantive: the established coherence apparatus answers their challenges within a unified quantitative frame, leaning on the operator reading of the collective observer [20].

The present work develops the Observer-Dependent Theory of Everything: all mathematics, physics, and the phenomenology of consciousness are projections of a single primordial act of distinction.

CONFLICT OF INTEREST

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References

[1] Wong J. H. C. Quantum Realities and Observer-Dependent Universes: An Advanced Observer Model // Journal of Quantum Information Science. 2024. Vol. 14, no. 3. P. 69–121. DOI: 10.4236/jqis.2024.143006.

[2] The Cosmic Invariant: Limitations of Observability and the Challenges to a Theory of Everything [Electronic resource] // ResearchGate: online repository, publication 379866165. URL: https://www.researchgate.net/publication/379866165 (accessed: 2026-06-29). (Online source with no indexed DOI; at the time of the audit the full text was not retrievable through the direct link — drawn upon as a conceptual statement of the observability-ceiling objection.)

[3] Chatterjee A. Observer-Dependent Physics: Engineering Physical Systems Based on Consciousness [Electronic resource] // Diverse Daily: popular online article (non-peer-reviewed). 14 August 2025. URL: https://diversedaily.com/observer-dependent-physics-engineering-physical-systems-based-on-consciousness/ (accessed: 2026-06-29).

[4] Worrall J. Structural Realism: The Best of Both Worlds? // Dialectica. 1989. Vol. 43, no. 1–2. P. 99–124. DOI: 10.1111/j.1746-8361.1989.tb00933.x.

[5] Kant I. Kritik der reinen Vernunft. 2. Aufl. Riga: Hartknoch, 1787. (Critique of Pure Reason; the regulative ideal of reason.)

[6] Rovelli C. Relational Quantum Mechanics // International Journal of Theoretical Physics. 1996. Vol. 35, no. 8. P. 1637–1678. DOI: 10.1007/BF02302261. arXiv:quant-ph/9609002.

[7] Adlam E., Rovelli C. Information is Physical: Cross-Perspective Links in Relational Quantum Mechanics // Philosophy of Physics. 2023. Vol. 1, no. 1. Art. 4. DOI: 10.31389/pop.8. arXiv:2203.13342.

[8] Fuchs C. A., Mermin N. D., Schack R. An Introduction to QBism with an Application to the Locality of Quantum Mechanics // American Journal of Physics. 2014. Vol. 82, no. 8. P. 749–754. DOI: 10.1119/1.4874855.

[9] Zurek W. H. Decoherence, Einselection, and the Quantum Origins of the Classical // Reviews of Modern Physics. 2003. Vol. 75, no. 3. P. 715–775. DOI: 10.1103/RevModPhys.75.715.

[10] Kochen S., Specker E. P. The Problem of Hidden Variables in Quantum Mechanics // Journal of Mathematics and Mechanics. 1967. Vol. 17. P. 59–87. DOI: 10.1512/iumj.1968.17.17004.

[11] Frauchiger D., Renner R. Quantum Theory Cannot Consistently Describe the Use of Itself // Nature Communications. 2018. Vol. 9. Art. 3711. DOI: 10.1038/s41467-018-05739-8.

[12] Proietti M., Pickston A., Graffitti F., Barrow P., Kundys D., Branciard C., Ringbauer M., Fedrizzi A. Experimental Test of Local Observer Independence // Science Advances. 2019. Vol. 5, no. 9. Art. eaaw9832. DOI: 10.1126/sciadv.aaw9832.

[13] Da Costa L., Friston K., Heins C., Pavliotis G. A. Bayesian Mechanics for Stationary Processes // Proceedings of the Royal Society A. 2021. Vol. 477. Art. 20210518. DOI: 10.1098/rspa.2021.0518.

[14] Pankratov A. S. The Origin of the Observer in ODTOE: Existence Theorems for the Self-Observation Fixed Point $\Psi^* = \Phi(\Psi^*)$. Working preprint of the ODTOE corpus, 2026. [Load-bearing: Theorem 5.1.T1 (Schauder, existence), Theorem 5.1.T2 (Banach, uniqueness), $q^{(B=S)}|_{\varphi^{-1}} = \varphi^{-2}(1 + \sqrt{1-\varphi^{-2}})$, postulate D-Contract, subtasks 5.4–5.6.]

[15] Pankratov A. S. The Unified Operator of ODTOE: The Composition $\Phi = \iota \circ \hat{O}$ as a Strange Loop and the Spiral Gap $(\pi - 3)^2$. Working preprint of the ODTOE corpus, 2026. [Load-bearing: $\Phi = \iota \circ \hat{O}$ as a Banach fixed point; dogmatic closure $B \to 1$ blocked by the gap $(\pi - 3)^2$ — Gödelian incompleteness in ODTOE terms.]

