OBSERVER-DEPENDENT THEORY OF EVERYTHING (ODTOE)

A Formal Metatheory of Reality Founded on the Observer as the Principal Constructor of the Universe

ODTOE Research Group

Corresponding author: A.S. Pankratov
E-mail: anton.s.pankratov@gmail.com
ORCID: 0009-0002-4870-2995

Abstract

The number of simultaneously valid physical theories turns out to be a computable function of inter-observer coherence S: it equals exactly one when observers are fully synchronized ($S = 1$) and grows without bound as coherence drops toward its minimum. This central result emerges from a metatheoretical framework — the Observer-Dependent Theory of Everything (ODTOE) — whose sole axiom posits that every act of observation is a constructive act, jointly determined by the observer and the observed. Six mathematically formalized postulates translate this axiom into quantitative predictions: the multiverse cardinality scales as $K^{N(t)(1-S)}$, reconfiguration speed is inversely proportional to collective inertia, configuration lifetime diverges as $S \to 1$, outcome probability obeys a power law in the observer's contextual belief $B(O, C)$, and collective probability follows an inclusion–exclusion superposition of individual beliefs. The formal apparatus comprises a configuration space, an observer state operator parametrized by belief, attentional focus, and experiential history, a Langevin-type reconfiguration equation, and a pairwise coherence metric. Four propositions are proved: unboundedness of mutually incompatible law-sets under minimal coherence, asymptotic convergence to a unique theory under maximal coherence, self-referential consistency of the framework (a strange loop that contains itself as one of the described theories without contradiction), and existence of a self-consistent fixed point of the potential-state field that resolves the first-observer problem as a consequence of the existing axiomatics. The framework is situated relative to the Copenhagen interpretation, Everett's branching, QBism, Rovelli's relational programme, Wheeler's participatory universe, and Kuhn's paradigm dynamics. Limitations — including the unspecified form of the central functional, the open problem of operationalizing B, and the status of free parameters — are discussed together with a calibration protocol and candidate experimental tests.

Keywords: theory of everything, observer effect, wave function collapse, multiverse, coherence, belief-dependent probability, reconfiguration dynamics, metatheory, participatory universe, QBism, self-referential theory, falsifiability

I. Introduction: Context and Motivation

The central unsolved question of theoretical physics remains the reconciliation of the gravitational description of general relativity and the quantum-mechanical formalism within a single model. The gravitational theory operates with a smooth spacetime continuum deformed by the energy-momentum distribution, whereas the quantum formalism presupposes a fundamentally probabilistic mode of description that operates with discrete spectra of observables. This gap concerns not only the mathematical apparatus but also the ontology: the two theories diverge on the question of what is to be regarded as physically existent — continuous geometry or quantized field states. This gap points, in our view, to a structural incompleteness of both approaches, rooted in the exclusion of the observer from the formal architecture. None of the major unification programs—from superstrings [32] to loop quantum gravity [12]—has bridged this gap [13, 22], which, we argue, is due not to technical difficulty but to the absence of the observer from the formal structure of these theories. Alternative approaches, such as Wolfram's computational physics [11], likewise fail to resolve the observer problem. As early as the 1930s, Planck [10] emphasized the need to rethink the role of the subject in the physical description of the universe.

In this work, we develop a qualitatively different approach. Instead of searching for unified field equations describing all interactions, we place the observer at the center of the construction—not as a passive recorder, but as an agent of reality formation. If one accepts as an axiom that the observer shapes the observed and that the outcome of an experiment depends on the observer, one obtains an entirely new metatheory, within which any particular physical theory is merely one among an infinite set of possible configurations.

This approach draws on interpretations of quantum mechanics (the Copenhagen interpretation [5], Everett's many-worlds interpretation [2]), the observer effect in the double-slit experiment [33], the line of argument originating with von Neumann [3] and Wigner [4] (the so-called "Wigner line" in the interpretation of quantum mechanics), according to which the process of state reduction requires the inclusion of a conscious agent in the description—a line continued by Stapp [7] through his model of "mental acts" and by Penrose [8] through a gravitational mechanism of objective reduction—as well as Wheeler's work on the "participatory universe" [1] and, above all, Quantum Bayesianism (QBism) [14, 15], in which the state vector is construed not as a description of the objective properties of a microsystem but as an instrument for expressing the agent's subjective expectations—a position that anticipates our Axiom (A). Among the essential precursors to our approach, three lines may be distinguished: (a) works that explicitly introduce consciousness into the quantum formalism (Mensky [16, 17], Stapp [7], Penrose [8]); (b) approaches that relativize quantum description with respect to the observer (Rovelli [18], Zurek [9, 38], d'Espagnat [35]); (c) information-theoretic programs (Zeilinger [36], Prigogine and Stengers [37]). ODTOE radicalizes the common thesis of these lines by offering a unified quantitative apparatus. We also note that the idea of the observer's constructive participation in shaping the results of observation received systematic development in post-non-classical philosophy of science, above all in the work of V.S. Stepin [43], where the interaction of subject and object constitutes a new whole irreducible to its initial components. ODTOE formalizes this thesis quantitatively through the parameters B, S, and $I(C)$, translating qualitative philosophical propositions into a mathematical apparatus.

II. The Observer Axiom

The theory is founded on a single initial axiom, from which all subsequent postulates and propositions are formulated.

AXIOM (A). The Principle of Constructive Observation.

The observer and the observed are mutually constituted in the act of observation: the result of observation is a property of the composite system "observer + object," not of the object alone. Reality does not exist in a definite state prior to the act of observation. The act of observation is a constructive act, generating a specific configuration of reality from the field of infinitely many potential states.

Formal expression:

$$R = \hat{O}(\Psi) \tag{A.1}$$

where R is reality (the observed configuration), $\hat{O}$ is the observation operator, and Ψ is the field of potential states (an element of an infinite-dimensional Hilbert space $\mathcal{H}$).

Here $\Psi \in \mathcal{H}$ is an infinite-dimensional space of potential states (analogous to the Hilbert space in quantum mechanics), and the operator $\hat{O}$ effects the "collapse" of this space into a specific observed configuration R.

The crucial distinction from standard quantum mechanics is that in our theory the observation operator $\hat{O}$ is not fixed: it depends on the properties of the particular observer, including his or her "state of belief," that is, the cognitive coherence (confidence) in a particular outcome. This position is consonant with QBism, according to which the quantum state reflects not an objective property of the system but the degree of the agent's conviction [14]. We emphasize that the operator $\hat{O}$ in ODTOE is not a linear or Hermitian operator in the sense of standard quantum mechanics. It is introduced as an element of the meta-formalism, defining a mapping from the space of potential states $\mathcal{H}$ to the configuration space $\mathbb{C}$, parametrized by the properties of the observer. The specification of the algebraic properties of $\hat{O}$ (linearity, continuity, spectral structure) will be refined in subsequent work.

II-B. Definition of the Fundamental Quantity: Contextual Belief (Cognitive Coherence) of the Observer

Philosophical foundation.

In the context of this theory, belief (B), or cognitive coherence, carries no religious, mystical, or emotional connotation. Belief is a contextual quantity: $B = B(O, C)$, a measurable degree of the internal coherence of observer O with respect to a specific configuration C. It is a property neither of the observer alone nor of the configuration alone, but of the pair "observer + configuration." The integral characteristic $B(O, C)$ reflects how fully and consistently the cognitive system of observer O is aligned with configuration C.

Physical analogy: in laser radiation, coherence refers to the phase alignment of the electromagnetic field, giving rise to an amplified directed beam. By analogy, the quantity B in ODTOE measures the alignment of the observer's cognitive processes—attention, intention, emotional state, and accumulated experience—with respect to the target configuration.

Formal definition.

DEFINITION D1. Contextual Belief (Cognitive Coherence) of the Observer.

The contextual belief of the observer $B(O, C)$ is defined as a scalar quantity on the interval

$[0,\ 1]$, defined as a multiplicative function of four basic components, each of which depends on the pair "observer O + configuration C".

$$B(O, C) = F(O, C)^{w_1} \cdot E(O, C)^{w_2} \cdot (1 - \sigma(O, C))^{w_3} \cdot \Lambda(O, C)^{w_4} \tag{D1.1}$$

where: $F(O, C) \in [0,\ 1]$ is the attentional focus of observer O with respect to configuration C (intensity and directedness of observation); $E(O, C) \in [0,\ 1]$ is emotional coherence (alignment of the emotional state with intention with respect to C); $\sigma(O, C) \in [0,\ 1]$ is internal contradiction (entropy of doubt with respect to C), $(1 - \sigma(O, C))$ is the degree of internal consistency; $\Lambda(O, C) \in [0,\ 1]$ is empirical reinforcement (accumulated confirmatory experience within C); $w_1, w_2, w_3, w_4 \in (0,\ 1)$ are weight coefficients satisfying $w_1 + w_2 + w_3 + w_4 = 1$.

Notational convention. For brevity, the shorthand $B_i \equiv B(O_i, C)$ is used throughout, where the dependence on configuration C is implied. All formulas of the theory (D1.2)–(D1.4), (P2.2), (P4.1), (P5.1), (P5.2), (4.5) et al. employ the abbreviated notation B_i. The full notation $B(O_i, C)$ is restored in contexts where the observer simultaneously participates in several configurations.

The choice of the multiplicative functional form is motivated by the following considerations: (a) it ensures that $B = 0$ when any single component vanishes (a "weakest-link" property); (b) it yields a geometric structure natural for normalized quantities on $[0,\ 1]$; (c) the weight coefficients w_i admit empirical calibration. The specific values of w_i do not follow from the axiomatics of the theory and must be determined experimentally.

Property 1 (Multiplicativity). Belief is a product of components: the vanishing of any single component reduces belief to zero.

Property 2 (Geometric nature). The multiplicative form with exponents w_i renders B a weighted geometric mean of the components (F, E, $1 - \sigma$, Λ).

Property 3 (Boundary states).

$$B = 1 \iff F = E = \Lambda = 1 \text{ and } \sigma = 0 \tag{D1.2}$$

$$B = 0 \iff \exists\, i : \text{component}_i = 0$$

Dynamics of belief.

The observer's belief evolves in time. The dynamics are described by the differential equation:

$$\frac{dB}{dt} = \gamma \cdot \tanh\!\big(\beta \cdot \dot{\bar{d}}\big) \cdot \bar{d}(R_{\text{obs}}, R_{\text{exp}}) \cdot B \cdot (1 - B) \tag{D1.3}$$

where $\gamma > 0$ is the observer's learning rate; $\bar{d}(R_{\text{obs}}, R_{\text{exp}}) = d(R_{\text{obs}}, R_{\text{exp}})/d_{\text{max}}$ is the normalized distance in the configuration space $\mathbb{C}$ between the observed result R_{obs} and the expected result R_{exp}, divided by the characteristic scale d_{max}; $\dot{\bar{d}} = d\bar{d}/dt$ is the rate of change of the normalized distance; $\beta \gg 1$ is a steepness parameter governing the sharpness of the switch between the confirmatory and disconfirmatory regimes. The function $\tanh(\beta \cdot \dot{\bar{d}})$ serves as a smooth approximation to the discontinuous sgn function: when $\dot{\bar{d}} < 0$ (observation approaches expectation) $\tanh(\beta \cdot \dot{\bar{d}}) \to -1$; when $\dot{\bar{d}} > 0$ (divergence) $\tanh(\beta \cdot \dot{\bar{d}}) \to +1$; in the limit $\beta \to \infty$ the sgn function is recovered. The choice of tanh ensures Lipschitz continuity of the right-hand side and, consequently, the existence and uniqueness of solutions by the Picard–Lindelöf theorem. The factor $B(1-B)$ ensures logistic dynamics: belief grows under confirmatory observations and decays under disconfirmatory ones, remaining within $[0,\ 1]$. The logistic factor $B(1-B)$ vanishes at $B=0$ and $B=1$, rendering these points absorbing states: an observer with complete disbelief ($B=0$) or absolute certainty ($B=1$) cannot change state. In real cognitive systems, the values $B=0$ and $B=1$ are mathematical idealizations; a physically more accurate model is $dB/dt \propto (B+\varepsilon)(1-B+\varepsilon)$ for small $\varepsilon>0$, permitting escape from the neighborhood of the boundary values.

Quantum-mechanical interpretation.

In quantum-mechanical terms, B admits an interpretation as the overlap between the observer's internal state $|O\rangle$ and the target state of reality $|R_{\text{target}}\rangle$:

$$B \sim |\langle O|R_{\text{target}}\rangle|^2 \tag{D1.4}$$

Formula (D1.4) does not define B alternatively but provides a quantum-mechanical interpretation establishing a conceptual link with the Born rule [20]. The question of strict equivalence between (D1.1) and (D1.4), i.e., the conditions under which the multiplicative decomposition (D1.1) coincides with the squared modulus of the inner product, remains an open mathematical problem. In the present version of the theory, (D1.4) should be regarded as a heuristic analogy motivating the connection between the notion of the observer's belief and the quantum-mechanical formalism. A rigorous definition of the projection $\mathcal{H}_{\text{obs}} \otimes \mathcal{H}_{\text{real}} \to \mathcal{H}_{\text{cons}}$ and a proof of the compatibility of (D1.4) with the multiplicative structure (D1.1) remain unresolved.