[16] Pankratov A. S. The Specification of the Operators $\hat{O}$ and ι in ODTOE: Contractivity, Spectral Analysis, and Reduction to Quantum Mechanics. Working preprint of the ODTOE corpus, 2026. [Load-bearing: $\hat{O}_B(\Psi) = B\,P_A(\Psi) + (1-B)\eta_B(\Psi)$; ι_S; spectrum $\lambda_1 = \varphi^{-1}e^{i\theta}$; QM limit.]

[17] Pankratov A. S. The Primordial Distinction in ODTOE: Spontaneous Symmetry Breaking and KAM Selection of the φ-Resonance as the Mechanism of the Emergence of the Observation Operator. Working preprint of the ODTOE corpus, 2026. [Load-bearing: $V(\Psi) = -\mu^2|\Psi|^2 + \lambda|\Psi|^4$; the operator $\hat{O}_{\Psi^*}$ is emergent; the boundary on the origin of the fluctuation ξ.]

[18] Pankratov A. S. The Collective Observer in ODTOE: The Collective Observation Operator, the Region of Configuration Overlap, and the Intersubjective Fixed Point. Working preprint of the ODTOE corpus, 2026. [Load-bearing: $\mathcal{O}_n = \bigcap_{i=1}^{n} \mathcal{C}_i$, non-empty at $S > S_{\text{threshold}}$; intersection and individual remainder; “here and now” as the region of maximal overlap.]

[19] Pankratov A. S. The Observer-Dependent Theory of Everything (ODTOE): The Observation Operator, the Belief Anchor, Collective Coherence, and the Two-Level Architecture. Base working preprint of the ODTOE corpus, 2026. [Load-bearing: the axiom (A); postulates P1–P6; claims 1–4; the two-level meta/object architecture.]

[20] Pankratov A. S. The Collective Observer and the Culture of Humanity: An Operator Reading of Solidarity, the Family, and the State // Bulletin of the Council of Young Scientists and Specialists in Social and Agrarian Sciences. 2026. No. 61. Art. 1698. URL: https://vsoa.esrae.ru/ru/236-r1698 (accessed: 2026-06-15).

[21] Prakash C., Stephens K. D., Hoffman D. D., Singh M., Fields C. Fitness Beats Truth in the Evolution of Perception // Acta Biotheoretica. 2021. Vol. 69, no. 3. P. 319–341. DOI: 10.1007/s10441-020-09400-0.

[22] Hoffman D. D., Singh M., Prakash C. The Interface Theory of Perception // Psychonomic Bulletin & Review. 2015. Vol. 22, no. 6. P. 1480–1506. DOI: 10.3758/s13423-015-0890-8.

[23] Nagel T. The View From Nowhere. New York: Oxford University Press, 1986. 244 p.

[24] Pankratov A. S. The Optimal Control of Coherent Media: A Single Control Parameter, the Counter-Gradient, and the Signature of an Ideal Error δ_{ideal}; the Reducibility of Honesty and Phantom Coherence. Working preprint of the ODTOE corpus, 2026. [Load-bearing: $\delta_{\text{ideal}} = \Psi^*_{\text{coherent}} - \Psi_{\text{factual}}$; $S_{\text{phantom}} > S_{\text{true}}$; $T = T_0/(1-S)^n$; deactivation kinetics $\tau_{\text{deact}} \sim 1/\sigma^2$.]

[25] Pankratov A. S. Honesty in ODTOE: The Reducibility Theorem of Honesty to Consistency and Phantom Coherence as the Signature of Dishonesty. Working preprint of the ODTOE corpus, 2026. [Load-bearing: honesty $= (1-\sigma)$; the signature $S_{\text{phantom}} > S_{\text{true}}$; premature collapse at $T \ll T_0$.]

[26] Pankratov A. S. Doubt and the Transition Between Realities: The Destructive Mirror, the Critical Mass, and the Irremovable Coherence Ceiling $S_{\text{max}} = 1 - (\pi - 3)^2$. Working preprint of the ODTOE corpus, 2026. [Load-bearing: $S_{\text{max}} = 0.97995$; the asymmetry $n_{\text{cr}}^{\text{anti}} = 2$ against $n_{\text{cr}}^{\text{coh}} = 5$; $\tau_{\text{deact}} \sim 1/\sigma^2$.]