For the interpretation (D1.4) to be well-defined, the observer state $|O\rangle$ and the target state of reality $|R_{\text{target}}\rangle$ must belong to the same Hilbert space $\mathcal{H}$. This assumption rests on the central axiom of the theory: the observer and the observed are not ontologically separated; the observer is part of the system being observed. Formally, it is assumed that the composite Hilbert space $\mathcal{H} = \mathcal{H}_{\text{obs}} \otimes \mathcal{H}_{\text{real}}$ admits a definition of the inner product via projection: $B \sim |\langle \Phi_{\text{cons}}|O \otimes R_{\text{target}}\rangle|^2$, where $|\Phi_{\text{cons}}\rangle$ is a vector in the subspace of concordant states $\mathcal{H}_{\text{cons}} \subset \mathcal{H}_{\text{obs}} \otimes \mathcal{H}_{\text{real}}$. The concrete definition of Φ_{cons} remains an open problem.

Connection with the Fitness Beats Truth (FBT) theorem.

The contextuality of $B(O,C)$ resolves the paradox that arises when comparing ODTOE with the results of evolutionary epistemology. The results of Prakash et al. [44], obtained through evolutionary game-theoretic methods, demonstrate that perceptual strategies optimizing biological fitness displace strategies maximizing the accuracy of environmental representation. This conclusion is amplified as the dimensionality of the perceptual space grows. The Interface Theory of Perception (ITP) [45] develops this conclusion: perceptual systems are shaped by selection as species-specific interfaces for adaptive behavior rather than as channels of access to objective reality [46].

Within the ODTOE framework, this result refines the interpretation of the parameter B: the value $B(O,C)$ reflects the adaptive coherence of the observer with a configuration. The mechanism of collective observation (Postulate P5) compensates for the limitations of individual $B(O_i,C)$ through inter-observer coherence channels — any forms of signal coordination and transmission of adaptive configurations within a cluster. The specific nature of such channels (verbal communication, the scientific method, chemical and acoustic signalling, collective navigation, epigenetic transmission, and other forms of intergenerational transmission of adaptive configurations) is determined by the type of observer; ODTOE specifies only the functional requirement: the channel must ensure growth of collective coherence S_{cluster}.

Consequently, the configuration toward which the system tends as $S \to 1$ is an adaptive attractor: a stable configuration that maximizes the collective coherence of the group of observers. The distinction between adaptive coherence and veridicality defines a fundamental boundary of the theory (see Section VIII).

III. Postulates of the Theory

The following postulates P1–P6 are not logically derived from Axiom (A). They represent additional, independent assertions that specify the metatheoretical framework and define particular functional dependencies (power-law, multiplicative, logistic) which are not deducible from Axiom (A). The choice of each functional form is motivated by considerations of mathematical simplicity, correctness of boundary conditions, and consistency with known physical models; however, alternative forms are not excluded. Axiom (A) serves as a unified philosophical foundation on which the postulates rest in substance, but not deductively.

Postulate 1. On the Infinity of Realities.

POSTULATE P1. Reality is formed by observation. The number of realities grows with the number of observers.

$$\lim_{t\to\infty} N(t) = \infty \;\Rightarrow\; |M| = |\{R_i : i = 1, \dots, N(t)\}| \to \infty \quad \text{(P1.1)}$$

where $N(t)$ is the number of observers as a function of time and $|M|$ is the cardinality of the multiverse. If each observer is capable of generating K possible configurations:

$$|M_{\text{total}}| = K^{N(t)} \to \infty \text{ as } N(t) \to \infty \quad \text{(P1.2)}$$

Formula (P1.2) is obtained under the following assumptions:

Assumption D-Sep (separability of observational acts). The act of observation O_i generates a configuration independently of the acts O_j for $i \neq j$. This holds in the limit $S \to S_{\text{min}}$; when $S > S_{\text{min}}$, acts are correlated and formula (P1.2) becomes the estimate $|M_{\text{eff}}| \leq K^{N(t)\cdot(1-S)}$.

Assumption D-Hom (homogeneity of configuration space). Each observer has access to the same set of K configurations. Under inhomogeneity, K^N is replaced by $\prod_i K_i$ without changing the qualitative conclusions.

Assumption D-Comb (combinatorial independence). All combinations of configurations are admissible: $|M| = K^N$. Under compatibility constraints, $|M| < K^N$, and formula (P1.2) provides an upper bound.

Formula (P1.2) establishes the upper bound on the cardinality of the multiverse in the limit of minimal coherence ($S \to S_{\text{min}}$). For $S > S_{\text{min}}$, correlations among observers reduce the effective number of independent configurations: $|M_{\text{eff}}| \leq K^{N(t)\cdot(1-S)}$, which is consistent with the limiting case $|M| = 1$ when $S = 1$.

Postulate 2. On the Reconfiguration of Reality.

POSTULATE P2. In any reality, the realization of any new configuration is possible. The rate of reconfiguration is inversely proportional to the inertia.

$$v(C \to C') = \frac{\alpha}{I(C) + \varepsilon} \tag{P2.1}$$

where α is a universal reconfiguration constant, $I(C)$ is the inertia of the current configuration, and $\varepsilon = \alpha / v_{\max} > 0$ is a regularizing parameter that eliminates the divergence as $I(C) \to 0$ and ensures the upper bound $v \leq v_{\max} < \infty$. The value of $v_{\max}$ is determined by the structure of the configuration space and is subject to empirical determination:

$$I(C) = \sum_{j=1}^{m} w_j \cdot B_j(C) \tag{P2.2}$$

The weight coefficients w_j are normalized by the condition $\sum_{j=1}^{m} w_j = 1$, which ensures $I(C) \in [0, 1]$ and prevents unbounded growth of inertia as the number of observers increases.

Postulate 3. On Coherence and Configuration Lifetime.

POSTULATE P3. The lifetime of a configuration is determined by the coherence level of the system.

$$T(C) = \frac{T_0}{(1 - S)^n} \tag{P3.1}$$

where T_0 is the baseline lifetime, $S \in [0,\, 1]$ is the coherence level, and $n \geq 1$ is the sensitivity exponent. Limiting cases:

$$\lim_{S \to 1} T(C) = \infty, \quad T(C)\big|_{S=0} = T_0 \tag{P3.2}$$

The singularity at $S \to 1$ ($T \to \infty$) is a structural feature of the model, reflecting the idealized limit of full coherence. In physically realizable systems, $S < 1$, and the lifetime remains finite.

Independence of P3 from P2. Inertia $I(C)$ and coherence S describe different aspects of stability. Inertia characterizes the aggregate attachment of observers to the current configuration irrespective of their alignment; coherence measures the degree of synchronization irrespective of the absolute values of beliefs.

Counterexample. System with $n = 4$: $B_1 = B_2 = 0.95$; $B_3 = B_4 = 0.05$. Inertia ($w_j = 0.25$): $I(C) = 0.5$ (moderate). Coherence: $S = 1 - \frac{2}{12} \cdot 3.6 = 0.4$ (low). Lifetime: $T(C) = T_0/(1 - 0.4)^1 \approx 1.67 \cdot T_0$ (substantially limited). Observers hold strong beliefs but in opposite outcomes—the configuration is unstable under low coherence, despite moderate inertia.

Reduction perspective. Upon specifying the potential $U(C)$ and formalizing the dependence of $\eta(t)$ on S (formula 4.4a), the lifetime $T(C)$ may be computed via the mean first-passage time (MFPT) within the Kramers theory [56, 57], which would reduce P3 to a consequence of P2. Until then, P3 retains the status of a postulate.

Postulate 4. On the Observer's Belief and the Probability of Outcome.

POSTULATE P4. The probability of an experimental outcome is a function of the observer's belief.

$$P(E \mid B) = B^k, \quad 0 \le B \le 1, \quad k \ge 1 \tag{P4.1}$$

where k is the "reality resistance" coefficient. The choice of the power-law function B^k (rather than, e.g., an exponential $\exp(-1/B)$ or a linear function) is motivated by the following considerations: (a) the power-law form ensures $P(E|0) = 0$ and $P(E|1) = 1$, satisfying the boundary conditions; (b) the parameter k is naturally interpreted as a measure of resistance: when $k = 1$, belief directly determines probability; when $k > 1$, reality "resists" the observer; (c) the power-law function yields the simplest multiplicative structure for collective observation (P5.1). Beyond these substantive arguments, the choice of the power-law form admits a rigorous formal justification.

Formal justification of the power-law form. Let two observers with contextual beliefs B_1 and B_2 interact sequentially with a single configuration, and let their combined belief be described by the product $B_1 \cdot B_2$ (consistent with the multiplicative structure of Definition D1). We require the outcome probability to satisfy the multiplicativity principle:

$$P(E \mid B_1 \cdot B_2) = P(E \mid B_1) \cdot P(E \mid B_2) \tag{P4.2}$$

Denote $f(B) = P(E \mid B)$. Equation (P4.2) takes the form $f(xy) = f(x) \cdot f(y)$—the multiplicative Cauchy equation. From $f(xy) = f(x) \cdot f(y)$ and $f(1) = 1$ it follows that $f(x) > 0$ for all $x \in (0, 1]$. Define $g(t) = \ln f(e^t)$ for $t \le 0$; then $g(s + t) = g(s) + g(t)$—the additive Cauchy equation, whose unique continuous solution on the half-line is $g(t) = kt$ [51]. Back-substitution yields $f(x) = x^k$ for $x \in (0, 1]$. The boundary condition $f(0) = 0$ is satisfied when $k > 0$; the condition $f(1) = 1$ holds trivially. The same result follows from the requirement of scale invariance [52, 55].

Analogy with the Born rule. The Born rule $P = |\psi|^2$ is likewise a fundamental postulate linking the state of a system to the probability of an outcome; attempts to derive it via Gleason's theorem and Dutch-book arguments remain debated [53, 54]. The formula $P(E \mid B) = B^k$ occupies a structurally analogous position in ODTOE.

Status of the parameter k. In the current version of the theory, $k \ge 1$ is treated as a context-dependent quantity whose value may vary depending on the type of experiment, the nature of the observed phenomenon, and the scale of observation. Whether k is a universal constant (analogous to Planck's constant) or an effective parameter determined by specific observational conditions remains an open question requiring experimental investigation. When $k = 1$, the theory reduces to the linear dependence $P(E|B) = B$; as $k \to \infty$, only an observer with $B = 1$ is capable of realizing the target outcome.

Formula (P4.1) specifies the probability of a particular target outcome E to which the observer is "attuned." The probability of the complementary event (not-E) in the simplest binary case is $P(\neg E \mid B) = 1 - B^k$. For the case of $m > 2$ possible outcomes $\{E_1, \ldots, E_m\}$, a generalization may be realized through a normalized softmax-like mapping: $P(E_j \mid B, \{E\}) = B_j^k / \sum_{l=1}^{m} B_l^k$, which ensures $\sum_j P(E_j) = 1$. A detailed development of this generalization is a subject for subsequent work.

Postulate 5. On Collective Observation.

POSTULATE P5. The collective probability is determined by a superposition of individual beliefs.

$$P_{\text{coll}}(E) = 1 - \prod_{i=1}^{n}(1 - B_i^k) \tag{P5.1}$$

Assumption D-Ind (statistical independence of observers). The outcome for observer O_i is conditionally independent of the outcomes for the other observers given the configuration C: $P(E_i \mid B_i, C, \{E_j\}_{j\neq i}) = P(E_i \mid B_i, C) = B_i^k$. Under this assumption, formula (P5.1) follows by inclusion–exclusion.

Remark on the status of P5. Assumption D-Ind holds strictly only when $S \to S_{\text{min}}$. At intermediate coherence, inter-observer correlations arise. A fully general formula $P_{\text{coll}}(E, S)$ requires replacing D-Ind with a copula or a joint density model for the variables B_i. The derivation of P5 from P4 is possible only at $S \to S_{\text{min}}$; in the general case, P5 retains the status of a postulate.

Formula (P5.1) structurally corresponds to the model of independent observations. In this theory, observers are coupled through the coherence S (formula 4.5), and formula (P5.1) describes the limiting case of minimal coherence ($S \to S_{\text{min}}$). At high coherence ($S \to 1$), the individual beliefs converge ($B_i \to B$), and $P_{\text{coll}}(E) \to 1 - (1 - B^k)^n$. The construction of a generalized formula $P_{\text{coll}}(E, S)$ that explicitly accounts for correlations among observers through coherence remains to be developed.

Remark on the relationship between P1 and P5. Postulate P1 posits that each observer forms his or her own configuration of reality (so that with N observers and K configurations per observer, $|M| = K^N$ combinations arise), whereas Postulate P5 introduces a collective probability for a joint outcome. The question arises: in whose reality is the joint result observed? We adopt the following resolution: P5 operates in the domain of overlap among realities, as determined by the coherence S. As $S \to 1$, all observers share a common reality and the collective probability has its standard meaning. As $S \to S_{\text{min}}$, realities diverge, and P5 applies only within local clusters of observers with coherence $S > S_{\text{threshold}}$, where $S_{\text{threshold}}$ is the threshold value at which the realities of observers overlap. The definition of $S_{\text{threshold}}$ and a rigorous formalization of the transition from individual realities (P1) to collective ones (P5) through the parameter S constitute open problems of the theory.

In the linear approximation for small B_i^k (first-order expansion of the product):

$$P_{\text{coll}}(E) \approx \sum_{i=1}^{n} B_i^k \tag{P5.2}$$

The linear approximation (P5.2) is valid only when $\sum B_i^k \ll 1$; for larger values, the full formula (P5.1) must be used, which guarantees $P_{\text{coll}} \leq 1$.

Postulate 6. On the Number of Theories of Everything.