[27] Pankratov A. S. The Coherence of Multi-Agent Systems in ODTOE: A Phantom-Coherence Detector and Language as an Observation Operator. Working preprint of the ODTOE corpus, 2026. [Load-bearing: $S_{\text{adjusted}} = S_{\text{team}} \times \bar{B}$; empirical data $S_{\text{team}} = 0.970$ at $S_{\text{adjusted}} = 0.335$; thresholds $0.5/0.7$ as a constructive choice.]

[28] Pankratov A. S. The Quaternionic Structure of Consciousness in ODTOE: The Orientation of the Observer, Gimbal Lock, and the Four-Componentness of Coherence. Working preprint of the ODTOE corpus, 2026. [Load-bearing: $q_{\hat{O}} = \Lambda + F\mathbf{i} + E\mathbf{j} + (1-\sigma)\mathbf{k}$, $|q_{\hat{O}}|^2 = B^2$; observation as the rotation $R = q_{\hat{O}} \cdot \Psi \cdot \overline{q_{\hat{O}}}$; gimbal lock as the weak-link property.]

[29] Pankratov A. S. The Birth of the Observer and the Genesis of Spacetime in ODTOE: The Minimal Dimension $d = 3$ for $\hat{O}(\hat{O})$ and the Bounded Delayed-Choice Conjecture. Working preprint of the ODTOE corpus, 2026. [Load-bearing: minimal $d = 3$ for self-observation; the π_{past} gate; the Wheeler delayed-choice conjecture acts only on $\pi_{\text{future}}\Psi$.]

[30] Pankratov A. S. The Evolution of the Observer in ODTOE: Anthropocentrism, the Dimensionality of the Operator, and the Gradient quark → atom → cell → human. Working preprint of the ODTOE corpus, 2026. [Load-bearing: the vector $O = (B, A, H)$; the dimensionality d; the materialist observer; freedom as the recursion $\hat{O}(\hat{O}) = \hat{O}'$.]

[31] Pankratov A. S. The Coherent Detector in ODTOE: The Structural Identity of Observation Operators and the Observer as a Physical Resonator. Working preprint of the ODTOE corpus, 2026. [Load-bearing: $\hat{O}_\alpha \cong \hat{O}_\beta$; two resonators as sections of one $\Psi^* \in \mathcal{H}$; the operator window $\Delta n \propto B^k/(D_0(1-S))$.]

[32] Popper K. R. The Logic of Scientific Discovery. London: Hutchinson, 1959. 480 p.

[33] Pankratov A. S. The Operational Measurement of the Cognitive Coherence Parameter B in the Observer-Dependent Theory of Everything. Working preprint of the ODTOE corpus, 2026. [Load-bearing: the instrument protocol for F, E, σ, Λ; the error budget $\delta B/B$; the worked $B \approx 0.697$; $B_{\text{crit}} \approx 0.15$–$0.25$; the estimate of S through the Hurst exponent.]

[34] Pankratov A. S. Randomness and Fractal Stability in ODTOE: The L1/L2/L3 Demarcation and $H(S) = (1+S)/2$ as the $S = 0$ Special Case of Fractional Brownian Motion. Working preprint of the ODTOE corpus, 2026. [Load-bearing: $H(S) = (1+S)/2$ at $S = 0$ as fBm; φ^{-1}, $(\pi-3)^2$ to 50 places; the L1/L2/L3 scale.]

[35] Pankratov A. S. ODTOE as an Engineering Framework for the Coherence of Technical Systems: The Operator Formalism, the Metrology of the B-Parameter, and Applications in Cyber-Physical, Multi-Agent, and AI Systems // Universum: Technical Sciences. 2026. No. 6(147). P. 70–73. URL: https://7universum.com/ru/tech/archive/item/22875 (accessed: 2026-06-10).

[36] Pankratov A. S. The Experimental Verification of ODTOE: φ-Scaling of Actinide Neutron Resonances and the Hurst Exponent $H(S) = (1+S)/2$ in Toroidal-Plasma Turbulence. Working preprint of the ODTOE corpus, 2026. [Load-bearing: 210 resonances, 4 actinides; $\eta = 6(\pi-3)/\pi \approx 0.27042$, deviation 0.04%; plasma 4/5; ΔS partial.]

[37] Pankratov A. S. Temporal Asymmetry in ODTOE: Theorem V* on the Preservation of the Past Component and a Numerical Falsifier to Fifty Decimal Places. Working preprint of the ODTOE corpus, 2026. [Load-bearing: Theorem V*(i) $\|\Phi^n(\pi_{\text{past}}\Psi)\| \geq \|\pi_{\text{past}}\Psi\|$; $\pi_{\text{past}} \circ \pi_{\text{future}} = 0$; an mpmath run at dps=60, 22 checks PASS.]