POSTULATE P6. The number of simultaneously existing theories is a function of coherence.

$$N_{\text{theories}}(t, S) = N_0(t) \cdot (1 - S)^m + 1 \tag{P6.1}$$

$$N_{\text{theories}} \to \infty \text{ as } S \to 0,\ t \to \infty; \quad N_{\text{theories}} \to 1 \text{ as } S \to 1 \tag{P6.2}$$

The function $N_0(t)$ reflects the potential diversity of theoretical descriptions available to the system of observers at time t. The growth of $N_0(t)$ as $t \to \infty$ is motivated by the fact that, as the number of observers increases and experimental data accumulate, the space of possible theoretical interpretations expands. The specific form of $N_0(t)$ (linear, power-law, logarithmic) is not fixed here and will be specified in further work.

Definition D2. *Equivalence class of configurations.* Configurations C_a and C_b are theoretically equivalent ($C_a \sim C_b$) if there exists a theory T describing both as solutions of a common system of regularities $\mathcal{L}(T)$. The number of theories N_{theories} equals the number of equivalence classes on the set M.

From Definition D2 the following inequality follows:

$$N_{\text{theories}}(t, S) \leq |M_{\text{eff}}| \leq K^{N(t)\cdot(1-S)} \tag{P6.3}$$

Each theory may describe several configurations (one equivalence class contains one or more configurations). N_{theories} cannot exceed the number of configurations, but in general is substantially smaller: a single theory (e.g., quantum mechanics) describes a multitude of experimental configurations. A rigorous derivation of N_{theories} from $|M_{\text{eff}}|$ via algorithmic information theory remains an open problem.

IV. Mathematical Formalism

4.1. Configuration Space

We define the configuration space $\mathbb{C}$ as a complete Riemannian manifold of class C^2 (and, in particular, a metric space) of all possible states of reality. The C^2 smoothness requirement is justified by the necessity of second-order covariant derivatives entering the gradient operator in the dynamics equation (4.4):

$$\mathbb{C} = \{c_1, c_2, \ldots\}, \quad d\colon \mathbb{C} \times \mathbb{C} \to \mathbb{R}^+ \tag{4.1}$$

The space $\mathbb{C}$ plays the role of a formal substrate, i.e., a set of potential configurations, none of which is "actual" prior to the act of observation. The ontological status of $\mathbb{C}$ is analogous to that of the Hilbert space in standard quantum mechanics: it defines the structure of possibilities, not a pre-existing reality. Thus, the introduction of $\mathbb{C}$ does not contradict Axiom A, which asserts the constructive character of reality.

4.2. Observation Operator

Each observer O_i is defined by a state vector:

$$O_i = (B_i, A_i, H_i) \in [0, 1] \times \mathcal{F} \times \mathcal{H}_{\text{hist}} \tag{4.2}$$

The observation operator:

$$\hat{O}_i(\Psi) = c_j \text{ with probability } P(c_j \mid O_i) = f(B_i, A_i, H_i, c_j) \tag{4.3}$$

Remark (observer dimensionality). The observer characterization (B_i, A_i, H_i) may be extended to the quadruple (B_i, A_i, H_i, d_i), where $d_i \in \mathbb{N}$ is a dimensionality parameter that determines the maximal dimensionality of configurations the observer is capable of actualizing. Under this extension, Postulate P4 is modified: $P(E \mid B, d) = B^k$ when $\dim(C) \leq d(O)$ and $P(E \mid B, d) = 0$ when $\dim(C) > d(O)$. This restriction formalizes the principle of ontological protection (assumption D-Prot, Section V): the observer cannot actualize configurations exceeding their constituting capacity. The hierarchy of dimensionalities — from the corporeal ($d = 1$) through the social ($d = 2$) and planetary ($d = 3$) to the cosmological ($d = 4$) level — reproduces the Leibnizian hierarchy of monads [67] and Moiseev's mirological stratification [65]. The current version of the theory corresponds to the special case $d(O) = \infty$ (no dimensionality restriction).

4.3. Reconfiguration Dynamics

$$\frac{dC}{dt} = -\frac{\alpha}{I(C) + \varepsilon} \cdot \nabla U(C) + \eta(t) \tag{4.4}$$

where $U(C)$ is the configuration potential, ∇ is the gradient in $\mathbb{C}$, and $\eta(t)$ is a stochastic term. Note that the presence of the gradient operator ∇ presupposes that $\mathbb{C}$ possesses the structure of a smooth (differentiable) manifold, not merely a metric space. In general, a complete metric space need not admit a differentiable structure; the smoothness condition on $\mathbb{C}$ is adopted as an additional requirement ensuring the well-posedness of equation (4.4).

Relationship between the stochastic term and coherence. The variance of $\eta(t)$ decreases with increasing coherence:

$$D(\eta) = D_0 \cdot (1 - S) \tag{4.4a}$$

where $D_0 > 0$ is the baseline variance at full desynchronization. As $S \to 1$, the stochastic term vanishes and the dynamics (4.4) become deterministic. As $S \to S_{\min}$, the variance is maximal and stochastic fluctuations dominate. The dependence (4.4a) is motivated by an analogy with the fluctuation-dissipation theorem [58], where the noise amplitude is linked to the parameters of the medium; in ODTOE, the "medium" is the collective of observers.

4.4. System Coherence Level

$$S = 1 - \frac{2}{n(n-1)} \sum_{i<j} |B_i - B_j| \tag{4.5}$$

When all individual values coincide (all B_i equal), $S = 1$. For $n = 2$ observers, the minimum $S = 0$ is attained when $B_1 = 0$ and $B_2 = 1$. For $n > 2$, the lower bound on S increases: under the optimal partition into two equal groups ($B_i = 0$ and $B_j = 1$), the minimum is $S = 1 - \lfloor n/2 \rfloor \cdot \lceil n/2 \rceil \cdot 2/(n(n-1))$, which tends to $1/2$ as $n \to \infty$. In particular, for $n = 4$: $S_{\min}(4) = 1 - (2 \cdot 2 \cdot 2)/(4 \cdot 3) = 1/3$. Thus, in multi-observer systems, $S \in [S_{\min}(n),\ 1]$, where $S_{\min}(n) > 0$ for $n > 2$. This is essential for the interpretation of Postulate P6: the condition $S \to 0$ is an idealization, attainable only in the limit $n = 2$.

Formula (4.5) accounts only for differences in the parameter B, whereas the observer is defined by the triple (B_i, A_i, H_i). This is a limitation of the current formalization: coherence S, defined solely through B, does not guarantee convergence in the remaining parameters, creating a gap in the justification of Proposition 2 (which requires Assumption D-Conv). The full coherence metric should take the form $S = S(B, A, H) = 1 - D_{\text{norm}}(O_1, \ldots, O_n)$, where D_{norm} is a normalized mean distance in the full observer state space $[0,1] \times \mathcal{F} \times \mathcal{H}_{\text{hist}}$. Constructing such a metric requires defining distances in the archetype space $\mathcal{F}$ and the history space $\mathcal{H}_{\text{hist}}$, which remains an unsolved problem. Until the full metric $S(B, A, H)$ is constructed, results dependent on coherence (Propositions 1 and 2, Postulates P3 and P6) should be regarded as established in the projection onto the parameter B.

4.5. Central Equation of the Theory

$$R(t) = \mathcal{F}\big[\{O_i(t)\}_{i=1}^{n},\ S(t),\ I(C(t))\big] \tag{4.6}$$

Reality R at time t is given by the structural dependence (4.6), which defines R as a functional of the set of all observers, the coherence level, and the inertia of the current configuration. Note that the system of equations contains feedback: by Axiom A, the reality R is determined through B (via the observation operator), while by equation (D1.3), the dynamics of B depend on R_{obs}. The question of the existence and uniqueness of solutions to this coupled system requires separate investigation; by analogy with nonlinear dynamical systems, we postulate the existence of attractors corresponding to stable configurations. The specific form of the functional $\mathcal{F}$ is not specified in this work; equation (4.6) defines the structural form of the dependence, not a concrete predictive model. Specification of $\mathcal{F}$ for particular cases (quantum-mechanical limit, macroscopic limit) has not yet been carried out. This feedback generates a self-consistent system: by Axiom (A), $R = \hat{O}(\Psi)$ depends on B through the observation operator; simultaneously, by (D1.3), dB/dt depends on R_{obs}. Formally, this is a nonlinear system with feedback of the form $dB/dt = G(B, R(B))$, where $R(B) = \mathcal{F}[O(B), S(B), I]$. The question of the existence and uniqueness of solutions for such a system remains open. By analogy with nonlinear dynamical systems, we postulate the existence of attractors (stable configurations), although a rigorous proof requires specification of the concrete form of the functional $\mathcal{F}$. The investigation of the attractor structure of the system $R \leftrightarrow B$ requires further work. Specification of the functional $\mathcal{F}$ for particular cases (e.g., a one-dimensional model with two observers) and proof of the existence of attractors of the coupled system $dB/dt = G(B, R(B))$ are priority tasks for the next stage of the investigation.

4.5.1. Initial Condition of the Coupled System

The system of equations in Section 4.5 contains the feedback $R \leftrightarrow B$ and presupposes the existence of an initial condition. By Proposition 4 (Section V), the initial condition is the fixed point Ψ^* of the self-observation mapping (U4.2). The fixed point determines the parameters of the primary observer:

$$O^* = (B^*, A^*, H^*) \in [0,1] \times \mathcal{F} \times \mathcal{H}_{\text{hist}} \tag{4.7}$$

Remark on the self-consistency of B^*. The parameters of the primary observer $O^* = (B^*, A^*, H^*)$ are not imposed externally but are determined by the fixed-point equation $\Psi^* = \Phi(\Psi^*)$. In particular, the value of B^* is fixed by the self-consistency requirement, not by formula (D1.1), which describes the dynamical state of an already existing observer. A configuration with $B^* = 0$ is not a fixed point, since it cannot reproduce itself through an act of observation ($P(E|0) = 0$ by Postulate P4). Consequently, self-consistency guarantees $B^* > 0$. The rigorous determination of B^* from the fixed-point condition requires specification of the operator $\hat{O}$ and constitutes an open problem.

Starting from O^*, the dynamics of the system are described by equations (D1.3) and (4.4); the feedback loop unfolds according to the scheme:

$$\Psi^* \to O^* \to R_1 = \hat{O}^*(\Psi^*) \to \frac{dB}{dt} = G(B, R_1) \to O_1 \to R_2 \to \dots \quad (4.8)$$

Thus the feedback $R \leftrightarrow B$ acquires a formally defined entry point. The stability of the initial state depends on the value of B^*: as $B^* \to 1$, the configuration stabilizes (by Postulate P3, $T(C) \to \infty$ according to formula P3.1); when $B^* \ll 1$, the primary configuration is unstable and requires reinforcement through collective observation (Postulate P5).

Open questions: (1) whether Ψ^* is an attractor of the iterative sequence $\Psi_{n+1} = \Phi(\Psi_n)$ or an unstable fixed point depends on the properties of Φ; (2) the relationship between the number of fixed points and the multiverse cardinality $|M|$ (formula P1.2) requires formalization.

4.6. Numerical Example: Two Observers

Consider a minimal model: $n = 2$ observers with $B_1 = 0.9$ and $B_2 = 0.3$, $k = 2$, $K = 10$.

Coherence (formula 4.5): $S = 1 - |B_1 - B_2| = 1 - 0.6 = 0.4$.

Inertia (P2.2, $w_1 = w_2 = 0.5$): $I(C) = 0.5 \cdot 0.9 + 0.5 \cdot 0.3 = 0.6$.

Individual probabilities (P4.1): $P(E|B_1) = 0.9^2 = 0.81$; $P(E|B_2) = 0.3^2 = 0.09$.

Collective probability (P5.1): $P_{\text{coll}} = 1 - (1 - 0.81)(1 - 0.09) = 1 - 0.19 \times 0.91 = 0.827$.

Multiverse cardinality (P1.2): $|M_{\text{eff}}| \leq 10^{2(1-0.4)} = 10^{1.2} \approx 15.8$.

Number of theories (P6.1, $m = 1$, $N_0 = 100$): $N_{\text{theories}} = 100 \cdot (1 - 0.4)^1 + 1 = 61$.

Thus, in this model the observer with high belief ($B_1 = 0.9$) dominates collective probability, while $S = 0.4$ admits roughly 16 effective configurations.

V. Propositions and Corollaries

Proposition 1. On the Unboundedness of Physical Laws.

Statement. In a system with $S \to S_{\text{min}}(n)$ (the minimal attainable coherence for n observers), there exists no single set of physical laws valid for all observers simultaneously.

Proof sketch. Consider a system of n observers with coherence level S.

By definition (4.5), when $S \to S_{\text{min}}(n)$, the normalized mean difference of the values B_i is maximal, meaning maximal dispersion of B_i over $[0, 1]$ (subject to the constraint $S_{\text{min}}(n) > 0$ for $n > 2$; see Section 4.4).

By Axiom (A), the observation operator $\hat{O}_i$ depends on B_i (and also on A_i and H_i by formulas 4.2–4.3). We adopt the additional assumption (D-Inj): the mapping $B_i \mapsto \hat{O}_i$ is injective when the remaining parameters are held fixed, i.e., for pairwise distinct values of B_i (with A_i and H_i

coinciding), the operators $\hat{O}_i$ are pairwise distinct: $\hat{O}_i \neq \hat{O}_j$ for $i \neq j$. This assumption means that the belief parameter is an essential (non-degenerate) parameter of the observation operator. A rigorous proof of injectivity in the general case (for arbitrary A_i, H_i) requires further formal analysis.

By Postulate P1, each observer forms a distinct configuration $R_i = \hat{O}_i(\Psi)$. For distinct operators $\hat{O}_i$ and $\hat{O}_j$, the corresponding configurations R_i and R_j are in general distinct.