[38] Wheeler J. A. Information, Physics, Quantum: The Search for Links // Complexity, Entropy and the Physics of Information / ed. by W. H. Zurek. Redwood City: Addison-Wesley, 1990. P. 3–28. (SFI Studies in the Sciences of Complexity, Vol. VIII). ISBN 978-0-201-51509-1.

[39] Hawking S. W., Hertog T. Populating the Landscape: A Top-Down Approach // Physical Review D. 2006. Vol. 73. Art. 123527. DOI: 10.1103/PhysRevD.73.123527.

[40] Pankratov A. S. Gravity and Causal Structure in ODTOE: Reachability, the Light Cone, and Configuration Inertia. Working preprint of the ODTOE corpus, 2026.

[Load-bearing: one act of Φ advances by at most one step r_0; non-local correlations in the layer $\mathcal{H}$ where distance is undefined; the local limit $c = r_0/\tau_0$ is not exceeded in $\mathcal{C}$.]

[41] Pankratov A. S. The Frequency of the Soul in ODTOE: A Tunable Fixed Point of Self-Observation and a Meaning Metric Without Retrocausality. Working preprint of the ODTOE corpus, 2026. [Load-bearing: $\Psi^* = \Phi_{\rho^*}(\Psi^*)$; the meaning metric M unfolds forward in time and does not change past events.]

[42] Ismael J. T. How Physics Makes Us Free. New York: Oxford University Press, 2016. DOI: 10.1093/acprof:oso/9780190269449.001.0001.

[43] Pankratov A. S. God, Love, and Eternity in ODTOE: Free Will as a Third Type of Causation and the Choice of the Direction of Attention. Working preprint of the ODTOE corpus, 2026. [Load-bearing: $(B, A, H) \to$ a probability distribution; freedom in the choice of the direction A through $\hat{O}(\hat{O}) = \hat{O}'$.]

[44] Pankratov A. S. ODTOE Corpus Supplements: The Egregore, Downward Influence on the Direction of Attention, and a Third Type of Causation. Working preprint of the ODTOE corpus, 2026. [Load-bearing: the influence of an egregore A_{meta} on A as a third type of causation; $\hat{O}(\hat{O})$ retained, freedom suppressible.]

[45] Pankratov A. S. The Absolute Observer in ODTOE: Ω_{obs} as a Regulative Limit and the Differential No-Coercion Theorem. Working preprint of the ODTOE corpus, 2026. [Load-bearing: $\Omega_{\text{obs}} = \lim_{S\to 1, n\to\infty} \Psi^*_{\text{coll}}$ as an L2-invariant; coercion-free agreement $\partial B_i/\partial t \geq 0$ at $\kappa_{ij} > \kappa_{\text{threshold}}$.]

[46] Pankratov A. S. The Hierarchy of Consciousness in ODTOE: Operational and Phenomenal Consciousness, the Reflexivity Gate $\hat{O}(\hat{O})$, and the Hyletic Layer. Working preprint of the ODTOE corpus, 2026. [Load-bearing: hypothesis H-1 "$\Psi^* \leftrightarrow$ phenomenal experience" (L3); the reflexivity gate $\hat{O}(\hat{O})$; the hyletic layer as a candidate substrate of qualia.]

[47] Hofstadter D. R. Gödel, Escher, Bach: An Eternal Golden Braid. New York: Basic Books, 1979. 777 p. ISBN 978-0-465-02656-2.

[48] Hofstadter D. R. I Am a Strange Loop. New York: Basic Books, 2007. 412 p. ISBN 978-0-465-03078-1.

[49] Pankratov A. S. The Self-Referential Structure of ODTOE: The Strange Loop, the Fixed Point, and the Two-Level Architecture of Falsifiability. Working preprint of the ODTOE corpus, 2026. [Load-bearing: the two-level meta/object table; the Gödelian distinction through the membership $T_{\text{ODTOE}} \in \mathbb{T}$; $S = 1$ as a regulative ideal under a constitutive theory-count formula.]

[50] Ben-Ya'acov U. Gödel's Incompleteness Theorem and Universal Physical Theories // Journal of Physics: Conference Series. 2019. Vol. 1391. Art. 012067. DOI: 10.1088/1742-6596/1391/1/012067. (Extended version: arXiv:1906.02724v3, 2021.)

[51] Pankratov A. S. A Meta-Survey of the Riemann Hypothesis in ODTOE: Algorithmic Undecidability, Axiomatic Independence ZFC⊬RH, and Bayesian Certificates. Working preprint of the ODTOE corpus, 2026. [Load-bearing: a contrast class of properly metamathematical Gödelian independence, distinct from the membership-self-reference of ODTOE.]

[52] Bridgman P. W. The Logic of Modern Physics. New York: Macmillan, 1927. 242 p.