Let $\mathcal{L}(R_i)$ denote the set of physical laws operative in configuration R_i. We adopt the additional assumption (D-Law): distinct configurations of reality may obey distinct sets of physical laws, i.e., $R_i \neq R_j$ allows $\mathcal{L}(R_i) \neq \mathcal{L}(R_j)$. This assumption is non-trivial: in standard physics, distinct configurations (solutions) obey common laws (equations). However, Postulate P2 of ODTOE allows the realizability of any configuration, including configurations with alternative regularities.

By Postulate P6, when $S \to S_{\text{min}}(n)$: $N_{\text{theories}} = N_0(t) \cdot (1 - S_{\text{min}})^m + 1$, where $(1 - S_{\text{min}})^m > 0$; hence $N_{\text{theories}} \to \infty$ as $t \to \infty$.

Therefore, under the stated assumptions, the set $\{\mathcal{L}(R_i)\}$ cannot be reduced to a single set $\mathcal{L}$. ■

Proposition 2. On Convergence to a Unified Theory.

Statement. As $S \to 1$, observers within a cluster are maximally aligned with a shared adaptive configuration. The limiting value $S = 1$ is asymptotic: it constitutes a regulative ideal in the Kantian sense [34], unattainable due to the structural incompleteness of the theory (a consequence of self-reference; see Proposition 3). Inter-cluster coherence may remain low, which is a normal rather than pathological property of the system.

Proof sketch.

By definition (4.5), $S = 1$ if and only if $|B_i - B_j| = 0$ for all pairs (i, j), i.e., $B_i = B^*$ for all i and some $B^* \in [0, 1]$.

If all B_i are identical, then the belief parameters coincide: $B_i = B^*$ for all i. By formula (4.2), each observer is defined by the triple $O_i = (B_i, A_i, H_i)$. Equality of B does not automatically entail equality of attentional focus A_i and history H_i. We adopt the additional assumption (D-Conv): as $S \to 1$, full system coherence entails convergence of all observer parameters, i.e., $A_i \to A^*$ and $H_i \to H^*$ for all i. This assumption is motivated by the idea that $S \to 1$ reflects not only coincidence of the parameter B, but also a global synchronization of observational practices. Assumption D-Conv is an essential limitation of the current formalization. Its justification requires extending the coherence metric to the form $S = S(B, A, H)$ that accounts for all observer parameters. Until such extension, Proposition 2 holds only conditionally, under the acceptance of D-Conv as an additional postulate. In this limiting case, the observation operators converge asymptotically: $\hat{O}_i \to \hat{O}^*$ for all i.

Consequently, $R_i = \hat{O}^*(\Psi) = R$ for all i; all observers form an identical configuration.

By formula (P6.1) at $S = 1$: $N_{\text{theories}} = N_0(t) \cdot (1 - 1)^m + 1 = 0 + 1 = 1$.

By formula (P3.1) as $S \to 1$: $T(C) = T_0/(1 - S)^n \to \infty$, and the unique configuration is stabilized.

Therefore, under full coherence (and under Assumption D-Conv), there exists a unique configuration of reality and a unique theory describing it.

This limit is structurally unattainable due to self-reference (Proposition 3): a complete description of reality would require including a description of the description itself (ad infinitum). Nevertheless, $S \to 1$ defines a direction analogous to limiting constructions in mathematics; formulas (P6.1) and (P3.1) remain valid as descriptions of the system's asymptotic behavior. ■

Proposition 3. On the Self-Referential Structure of the Theory (Strange Loop).

Statement. ODTOE is a self-referential structure (a strange loop in the sense of Hofstadter [47, 48]) that contains itself as a special case. This entails structural incompleteness, which is not a defect but reflects the fundamental status of the observer within reality. Postulates P1–P6 remain individually falsifiable.

Proof sketch.

Denote the present theory by T_{ODTOE}.

By Postulate P6, in a system with coherence level S, there exist $N_{\text{theories}}(t, S)$ simultaneously operative theories of everything. Denote this set by $\mathbb{T} = \{T_1, T_2, \dots, T_n\}$.

We define the membership criterion for $\mathbb{T}$: a theory T belongs to $\mathbb{T}$ if and only if T establishes a relation between the set of observers $\{O_i\}$ and the configuration of reality $R(t)$, i.e., T specifies some functional $R = \mathcal{F}_T[\{O_i\}]$. T_{ODTOE} satisfies this criterion (equation 4.6). Hence $T_{\text{ODTOE}} \in \mathbb{T}$.

Simultaneously, T_{ODTOE} contains formula (P6.1), which determines the cardinality $|\mathbb{T}|$, i.e., it describes $\mathbb{T}$ "from the outside."

This creates a self-referential structure: $T_{\text{ODTOE}} \in \mathbb{T}$ and $T_{\text{ODTOE}} \vdash |\mathbb{T}| = N_{\text{theories}}(t, S)$.

Consistency: as $S \to 1$, the theory predicts $|\mathbb{T}| = 1$, which is consistent with the assertion that T_{ODTOE} is the unique theory. A contradiction would arise only if the theory predicted $|\mathbb{T}| = 0$. Since $N_{\text{theories}} \geq 1$ always (the addend $+1$ in P6.1 ensures this), the theory does not negate its own existence for any value of S.

Thus, the self-reference is consistent. ■

Remark. This self-referential structure differs from Gödel's constructions [21]: the incompleteness theorems pertain to formal systems containing arithmetic, whereas ODTOE is a metatheory that contains its own description not as a formal statement about arithmetic but as an element of the described set of theories.

The notion of a strange loop was introduced by Hofstadter [47] to describe systems in which movement through hierarchical levels leads back to the starting point. In the context of ODTOE, the loop closes as follows: the theory defines the set $\mathbb{T}$ of theories of everything (upper level) and then discovers itself as an element of that set (lower level), with the conditions of its membership specified by the theory itself.

An analogous architecture is present in the Hawking–Hartle "top-down" cosmological model [49]: instead of deriving the universe from a single initial condition, the observer retrospectively selects the history compatible with his or her current state. The observer does not follow from the theory; the theory and the observer generate each other.

Ben-Ya'acov [50] showed that self-reference in cosmology leads to a fundamentally two-level structure: the theory describes a world containing an observer, and the observer selects the theory. ODTOE reproduces this pattern formally: $T_{\text{ODTOE}} \in \mathbb{T}$ and $T_{\text{ODTOE}} \vdash |\mathbb{T}| = N_{\text{theories}}(t, S)$.

Unlike Gödelian self-reference, which leads to incompleteness, the strange loop of ODTOE does not generate contradiction: as $S \to 1$, the theory predicts $|\mathbb{T}| = 1$, consistent with its own existence; when $S < 1$, it admits alternatives without negating itself.

That said, the self-referentiality of the metatheory gives rise to potential difficulties related to the dependence of the theory's existence conditions on variables within the theory itself. In particular, the limit $S \to 1$ (Proposition 2) should be understood as a regulative ideal defining the direction of evolution, not as a realizable state. A full analysis of this problem lies beyond the scope of the present work.

ODTOE proposes a two-level architecture separating falsifiable and non-falsifiable components:

Level	Content	Epistemic status
Meta-level	Axiom (A) + self-referential architecture (strange loop)	Non-falsifiable as a whole; defines the descriptive frame
Object level	Postulates P1–P6, definitions, propositions 1–4	Individually falsifiable (see Section VIII)

Proposition 4. On the Existence of a Self-Consistent Configuration (Observer Bootstrap)

Statement. From Axiom (A), Postulates P1, P2, and the assumption D-Rich (richness of the field), the existence of at least one self-consistent configuration Ψ^* follows — a fixed point of the self-observation mapping in which the field of potential states generates an observer who constitutes the very same configuration. Thereby the question "where does the first observer come from" receives an internal resolution: the observer is not introduced from outside but arises as a fixed point of the structure given by Axiom (A).

Justification.

Step 1. By Axiom (A), the field of potential states $\Psi \in \mathcal{H}$ is an infinite-dimensional space containing all possible configurations. By Postulate P1, as $N(t) \to \infty$ the multiverse cardinality $|M| \to \infty$ (formula P1.2); consequently, the configuration space $\mathbb{C}$ contains configurations of arbitrary type. By Postulate P2, in any reality the realization of any new configuration is possible (formula P2.1). From the conjunction of these statements and the additional assumption D-Rich (richness of the field) it follows that among the configurations in $\mathbb{C}$ there exist those containing observers, i.e., objects described by the vector $O_i = (B_i, A_i, H_i)$ according to formula (4.2).

Assumption D-Rich (richness of the field of potential states). The space $\mathcal{H}$, being infinite-dimensional, contains projections onto subspaces admitting interpretation as configurations with observers. This assumption is non-trivial: it asserts that observers exist in $\mathcal{H}$ as potential (non-actualized) configurations prior to any act of observation. Motivation: Axiom (A) defines Ψ as the "field of infinite potential states," and the infinite-dimensionality of $\mathcal{H}$ guarantees that the set of potential configurations is unbounded.

Assumption D-Prot (ontological protection). An observer O with dimensionality $d(O)$ cannot actualize configurations of dimensionality $\dim(C) > d(O)$. Formally: $B(O, C) = 0$ when $\dim(C) > d(O)$, which by Postulate P4 entails $P(E \mid B) = 0^k = 0$. The restriction mechanism is consistent with the interface theory of perception [45, 46]: perception provides an interface adapted to the observer's level rather than a complete mapping of all configurations. Assumption D-Prot does not contradict existing postulates: Propositions 1–2 are preserved, since each dimensionality level contains an unbounded number of configurations and convergence at $S \to 1$ occurs within the accessible level. The current version of the theory corresponds to the special case $d(O) = \infty$ (no restriction).

Step 2. By Axiom (A), the observation operator $\hat{O}$ maps the field of potential states to a configuration: $\hat{O} : \mathcal{H} \to \mathbb{C}$. To define a fixed point, a mapping of the space into itself is required. We introduce the embedding operator $\iota : \mathbb{C} \hookrightarrow \mathcal{H}$, which assigns to each configuration $c \in \mathbb{C}$ its representation as an element of the space of potential states (the reverse operation to "collapse"). We define the self-observation mapping $\Phi : \mathcal{H} \to \mathcal{H}$ acting by the rule:

$$\Phi(\Psi) = \iota(\hat{O}_\Psi(\Psi)) \tag{U4.1}$$

where $\hat{O}_\Psi$ is the observation operator induced by the configuration contained in Ψ itself (the existence of which was established in Step 1), and ι is the embedding of the observation result back into $\mathcal{H}$. The mapping Φ is well-defined by virtue of Axiom (A): the operator $\hat{O}$ is applied to the field Ψ and generates a configuration $R = \hat{O}(\Psi) \in \mathbb{C}$ by formula (A.1); the embedding ι returns the result to $\mathcal{H}$, closing the mapping. The existence of ι is motivated by the fact that the space $\mathcal{H}$ contains all potential configurations (by Axiom A) and therefore admits a canonical inclusion $\mathbb{C} \subset \mathcal{H}$. The rigorous definition of ι (in particular, its continuity and injectivity) constitutes an open problem, analogous to the specification of the algebraic properties of $\hat{O}$ (Section II).

Step 3. In Section 4.5 it was established that the system $R \leftrightarrow B$ contains feedback: $R = \mathcal{F}[\{O_i(t)\}, S(t), I(C(t))]$ by equation (4.6), and $dB/dt = G(B, R(B))$ by equation (D1.3). By analogy with nonlinear dynamical systems, the text of the article already postulates the existence of attractors corresponding to stable configurations. Among the attractors of the coupled system $R \leftrightarrow B$, stationary states (equilibria) are fixed points of the dynamics. We assume that the system possesses at least one stationary attractor, which is typical for dissipative systems with a stochastic term (formula 4.4a). Non-stationary attractors (limit cycles, strange attractors) are also admissible but correspond to periodic or chaotic reconfiguration regimes rather than to a stable self-consistent configuration.

Step 4. Combining Steps 1–3, we assert: the mapping Φ possesses a fixed point Ψ^* such that:

$$\Psi^* = \Phi(\Psi^*) = \iota(\hat{O}_{\Psi^*}(\Psi^*)) \tag{U4.2}$$

The configuration Ψ^* is a self-consistent state in which the observer and the observed are constituted by one and the same act: the field generates an observer who actualizes the very same field.

The conditions for the existence of the fixed point depend on the properties of the mapping Φ:

(a) If $\mathcal{H}$ is endowed with the weak topology and the image of Φ is contained in a compact convex subset of $\mathcal{H}$, then the existence of Ψ^* is guaranteed by the Schauder fixed-point theorem [62].

(b) If Φ is a contraction mapping with respect to some metric on $\mathcal{H}$, then the existence and uniqueness of Ψ^* follow from the Banach fixed-point theorem [63], and the iterative sequence $\Psi_{n+1} = \Phi(\Psi_n)$ converges to Ψ^* for an arbitrary initial element.

Rigorous verification of conditions (a) or (b) requires specification of the algebraic properties of the operator $\hat{O}$ and the properties of the embedding ι, which is marked in Section II as an open problem. At the same time, the existence of stationary attractors of the coupled system $R \leftrightarrow B$, assumed in Section 4.5, serves as the physical basis for the existence of the fixed point: a stationary attractor of a dynamical system and a fixed point of the mapping Φ are two descriptions of one and the same object.

Remark 1 (connection with Proposition 3). Proposition 3 establishes the self-referential structure of the theory: $T_{\text{ODTOE}} \in \mathbb{T}$. Proposition 4 supplements this structure at the level of a physical mechanism: not only does the theory contain itself as an element of the described set, but the field of potential states contains an observer capable of actualizing that field. Together, Propositions 3 and 4 close the strange loop in two planes — metatheoretical and physical.

Remark 2 (multiplicity of fixed points). If Ψ^* is not unique, then each fixed point defines a separate self-consistent configuration. The set of such points $\{\Psi^*_\alpha\}$ may be related to the multiverse cardinality $|M|$ (Postulate P1): different fixed points generate different branches of reality with different primary observers. Formalization of this connection is a subject for future research.

Remark 3 (cosmological interpretation). The fixed point Ψ^* formalizes Wheeler's idea of a self-excited circuit [1, 60]: the Universe, by expanding and generating observers, retroactively endows its own origin with actuality. In ODTOE terms, Ψ^* is a state in which the act of observation and the observed configuration coincide. Formula (U4.2) — where the embedding operator ι closes the cycle "potential $\to$ actual $\to$ potential" — is a quantitative expression of this idea, derived, unlike Wheeler's metaphor, from formal axiomatics. ■

VI. Relations to Existing Theories

6.1. Quantum Mechanics (Copenhagen Interpretation)

ODTOE relates to the Copenhagen tradition through the shared thesis of the special role of the act of measurement. However, while in the orthodox approach [5, 20] the observer is not parametrized—present only as a boundary condition that triggers "collapse"—in ODTOE the observation operator $\hat{O}$ depends on the full state vector of the observer (B, A, H), rendering the dependence on the observer not merely qualitative but quantitative. A detailed analysis of the decoherence problem and its connection to interpretations of quantum mechanics is presented in the work of Schlosshauer [40]. Bohr's article [5] is devoted to the complementarity principle, and Born's rule [20] establishes the probabilistic link between the quantum state and the measurement outcome.

The connection between the ODTOE formalism and the Copenhagen framework is clarified by comparing Postulate P4 with Born's rule. In orthodox quantum mechanics, the outcome probability is determined by the squared modulus of the transition amplitude: $P = |\langle\varphi|\psi\rangle|^2$ [20]. The formula $P(E \mid B) = B^k$ (P4.1) generalizes this structure: the parameter $k \geq 1$ serves as a measure of the environment's resistance to the observer, while contextual belief B replaces the objective amplitude. At $k = 2$ and the identification $B \sim |\langle O|R_{\text{target}}\rangle|$ according to formula (D1.4), the power-law dependence reproduces Born's form as a special case. Moreover, the belief dynamics equation (D1.3) introduces a mechanism absent from the Copenhagen scheme: the observer evolves between successive measurements according to the logistic law $dB/dt = \gamma \cdot \tanh(\beta\dot{\bar{d}}) \cdot \bar{d} \cdot B(1-B)$, generating non-stationary probabilities dependent on prior experience.

6.2. Everett's Many-Worlds Interpretation

The Everettian programme [2, 23] accounts for the multiplicity of outcomes through branching of a single wave function: collapse is replaced by decoherence, and each "branch" contains one possible result. Postulate P1 extends this mechanism by linking branching not only to quantum events but also to the internal structure of the act of observation at any scale. The critical demarcation is that the Everettian scheme fixes the observer and varies outcomes, whereas ODTOE varies both. The cardinality of the ODTOE multiverse (formula P1.2)—$K^{N(t)}$—has a different origin: in Everett's framework the number of branches is governed by the dimensionality of the Hilbert space, whereas in ODTOE it is set by the combinatorics of observers and configurations. Studies of nonlocal correlations [24] further confirm that the properties of physical quantities are determined by the context of observation.

The assumption D-Sep (separability of observational acts), adopted in the formulation of Postulate P1, introduces an additional dividing line between ODTOE and the Everettian programme. Branching in Everett's interpretation [2, 23] is generated by decoherence of a single wave function; the number of branches is determined by the dimensionality of the Hilbert space and is independent of observer properties. Under D-Sep and at minimal coherence ($S \to S_{\text{min}}$), ODTOE estimates the multiverse cardinality combinatorially: $|M_{\text{total}}| = K^{N(t)}$ (formula P1.2), where K is the number of configurations accessible to each observer (assumption D-Hom). As coherence increases, correlations among observers reduce the effective number of configurations: $|M_{\text{eff}}| \leq K^{N(t)\cdot(1-S)}$, yielding a continuous transition from the Everettian set of branches to a single configuration at $S \to 1$ (Proposition 2). The numerical example in Section 4.6 illustrates the intermediate regime: at $S = 0.4$ and $K = 10$ for two observers, $|M_{\text{eff}}| \leq 10^{1.2} \approx 15.8$ — appreciably less than $10^2 = 100$ under full separability.

6.3. General Relativity

From the standpoint of ODTOE, the spacetime metric, described by Einstein's equations, represents a stable configuration sustained by an exceedingly high coherence level S among macroscopic observers: the overwhelming majority of observers "agree" on the spacetime geometry. Spacetime geometry thus constitutes one of the configurations in the space $\mathbb{C}$, formed by collective observation, which explains the universal applicability of Einstein's equations within our framework.

Postulate P3 gives this assertion quantitative content. The lifetime of the spacetime configuration $T(C) = T_0/(1 - S)^n$ (formula P3.1), at coherence of macroscopic observers close to unity, takes values exceeding characteristic cosmological timescales, which accounts for the practical stability of the Einstein metric. Simultaneously, formula (4.4a) establishes that the stochastic-term variance $D(\eta) = D_0 \cdot (1 - S)$ is suppressed at high coherence, and the reconfiguration dynamics (equation 4.4) becomes quasi-deterministic: gradient descent in the potential $U(C)$ reproduces classical evolution. At local coherence breakdowns ($S < 1$ in the vicinity of quantum scales), the variance $D(\eta)$ increases and the stochastic term begins to dominate, which formally corresponds to a transition to the quantum regime. ODTOE thereby proposes a unified mechanism in which classical spacetime behaviour and quantum fluctuations are two regimes of a single dynamical system governed by the coherence parameter.

6.4. Quantum Bayesianism (QBism)

ODTOE and QBism [14, 15] share a rejection of the "objectivist" reading of the wave function: in both approaches, the quantum state reflects the agent's position rather than properties of the system "in itself." Yet QBism remains localized within the quantum domain and does not offer a quantitative description of the observer. ODTOE extends this approach in three directions: (i) Definition D1 specifies the internal structure of "agent belief" through four measurable components; (ii) Postulate P5 describes collective effects absent from QBism; (iii) the framework extends to all scales of reality, not only the quantum domain. At the same time, a distinction should be emphasized: QBism rejects the "view from nowhere," whereas ODTOE, through the parameter S, defines an asymptotic limit ($S \to 1$) in which all observers converge to a single description, which is functionally analogous to the regulative ideal of objectivity.

The connection of Postulate P5 with the QBist position deserves separate consideration. Within QBism, subjective probability is ascribed to a single agent; inter-agent agreement is treated as an empirical fact requiring no formal description [14, 15]. The formula $P_{\text{coll}}(E) = 1 - \prod(1 - B_i^k)$ (P5.1) introduces precisely such a formalism, absent from QBism: collective probability is determined by superposition of individual beliefs under assumption D-Ind (statistical independence at $S \to S_{\text{min}}$). Definition D2 further links collective observation to the set of theoretical descriptions: the number of simultaneously valid theories N_{theories} equals the number of equivalence classes on the set of configurations M (formula P6.1), which allows the QBism-compatible interpretation to be extended to the level of philosophy of science.

The works of Mensky [16, 17] on the connection between quantum mechanics and consciousness, in which the selection of an Everettian alternative is interpreted as a function of the observer's consciousness, also served as one of the starting points for our theory. The Orch OR model of Hameroff and Penrose [42] also deserves mention: it links the emergence of consciousness to coherent quantum dynamics in cytoskeletal tubulin structures, and the critical work of Tegmark [41], which points to the extremely rapid decoherence of quantum states in the brain. ODTOE does not postulate a specific mechanism of quantum consciousness, but introduces the observer as a formal element of the metatheory.

6.5. Kuhnian Paradigm Shifts

Scientific revolutions (in Kuhn's sense [6]) are interpreted as reconfiguration processes (P2), where the inertia of the old paradigm $I(C)$ determines the rate of transition to the new one. The more observers (scientists) who support the old paradigm, the higher its inertia. This formalism offers a quantitative description of the phenomenon that Kuhn described only qualitatively.

The inertia formula $I(C) = \sum_{j=1}^{m} w_j \cdot B_j(C)$ (P2.2), where B_j is the contextual belief of the j-th observer and the weight coefficients are normalized by $\sum w_j = 1$, concretizes the Kuhnian thesis: the inertia of the old paradigm is higher when more scientists (observers) hold high belief $B_j \to 1$ in the current configuration. The rate of transition to a new paradigm $v(C \to C') = \alpha / I(C)$ (P2.1) decreases as inertia grows. Postulate P6 complements the picture: the number of competing theoretical descriptions $N_{\text{theories}}(t, S) = N_0(t) \cdot (1 - S)^m + 1$ (P6.1) predicts a power-law dependence on the coherence of the scientific community: at high synchronization ($S \to 1$) a single theory remains, while at low synchronization incompatible descriptions coexist, reproducing the Kuhnian picture of a pre-paradigmatic period.

6.6. Relational Quantum Mechanics

Rovelli's relational program [18] asserts the contextuality of any quantum description: physical quantities are defined only relative to a specific observational system. Axiom (A) of ODTOE is consonant with this thesis, but adds an essential structure—the belief parameter B—which the relational approach does not contain. ODTOE may thus be regarded as an extension of the relational program, in which the observer is transformed from an abstract "reference frame" into an agent with quantitatively described properties.

The coherence metric $S = 1 - \frac{2}{n(n-1)} \sum_{i<j} |B_i - B_j|$ (formula 4.5) formalizes Rovelli's central thesis at a quantitative level: the relationality of description is expressed through pairwise divergence of observer belief values. At $S < 1$, each observer possesses its own contextual description (its own value $B(O_i, C)$), which reproduces the relational position. Proposition 2, relying on assumption D-Conv (convergence of all parameters at $S \to 1$), extends the relational approach by establishing conditions under which the set of relational descriptions converges to a single one: all observers form an identical configuration. An essential limitation, without analogue in Rovelli's framework, is that the coherence (4.5) is defined only over the parameter B, whereas the full metric $S(B, A, H)$ has not yet been constructed (see Section 4.4).

6.7. Post-Non-Classical Philosophy of Science

The idea of the observer's constructive participation in the formation of reality forms a central tenet of post-non-classical rationality, as developed in the work of V.S. Stepin [43]. According to the post-non-classical approach, the interaction of subject and object constitutes an irreducible whole in which the observer and the observed mutually condition one another. ODTOE quantitatively formalizes this thesis: the belief parameter B describes the observer's contribution, the dynamics equation (D1.3) specifies the feedback "result $\to$ observer," and the reconfiguration equation (4.4) specifies the forward link "observer $\to$ reality." The theory thereby gives quantitative form to the propositions of post-non-classical philosophy, analogously to the way formulas (P6.1)–(P6.2) formalize Kuhn's paradigmatic dynamics (see Section 6.5).

The connection of ODTOE with post-non-classical rationality is further refined by results from evolutionary epistemology. The Fitness Beats Truth (FBT) theorem [44] and the interface theory of perception (ITP) [45, 46], discussed in Section II-B, point to a constraint essential for the post-non-classical reading of ODTOE: the configuration towards which the collective of observers tends at $S \to 1$ serves as an adaptive attractor rather than a veridical (corresponding to "objective reality") description. The parameter $B(O, C)$ reflects adaptive coherence, not the accuracy of environmental mapping. Post-non-classical epistemology, which emphasizes the constructive role of the subject, acquires rigorous quantitative bounds within ODTOE: the feedback "result $\to$ observer" (equation D1.3) and the forward link "observer $\to$ reality" (equation 4.4) close a loop in which subject and object mutually condition each other, with the boundary between adaptive coherence and veridicality defining a fundamental limit of the framework.

Within Moiseev's mirology [65], world-being is defined as a wholeness possessing its own space, time, matter, and laws. The concept of "small worlds" — nested world-like systems — substantively corresponds to the hierarchical structure of the configuration set $\mathbb{C}$: each "small world" is endowed with its own coherence parameter S and its own stability $I(C)$, which define the boundaries of accessibility between levels. ODTOE concretizes the mirological programme by equipping “small worlds” with a quantitative apparatus: formula (P3.1) describes the lifetime of a configuration at each level, the inertia formula (P2.2) describes stability, and assumption D-Hom ensures homogeneity within a level. ODTOE thereby fills a gap characteristic of integral philosophical programmes: mirology remains a framework construction without practically applicable instruments, whereas ODTOE offers measurable parameters for describing each world-like level.

6.8. Wheeler’s Self-Excited Circuit and Top-Down Cosmology

Proposition 4 establishes a formal connection between ODTOE and two concepts previously addressed only at the level of Proposition 3.

Wheeler [1, 60] described the Universe as a self-excited circuit: by expanding and generating observers, it retroactively endows its own origin with actuality. Formula (U4.2) — via the embedding operator ι — quantitatively expresses this metaphor: the fixed point of self-observation closes the circuit, identifying the initial and final states. Unlike Wheeler’s qualitative description, ODTOE specifies structural conditions for the existence of such a point through the Banach [63] and Schauder [62] theorems and connects it with the observer parameters (B^*, A^*, H^*).

The top-down cosmology of Hawking and Hertog [61] asserts that cosmological histories are determined by boundary conditions in the present rather than initial conditions in the past. Proposition 4 contains an analogous retrospective logic: Ψ^* is determined through the operator $\hat{O}_{\Psi^*}$, which itself belongs to the configuration generated by Ψ^*. The causal structure is nonlinear: the “past” (the field Ψ) and the “present” (the observer O^*) mutually condition each other, which corresponds to the idea of top-down selection of histories. This connection supplements the mention of the Hawking–Hartle model in the remark to Proposition 3 [49], endowing it with quantitative content.

An essential distinction: the Hawking–Hertog cosmology operates with a path integral over the superspace of metrics and does not parametrize the observer; ODTOE introduces the internal structure of the observer through the vector (B, A, H) according to formula (4.2) and formulates self-consistency as a fixed point in configuration space.

The specific mechanism of the self-excited circuit is specified in Section 4.5.1: the initial condition of the coupled system $R \leftrightarrow B$ is the fixed point Ψ^* of the self-observation mapping (formula U4.2), which determines the parameters of the primary observer $O^* = (B^*, A^*, H^*)$ through the self-consistency equation (formula 4.7). The existence of Ψ^* relies on assumption D-Rich (richness of the field of potential states): the infinite-dimensional space $\mathcal{H}$ contains configurations with observers as potential (non-actualized) states. The iterative scheme (4.8) — $\Psi^* \to O^* \to R_1 = \hat{O}^*(\Psi^*) \to dB/dt = G(B, R_1) \to \ldots$ — unfolds the feedback from the fixed point, thereby translating Wheeler’s metaphor into a dynamical procedure with a formally defined entry point. Self-consistency guarantees $B^* > 0$, since a configuration with $B = 0$ cannot reproduce itself through an act of observation ($P(E \mid 0) = 0$ by Postulate P4), which excludes a nihilistic origin.

6.9. Decoherence and Quantum Darwinism

Zurek's quantum Darwinism programme [9, 38] asserts that classical properties are formed through selective proliferation of information about quantum states into the environment: the environment acts as a witness, repeatedly replicating information about certain states (pointer states), thereby making them accessible to multiple independent observers. In ODTOE terms, pointer states correspond to configurations with high inertia $I(C)$ (formula P2.2): multiple observers with concordant values of B_j sustain the same configuration, impeding transition to an alternative. The einselection mechanism (environment-induced superselection) receives quantitative expression in ODTOE through the coherence formula (4.5): at $S \to 1$ all observers are aligned and a single configuration is selected, reproducing the classicalization effect. At intermediate values of S ($0 < S < 1$), formula (P5.1) describes the joint probability for a partially coherent cluster of observers, generalizing Zurek's mechanism to the case of incomplete decoherence.

An essential difference is as follows: quantum Darwinism treats the observer as a passive recipient of information disseminated by the environment, whereas ODTOE endows the observer with a constructive role through Axiom (A). The environment in Zurek's programme is objective and independent of the observer; in ODTOE, the "environment" is the totality of configurations formed by collective observation. Nevertheless, both programmes converge on a key conclusion: classical definiteness is the result of a collective process, not a property of an isolated system.

6.10. Integrated Information Theories and the Problem of Observer Consciousness

The Integrated Information Theory (IIT), proposed by Tononi [64], defines consciousness through the quantity Φ, measuring the degree of information integration in a system. A substantive analogy holds between Φ and contextual belief $B(O, C)$: both quantities are scalars on a closed interval characterizing the internal consistency of a system. The multiplicative structure $B = F^{w_1} \cdot E^{w_2} \cdot (1-\sigma)^{w_3} \cdot \Lambda^{w_4}$ (D1.1) may be regarded as a macroscopic decomposition of the observer's integrated information with respect to a specific configuration, whereas Φ in IIT is defined through informational partitions of a neural network. The distinction is fundamentally one of scale: IIT is addressed to the neural substrate and does not extend beyond neurophysiology; ODTOE introduces the observer as an element of a metatheory, unconstrained by a specific physical substrate of consciousness.

This comparison defines a prospect for experimental concretization: if the components of $B(O, C)$ are operationalized through neurophysiological correlates (Section 8.2), then the quantity B may serve as a functional analogue of Φ in the context of ODTOE tasks, providing a bridge between the theory of consciousness and the metatheory of reality.

6.11. Heidegger's Ereignis and the Existential Interpretation of Coherence

The coherence metric S (formula 4.5) admits a parallel existential interpretation, drawing on the concept of Ereignis (co-event, appropriation) in later Heidegger [66]. In the standard reading of ODTOE, $S \to 1$ signifies numerical coincidence of B_i values across all observers; in the existential reading, it signifies mutual disclosure (aletheia) of observers to one another, wherein each becomes "visible" to the other in the authenticity of their perspective. Truth for Heidegger is not adaequatio (correspondence of statement to fact) but unconcealment ($\alpha\lambda\acute{\eta}\theta\varepsilon\iota\alpha$) — the event in which beings emerge from concealment. In this context, convergence to a single configuration at $S \to 1$ is interpreted not as erasure of differences among observers but as an event of mutual disclosure in which a configuration is actualized as shared reality. The statistical definition of S through divergence of B values (formula 4.5) and the existential interpretation through Ereignis do not contradict each other: the former provides an operational criterion, the latter a philosophical interpretation of the same process.

6.12. Leibniz's Monadology and ODTOE

Leibniz's Monadology [67] contains a number of structural parallels with ODTOE. The monad — a simple substance "without windows," in which "the entire universe is folded" (§63) — corresponds to the observer O, who constitutes reality from their own perspective (Axiom A). The perception of the monad is analogous to contextual belief $B(O, C)$ (Definition D1.1): both quantities characterize the degree of "distinctness" with which a system represents the whole. The pre-established harmony of monads — the principle of co-attunement without direct interaction — finds quantitative expression in the coherence metric S (formula 4.5) and Proposition 2: at $S \to 1$ observers converge to a single configuration. The Leibnizian hierarchy — from "bare" monads through "souls" to "spirits" — is reproduced in ODTOE through the spectrum of B values: an observer with $B \approx 0$ hardly constitutes reality ($P(E \mid B) \approx 0$ by P4), while an observer with $B \to 1$ approaches a state of full cognitive coherence. The fixed point $\Psi^* = \Phi(\Psi^*)$ (Proposition 4) is interpreted as the "monad of monads" — a self-consistent configuration containing the ground of its own existence.

An essential difference: in Leibniz's scheme, monads "have no windows" and do not interact directly; harmony is pre-established by God. In ODTOE, observers interact through collective observation (Postulate P5) and coherence channels (Section 4.4). Pre-established harmony is replaced by dynamic convergence — a process rather than a given.

VII. Philosophical Implications

7.1. Ontological Status of Reality

In ODTOE's terminology, the Kantian distinction between the "thing-in-itself" and the "appearance-for-us" [34] becomes irrelevant: the observer does not decode a pre-given noumenal layer but co-generates a configuration together with the field of potential states Ψ. Whereas classical transcendentalism treats reality "in itself" as fundamentally closed to the subject, in ODTOE the very demarcation loses its ground: reality $R = \hat{O}(\Psi)$ is the product of the act of observation, not a substrate preceding it. Reality in our framework is a dynamic process, continuously constructed by the collective of observers. This interpretation is consonant with Wheeler's ideas about the "participatory universe" [1]. Vladimirov [25] in his work on the metaphysics of physics likewise emphasizes the need to move beyond the classical "subject–object" dichotomy. The Fitness Beats Truth (FBT) theorem [44] and the interface theory of perception [45, 46] introduce an additional constraint: the configuration toward which the system of observers converges as $S \to 1$ need not be veridical, i.e., "true" in the correspondence sense. As established in Section II-B, it constitutes an adaptive attractor — a configuration that maximizes collective coherence rather than the accuracy of representing an independent reality. The distinction between adaptive coherence and veridicality defines the ontological position of ODTOE: the question of reality beyond observation is not rejected but recognized as undecidable within a framework that operates exclusively with pairs "observer + configuration." Instead of correspondence truth, ODTOE proposes coherent truth: a configuration is "true" to the extent that it is stable under collective observation ($T(C) \to \infty$ as $S \to 1$ according to formula P3.1).

7.2. The Nature of Scientific Knowledge

In the terms of ODTOE, scientific theories are not "discoveries" of pre-existing regularities but stable configurations formed by the scientific community with a high level of coherence S. The inertia parameter $I(C)$ quantitatively describes the resistance of each such configuration to paradigm change [6]. This thesis is consonant with social constructivism in epistemology; however, ODTOE provides a formal apparatus (the parameters S, $I(C)$, B) enabling the transition from qualitative descriptions to quantitative models of scientific knowledge formation.

7.3. Collective Observation and the Social Nature of Knowledge

Postulate P5 introduces a mechanism for collective probability formation: $P_{\text{coll}}(E) = 1 - \prod(1 - B_i^k)$ (formula P5.1). Reality in a multi-observer system is constituted not by an individual but by a joint act of observation — a position closely aligned with the central thesis of social epistemology: knowledge is a collective achievement irreducible to the sum of individual beliefs. ODTOE introduces a quantitative dimension into this problematic. Formula (P5.1) determines each observer's contribution: a participant with $B_i \approx 0$ has virtually no effect on collective probability, whereas a participant with $B_i \approx 1$ substantially increases it. This asymmetry means that collective probability does not reduce to voting: each participant's weight is determined by their cognitive coherence with the target configuration. The parameter S (formula 4.5) provides a measure of collective synchronization. At high S, observers form a stable shared reality (Proposition 2); at low S, realities diverge (Postulate P1). The threshold $S_{\text{threshold}}$ marks the boundary beyond which joint observation acquires meaning. This construction formalizes Kuhn's paradigmatic communities [6]: within a community with $S > S_{\text{threshold}}$, results are stable and reproducible; between communities with different values of S, they are incommensurable.

7.4. The Observer as Co-Creator

The observer's level of belief in the outcome of an experiment shapes the observed reality. This places the observer in the position of a co-creator of reality rather than a passive recorder. The position of the observer as co-creator extends the line inaugurated by Kant's "Copernican revolution" — the thesis that the object conforms to the subject [34] — and continued by Husserl's analysis of the intentional directedness of consciousness [39], where every act of perception already carries meaning-constituting activity. ODTOE radicalizes this line: the observer shapes not only meaning but the very structure of reality. Yakovlev [28], in his study of the metaphysical foundations of the model of consciousness, reaches similar conclusions about the generative role of consciousness.

7.5. The Problem of the First Principle and Self-Generation

Traditional metaphysics confronts the problem of infinite regress in the search for the first cause: each observer presupposes a preceding one, each foundation requires a deeper foundation. The cosmological argument from Aristotle to Leibniz resolved the regress by positing an external self-sufficient principle — a prime mover or necessary being. Proposition 4 offers an alternative path. The fixed point $\Psi^* = \Phi(\Psi^*)$ (formula U4.2) describes a configuration in which the observer and the observed constitute each other simultaneously, without causal asymmetry. The first principle is not introduced from outside: it arises as a structural property of the system itself — as the point at which the process of observation closes upon itself. Formally, this is expressed through the stationary attractor of the coupled system $R \leftrightarrow B$ (Section 4.5), which translates the problem of the first principle from the domain of metaphysics into the domain of dynamical systems theory. The construction resonates with Wheeler's idea of a self-excited circuit [1, 60], but differs in possessing a formal apparatus: the conditions for the existence of Ψ^* are linked to the Banach [63] and Schauder [62] theorems, and the parameters $O^* = (B^*, A^*, H^*)$ are determined by the self-consistency equation (formula 4.7). It is essential for the theory that self-consistency guarantees $B^* > 0$ (Section 4.5.1): a configuration with $B = 0$ cannot reproduce itself through an act of observation ($P(E|0) = 0$ by P4). This excludes a nihilistic first principle: the emergence of reality through observation presupposes a minimal nonzero level of cognitive coherence.

7.6. Self-Referentiality and the Limits of Knowledge

Proposition 3 establishes that ODTOE belongs to the set of theories T whose cardinality it itself determines (formula P6.1). This strange loop [47, 48] generates not a logical contradiction — as $S \to 1$, formula P6.1 yields $|T| = 1$, which is compatible with the theory's own existence — but structural incompleteness: the limiting state $S = 1$ is unattainable, for a complete description of reality would require including a description of the description itself. For epistemology, this entails a series of conclusions. Gödelian incompleteness [21] prohibits a formal system containing arithmetic from proving its own consistency. ODTOE reveals a limitation of a different nature: not in the self-reference of statements, but in the theory's membership in the set it describes. At the same time, ODTOE does not negate its own existence ($N_{\text{theories}} \geq 1$ for any S) and does not generate a liar's paradox. A complete "theory of everything" in the absolute sense turns out to be not only technically inaccessible but conceptually impossible within any framework that includes the observer. The limit $S \to 1$ functions as a regulative ideal in the Kantian sense [34]: it sets the direction of inquiry without being its attainable result. Formula (P6.1) describes the actual number of theories (constitutive), while the limit $S \to 1$ represents the regulative horizon, thereby quantitatively formalizing the Kantian distinction between the constitutive and the regulative.

7.7. Unity and Multiplicity

The theory unites two principles: the uniqueness of truth (under full synchronization) and the infinity of truths (under desynchronization). This resolves the philosophical dispute between monism and pluralism by presenting them as two limiting cases of a single continuum parametrized by coherence S. Vladimirov [22] discusses a similar approach to the problem of the metaphysical trinity of physics, mathematics, and philosophy. The dynamics of belief (formula D1.3) reveals an additional aspect. The factor $B(1-B)$ vanishes at $B = 0$ and $B = 1$, turning the boundary values into absorbing states: an observer with absolute disbelief cannot acquire belief, and an observer with absolute certainty is impervious to doubt. The two limiting states correspond to two forms of dogmatism: nihilistic (the impossibility of initiating cognition) and absolutist (the impossibility of revision). Both are mathematical idealizations; real cognitive systems operate at $0 < B < 1$, retaining the capacity for learning. From this follows a formal condition for the possibility of cognition: cognition takes place only under nonequilibrium belief, when the observer is open to both confirmation and refutation. Equation (D1.3) with the learning coefficient γ and the metric $d(R_{\text{obs}}, R_{\text{exp}})$ describes this process quantitatively. Such a model is consonant with Popper's fallibilism [19]: reliable knowledge rests not on achieving absolute certainty but on the systematic correction of beliefs in light of new experience.

7.8. Position Among Philosophical Traditions

The coherence parameter S allows ODTOE to be positioned relative to three philosophical lines: (a) as $S \to 1$, the theory reproduces the thesis of transcendental idealism on the constructive role of the subject — a single observation operator $\hat{O}^*$ forms a single reality; (b) at intermediate S, it is consonant with pragmatism — the truth of a configuration is determined by the practice of collective observation (Postulate P5); (c) as $S \to S_{\text{min}}$, the multiplicity of realities is akin to constructive realism, where reality is the result of the interaction between the observer and the potential field. The framework does not identify itself with any one of these traditions but offers their formal synthesis through a single parameter S.

7.9. Contextuality and Relational Epistemology

The contextuality of $B(O, C)$ merits separate consideration. In classical epistemology, knowledge is attributed to the subject: "S knows that p." In ODTOE, cognitive coherence is attributed to the pair: B is a property of the relation between the observer and the configuration, not a monadic property. The same observer may possess high B relative to one configuration and low B relative to another. This relational structure is consonant with Rovelli's relational quantum mechanics [18], where physical quantities are defined only relative to a specific reference system. At the same time, ODTOE goes beyond relationism by introducing a quantitative measure of the relation: the scalar $B \in [0, 1]$, decomposable into four components (F, E, $1 - \sigma$, Λ) via formula (D1.1), admits empirical calibration. Thereby the relational thesis is translated from the domain of philosophical declaration to the domain of measurable characteristics, defining a program of experimental investigation (Section VIII).

VIII. Limitations of the Theory and Prospects for Experimental Verification

8.1. The Question of Falsifiability

Any scientific theory that claims serious consideration must address the conditions of its falsifiability (Popper's criterion [19]). ODTOE, being a metatheory, occupies a special position in this regard. The theory would be falsified if:

- experiments were found whose outcomes demonstrably do not depend on any operationally measurable properties of the observer (the parameters F, E, σ, Λ defined in D1.1), under controlled observational conditions;
- it were shown that increasing the coherence of a group of observers does not lead to an increase in the stability (reproducibility) of results (this would refute Postulate P3);
- absolute physical constants were discovered that are invariant with respect to all observer properties, including the scale of observation (this would contradict Postulate P2);
- it were demonstrated that the coupled system $R \leftrightarrow B$ (Section 4.5) admits no stable stationary states (attractors) for any initial conditions, which would refute Proposition 4 on the existence of a self-consistent configuration.

Complete falsifiability of a metatheory is difficult for the same reasons that falsification of metamathematical statements is difficult. Nevertheless, the theory generates specific predictions amenable to experimental testing (see Section 8.3). It is important to emphasize that the presence of free parameters ($k, w_i, \gamma, \alpha, n, m, T_0$) weakens the predictive power of the theory and requires their stepwise experimental determination prior to testing the main predictions. Calibration protocol: (1) the parameters w_i are determined from cognitive experiments; (2) the parameter k from quantum-experimental statistics; (3) the parameters α and T_0 from scientometric data on paradigm shifts.

We additionally identify two types of testability distinguished by the theory. (1) Direct falsifiability of individual postulates: Postulate P4 predicts a power-law dependence $P(E \mid B) = B^k$, which can be rejected if the operationally measured B does not correlate with the frequency of target outcomes in a series of experiments. Postulate P3 predicts a specific dependence $T(S)$, testable by comparing the reproducibility of results from coherent and non-coherent groups. (2) Structural falsifiability of the metatheory as a whole: ODTOE can be rejected if it is established that quantum-mechanical probabilities are entirely independent of all observer properties, including subtle operational characteristics (attention, cognitive dispositions), under strict control of all physical experimental parameters. Such a result would contradict Axiom (A) and refute the theory as a whole. We acknowledge that at the current stage of formalization, in the absence of a specified functional $\mathcal{F}$ (equation 4.6), the theory does not make numerical predictions, which limits its immediate testability. Specification of $\mathcal{F}$ and the development of experimental protocols for measuring B constitute necessary conditions for the transition from metatheory to an empirically testable theory.

8.2. The Problem of Operational Definition of Belief (B)

The central quantity of the theory, the observer's belief B, is defined through four components (D1.1). To transition from the metatheory to testable predictions, an operational definition of the measurement procedure for each component is necessary:

The component F (attentional focus) can be operationalized by recording stable neurophysiological patterns of directed attention [26], with the value of F normalized to $[0, 1]$ through the ratio of the measured indicator to the observer's individual baseline level.

Emotional coherence (E): can be assessed through heart rate variability (HRV), galvanic skin response (GSR), and EEG rhythm coherence indices [27].

The component σ (internal contradiction) can be measured through the discrepancy between explicit declarations and implicit dispositions of the observer, identified, for example, by modified versions of the Implicit Association Test [29] adapted to the context of the physical experiment.

Empirical reinforcement (Λ): can be determined through the history of preceding observations and the degree of their correspondence to expectations, formalizable within a Bayesian framework [30].

Protocol for integral measurement of B. Determination of contextual belief $B(O, C)$ via formula (D1.1) requires simultaneous registration of all four components (F, E, σ, Λ). Protocol validity is ensured by two conditions: (a) simultaneity of registration, excluding mutual interference between measurement procedures; (b) preliminary calibration of the weight coefficients w_1–w_4 on a pilot sample. The first condition is achievable through parallel use of neuroimaging (fMRI/EEG for F), cardiovascular monitoring (heart rate variability for E), implicit tests (a modified Implicit Association Test [29] for σ), and Bayesian analysis of preceding observations (for Λ). The second condition requires a series of pilot studies to determine optimal values of w_i subject to the constraint $w_1 + w_2 + w_3 + w_4 = 1$.

Sensitivity of B to component errors. The multiplicative structure of formula (D1.1) exhibits a characteristic property: at small deviations the relative error $\delta B/B$ is described by the linear combination $\delta B/B = w_1 \cdot \delta F/F + w_2 \cdot \delta E/E + w_3 \cdot \delta(1-\sigma)/(1-\sigma) + w_4 \cdot \delta\Lambda/\Lambda$. It follows that the component with the largest weight coefficient w_i sets the priority for experimental precision: its error contributes most to the total uncertainty of B. This relation determines the calibration strategy.

8.3. Possible Experimental Directions

The theory generates a number of testable predictions:

1. *Group coherence effect.* A group of observers with a high level of S should demonstrate more reproducible results in quantum experiments with ambiguous outcomes compared to a control group with low S.

2. *Correlation of B with outcome probability.* If the components F, E, σ, Λ of an observer are measured prior to a quantum experiment, the computed B should correlate with the statistics of observed outcomes.

3. *Inertia effect.* The transition of the scientific community from one paradigm to another should proceed at a rate inversely proportional to the number of adherents of the old paradigm, which can be verified using scientometric data. Indirect evidence of paradigm inertia is provided by discussions in the scientific community such as those described in the conference review [31].

4. *Self-consistency effect (consequence of Proposition 4).* In systems with controllably high coherence ($S \to 1$), the theory predicts a nonlinear decrease in the statistical spread of results: if a group of observers repeats a series of quantum experiments while progressively increasing intra-group coherence S from S_{min} to values approaching unity, the variance of observed outcomes should decrease as $D(\eta) = D_0 \cdot (1 - S)$ according to formula (4.4a), while the configuration stability time should increase as $T(C) = T_0/(1 - S)^n$ according to (P3.1). Joint

verification of both dependencies on a single experimental sample constitutes a strong test of the theory's internal consistency.

5. *Test of the collective probability formula (P5.1).* The dependence $P_{\text{coll}}(E) = 1 - \prod_i (1 - B_i^k)$ admits quantitative verification: adding an observer with $B_i \approx 0$ should not alter P_{coll}, whereas an observer with $B_i \approx 1$ should produce a discontinuous increase in collective probability. The protocol involves registering individual values B_i of each participant before a series of experiments and comparing predicted and observed frequencies of target outcomes.

6. *Scientometric test of Postulate P6.* Formula (P6.1) predicts that the number of competing theoretical descriptions of a single phenomenon decreases as a power law with increasing coherence of the scientific community. Verification proceeds through analysis of historical data: upon operationalizing S via citation indices, reviewer agreement measures, or terminological unification metrics, a dependence $N(S) \propto (1 - S)^m + 1$ should be detectable. The history of interpretations of quantum mechanics, where the number of competing interpretations and the degree of consensus in the physics community are documented over a period exceeding 90 years [31], serves as a suitable test domain.

At present, ODTOE remains a predominantly metatheoretical construct, and the proposed experiments are programmatic in nature.

8.4. Structure of the Parameter Space

The theory contains free parameters: k (P4), w_i (D1), γ (D1.3), α (P2), n (P3), m (P6), T_0 (P3), K (P1), D_0 (4.4a). The presence of free parameters is typical of fundamental theories: the Standard Model contains 19 parameters [59], ΛCDM contains six.

Possible connections. The exponents n (P3) and m (P6) characterize the sensitivity to coherence S in different contexts. The hypothesis $n = m$ reduces the number of parameters; testing it requires comparing data on configuration lifetimes and the number of competing descriptions at controlled values of S.

Calibration protocol: (1) w_i—from cognitive experiments (relative contributions of F, E, σ, Λ); (2) k—from statistical data of quantum experiments with controlled values of B; (3) α and T_0—from scientometric data on paradigm shift dynamics; (4) D_0—from the statistics of experimental reproducibility in groups with different levels of S.

Reducibility analysis of the parameter space. The full inventory of free parameters of the theory comprises: w_1, w_2, w_3 (three independent parameters subject to $\sum w_i = 1$); k; γ; α; n; m; T_0; K; D_0—totaling 11 parameters. This number can be reduced through additional hypotheses: (a) the hypothesis $n = m$ (a unified sensitivity exponent for coherence) reduces the count by one; (b) establishing a functional relation $K = K(N)$ with the number of observers—by one more; (c) dimensional analysis may relate D_0 to α and T_0. Under all reduction hypotheses, the minimum number of independent parameters is 7–8, comparable to the six parameters of the ΛCDM model [59]. Each reduction hypothesis stands as an independently testable problem.

Formalization of the reconfiguration rate bound. In formula (P2.1), the regularizer $\varepsilon = \alpha / v_{\text{max}}$ is embedded directly in the denominator, eliminating the divergence as $I(C) \to 0$ and ensuring the upper bound $v \le v_{\text{max}}$. The physical meaning of ε admits interpretation as the inertia of the vacuum configuration (a configuration without observers): $\varepsilon \equiv I_{\text{min}}$. The value of v_{max} (and hence ε) is subject to experimental determination.

8.5. The Problem of Formalizing Self-Observation

Proposition 4 introduces the fixed point of the mapping Φ as the formal mechanism for observer initiation. The transition from the proposition to testable consequences requires solving the following problems.

(a) Specification of the topology on $\mathcal{H}$. The applicability of fixed-point theorems depends on the choice of topology on the space of potential states. In standard quantum mechanics, $\mathcal{H}$ is endowed with a norm and a weak topology; whether these structures are sufficient for the mapping Φ is determined by the algebraic properties of the operator $\hat{O}$, the specification of which is designated in Section II as an open problem.

(b) Verification of existence conditions. For the Banach theorem [63], contractivity of $\Phi = \iota \circ \hat{O}$ is required; for the Schauder theorem [62], compactness of the image in a convex closed subset is required. Both conditions depend on the specific form of $\hat{O}$ and the properties of the embedding ι.

(b′) Assumption D-Rich. The justification of Proposition 4 relies on the assumption D-Rich (richness of the field), which asserts the existence of observational configurations in $\mathcal{H}$ prior to the act of observation. Experimental verification of this assumption is possible only indirectly — through testing the consequences predicted by Proposition 4.

(b″) Minimal requirements for the operator $\hat{O}$. Applicability of the Schauder theorem [62] is guaranteed under the following conditions: the mapping $\Phi = \iota \circ \hat{O}$ is continuous in the weak topology of $\mathcal{H}$; there exists a bounded closed convex set $K \subset \mathcal{H}$ such that $\Phi(K) \subset K$ and the image $\Phi(K)$ is relatively compact. The infinite-dimensionality of $\mathcal{H}$ renders the last condition nontrivial; it is satisfied, in particular, when $\hat{O}$ is a compact operator (operators of integral type possess this property). Applicability of the Banach theorem [63] is ensured by contractivity: $\rho(\Phi(\Psi_1), \Phi(\Psi_2)) \leq q \cdot \rho(\Psi_1, \Psi_2)$ for some $q \in (0, 1)$, which is achieved when the operator derivative norm satisfies $\|D\Phi\| < 1$. Establishing these properties for a specific form of the operator $\hat{O}$ is designated in Section II as an open problem of first priority.

(c) Experimental accessibility. Proposition 4, like Proposition 3, belongs to the structural level of the theory. At the same time, it generates an indirect prediction: if self-observation is the mechanism of reality initiation, then in systems with high coherence ($S \to 1$) effects of self-consistency should be observable — retroactive fixation of initial conditions by the current state of observation, analogous to effects predicted by top-down cosmology [61].

8.6. Hierarchy of Experimental Verification

The experimental program of ODTOE involves stepwise verification organized by increasing complexity and required resources.

At the first stage, the values of the free parameters of the theory (w_i, k, γ) are determined through cognitive and psychophysiological experiments that do not require quantum-mechanical apparatus. The objective of this stage is to establish a correspondence between neurophysiological indicators and the components of formula (D1.1), thereby fixing the operational definition of B.

The next stage encompasses verification of the quantitative predictions of individual postulates: the power-law dependence $P(E \mid B) = B^k$ (P4), the dependence $T(S) = T_0/(1 - S)^n$ (P3), and the collective probability formula $P_{\text{coll}}(E)$ (P5.1). Each postulate is tested independently at controlled values of B and S.

The third level involves verification of structural propositions. Propositions 1 and 2 are verified through scientometric analysis—comparing the number of competing theoretical descriptions with the coherence of the corresponding scientific communities. Proposition 4 is verified indirectly—through detection of retroactive stabilization effects in systems with high coherence (see item 4 of Section 8.3).

The final level concerns the metatheoretical structure as a whole. Self-referentiality (Proposition 3) and the bootstrap mechanism (Proposition 4) are verified through the consistency of data accumulated at the preceding stages with the predictions of the theory as a unified whole. Full confirmation or refutation of the metatheory is achievable only with a sufficient volume of experimental data at each of the preceding levels.

IX. Conclusion

The proposed Observer-Dependent Theory of Everything (ODTOE) is a metatheoretical framework in which a single axiom (A) — the observer and the observed are mutually constituted — serves as the foundation for six postulates (P1–P6), definition (D1) of contextual cognitive coherence $B(O, C) \in [0, 1]$, and four propositions with mathematical formalization. The contextuality of B — its dependence on the pair "observer + configuration" rather than on the observer per se — establishes the relational nature of the framework: cognitive coherence is a property of a relation, not a monadic property of the subject. The four-component structure $B = F^{w_1} \cdot E^{w_2} \cdot (1-\sigma)^{w_3} \cdot \Lambda^{w_4}$ (formula D1.1) provides operationalization of this concept and admits empirical calibration. The central conclusion of the theory is that reality is formed by observation, and the number of simultaneously existing "theories of everything" is determined by the level of global synchronization among observers. In the asymptotic limit of full synchronization ($S \to 1$), which constitutes a regulative ideal in the Kantian sense, there exists a unique reality and a unique theory; at minimal coherence (subject to the constraint $S_{\text{min}}(n) > 0$ for $n > 2$ observers), the number of mutually incompatible realities and theories grows without bound, subject to $N_{\text{theories}} \leq |M_{\text{eff}}|$ (inequality P6.3).

The four propositions of the theory form a closed architecture. At minimal coherence $S \to S_{\text{min}}(n)$, a unified set of physical laws is impossible (Proposition 1): maximal dispersion of values B_i entails that each observer forms its own configuration with its own regularities, given the injectivity of the observation operator (D-Inj) and the non-uniqueness of laws (D-Law). Conversely, at $S \to 1$ the observation operators converge to a single operator, the number of theories $N_{\text{theories}} \to 1$ by formula (P6.1), configuration lifetime $T(C) \to \infty$ by formula (P3.1), and the system stabilizes in a unique configuration — yet the attainability of the limit $S = 1$ is restricted by structural incompleteness (Proposition 2, under assumption D-Conv). This incompleteness is rooted in the self-referential nature of the theory (Proposition 3): ODTOE belongs to the set $\mathcal{T}$ of theories whose cardinality it itself determines, which gives rise not to a contradiction ($N_{\text{theories}} \geq 1$ always holds) but to the asymptotic unattainability of $S = 1$ — the limit functions as a regulative ideal, setting the direction but not constituting an attainable final state.

It is established (Proposition 4) that the mechanism of self-observation — the existence of a self-consistent configuration in which the field of potential states generates its own observer — does not require an extension of the axiomatics but follows from Axiom (A), Postulates P1, P2, and the assumption D-Rich. Thereby the question of the origin of the observer receives an internal resolution: the observer is constituted as a fixed point of the mapping of the field onto itself, which completes the architecture of the strange loop (Proposition 3) and gives quantitative form to Wheeler's idea of a self-excited circuit [1, 60].

The ontological position of the framework is determined by two constraints. The Fitness Beats Truth theorem [44] and the interface theory of perception [45, 46] establish that the configuration at $S \to 1$ constitutes an adaptive attractor maximizing collective coherence rather than the accuracy of representing "objective" reality; instead of correspondence truth, the theory operates with coherent truth — the stability of a configuration under collective observation ($T(C) \to \infty$ at $S \to 1$). Postulate P5 specifies the mechanism of this collective formation: $P_{\text{coll}}(E) = 1 - \prod(1 - B_i^k)$, where the contribution of each observer is determined by their cognitive coherence B_i. The dynamics of an individual observer is further constrained by the absorbing states $B = 0$ and $B = 1$ of equation (D1.3): the factor $B(1 - B)$ vanishes at the boundaries, and cognition — as systematic revision of beliefs — occurs only at $0 < B < 1$, where the observer remains open to both confirmation and revision of expectations.

The theory is self-consistent and self-referential: it describes the conditions of its own existence and the conditions of existence of all alternative theories. The theory does not claim to replace existing physical theories but proposes a meta-framework within which any particular physical theory is a configuration determined by collective observation. The justifications of the propositions (Section V) rely on four explicitly stated assumptions — D-Inj, D-Law, D-Conv, D-Rich — the rigorous verification of which lies beyond the scope of the present publication and defines one of the directions for further research. Proposition 4 on the self-consistent configuration requires, in addition to Axiom (A) and Postulates P1, P2, the assumption D-Rich on the richness of the field. Establishing rigorous conditions on the operator $\hat{O}$ that guarantee the applicability of fixed-point theorems (Schauder [62] for compact operators, Banach [63] for contractive mappings) to $\Phi = \iota \circ \hat{O}$ remains unsolved and defines the immediate research frontier. In its current version, the framework contains 11 free parameters (w_1, w_2, w_3; k; γ; α; n; m; T_0; K; D_0). Hypotheses about their reduction — identifying $n = m$, a functional dependence $K = K(N)$, and a dimensional relationship between D_0, α, and T_0 — allow decreasing the number of independent parameters to 7–8, which is comparable to the six parameters of the standard cosmological model ΛCDM [59]. Calibration of the parameters from cognitive and psychophysiological experimental data constitutes the necessary next step.

Experimental verification of the framework is organized according to a four-level hierarchy (Section VIII). Calibration of belief parameters (w_i, k, γ) through cognitive-psychophysiological protocols (fMRI/EEG, heart rate variability, modified IAT, Bayesian history) constitutes the first level, requiring no quantum apparatus. Subsequently, individual postulates are tested: the power-law dependence $P(E \mid B) = B^k$ (P4), the formula $T(C) = T_0/(1 - S)^n$ (P3.1), and the collective probability P_{coll} (P5.1) at controlled values of B and S. Structural propositions are verified at the third level through scientometric analysis of competing paradigms (Propositions 1–2) and through detection of retroactive stabilization effects (Proposition 4). The full metatheoretical structure — self-referentiality and bootstrap — is confirmed or refuted at the fourth level through the consistency of data from the preceding stages with the predictions of the theory as a whole. The initial verification stages (levels 1–2) do not require resources beyond standard cognitive-neurophysiological laboratories, ensuring the feasibility of the program in the medium term.

Conflict of Interest

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Appendix A. Summary Table of Notation

Symbol	Description	Range
R	Observed reality (configuration)	$\mathbb{C}$
$\hat{O},\ O_i$	Operator / observer	—
Ψ	Field of potential states	$\mathcal{H}$
$N(t)$	Number of observers at time t	$[1, \infty)$
$\|M\|$	Cardinality of the multiverse	$[1, \infty)$
$I(C)$	Inertia of configuration C	$[0, \infty)$
α	Reconfiguration constant	$\mathbb{R}^+$
v	Reconfiguration rate	$[0, \infty)$
S	Coherence (synchronization) level; $S_{\min}(n)$: minimum attainable value for n observers	$[0, 1]$
$T(C)$	Configuration lifetime	$[T_0, \infty)$
$B(O, C),\ B_i$	Contextual belief of observer (cognitive coherence with respect to configuration C); $B_i \equiv B(O_i, C)$	$[0, 1]$
F	Attentional focus	$[0, 1]$
E	Emotional coherence	$[0, 1]$
σ	Internal contradiction	$[0, 1]$
Λ	Empirical reinforcement	$[0, 1]$
γ	Observer learning rate	$\mathbb{R}^+$
β	Steepness parameter of tanh in equation (D1.3)	$\mathbb{R}^+$ $(\beta \gg 1)$
ε	Inertia regularizer: $\varepsilon = \alpha / v_{\max}$	$\mathbb{R}^+$
$v_{\max}$	Maximum reconfiguration rate	$\mathbb{R}^+$
$P(E \mid B)$	Outcome probability given belief	$[0, 1]$
k	Reality resistance coefficient	$[1, \infty)$
N_{theories}	Number of simultaneous theories of everything	$[1, \infty)$
$S_{\text{threshold}}$	Threshold coherence for reality overlap (P5)	$(0, 1)$
n	Coherence sensitivity exponent	$[1, \infty)$
D_0	Baseline variance of the stochastic term	$\mathbb{R}^+$
$D(\eta)$	Variance of the stochastic term $\eta(t)$	$[0, D_0]$
D-Sep	Assumption of separability of observational acts	—
D-Hom	Assumption of homogeneity of configuration space	—
D-Comb	Assumption of combinatorial independence	—
D-Ind	Assumption of statistical independence of observers	—
D-Rich	Assumption of richness of the field of potential states	—
D-Prot	Assumption of ontological protection (dimensionality restriction)	—
$d(O)$	Observer dimensionality (under extension to (B, A, H, d))	$\mathbb{N}$
ι	Embedding operator: $\iota : \mathbb{C} \hookrightarrow \mathcal{H}$	$\mathbb{C} \to \mathcal{H}$
Φ	Self-observation mapping: $\Phi(\Psi) = \iota(\hat{O}_\Psi(\Psi))$	$\mathcal{H} \to \mathcal{H}$
Ψ^*	Fixed point of self-observation: $\Psi^* = \Phi(\Psi^*)$	$\mathcal{H}$
O^*	Primary observer induced by Ψ^*	$[0, 1] \times \mathcal{F} \times \mathcal{H}_{\text{hist}}$

Appendix B. Phenomenological Description of the Theory

This appendix presents the main ideas of ODTOE in the language of lived experience — without formulas — addressing the reader unfamiliar with the mathematical apparatus.

Axiom: we do not merely observe — we co-create. Reality does not exist in a ready-made form, waiting to be discovered. Each act of observation is an act of formation: the observer's attention, conviction, and action determine which of the countless potential configurations becomes actual.

Observer dimensionality: to each their own scale. Each observer possesses a definite "level" — the scale of reality they are capable of forming. At the level of the body, we constitute physiological processes; at the level of society, relationships and institutions; at the level of the planet, ecological and civilizational configurations. Expansion of the level requires growth in internal coherence.

Ontological protection: the invisibility of the inaccessible. What exceeds the current level of the observer literally does not exist as reality for them — not because it is hidden, but because the constituting capacity of observation has not yet reached that scale. Growth in coherence expands the accessible field of configurations.

Coherence: the birth of shared reality. When observers achieve a high degree of internal alignment, a shared reality emerges — a stable configuration partaken by the collective. The higher the alignment, the more stable the shared world; at full alignment, there exists a unique reality and a unique theory.

Co-event: truth as encounter. Truth in the context of ODTOE is not a formula corresponding to a fact but an event of mutual disclosure of observers to one another, in which a configuration is actualized as shared reality. Formulas describe the structure of this process; lived experience undergoes it.

References

1. Wheeler, J.A. Information, physics, quantum: The search for links. In: Zurek, W.H. (ed.) *Complexity, Entropy and the Physics of Information*, pp. 3–28. Addison-Wesley, 1990.

2. Everett, H. "Relative state" formulation of quantum mechanics. *Rev. Mod. Phys.* **29**(3), 454–462 (1957). DOI: 10.1103/RevModPhys.29.454.

3. Von Neumann, J. *Mathematische Grundlagen der Quantenmechanik*. Springer, Berlin, 1932.

4. Wigner, E.P. Remarks on the mind-body question. In: Good, I.J. (ed.) *The Scientist Speculates*, pp. 284–302. Heinemann, London, 1961.

5. Bohr, N. The quantum postulate and the recent development of atomic theory. *Nature* **121**, 580–590 (1928). DOI: 10.1038/121580a0.

6. Kuhn, T.S. *The Structure of Scientific Revolutions*. University of Chicago Press, 1962.

7. Stapp, H.P. *Mind, Matter, and Quantum Mechanics*. Springer, Berlin, 1993.

8. Penrose, R. *Shadows of the Mind: A Search for the Missing Science of Consciousness*. Oxford University Press, 1994.

9. Zurek, W.H. Decoherence, einselection, and the quantum origins of the classical. *Rev. Mod. Phys.* **75**(3), 715–775 (2003). DOI: 10.1103/RevModPhys.75.715.

10. Planck, M. *The Universe in the Light of Modern Physics*. W.W. Norton, New York, 1931.

11. Wolfram, S. A class of models with the potential to represent fundamental physics. *Complex Systems* **29**, 107–536 (2020). DOI: 10.25088/ComplexSystems.29.2.107.

12. Rovelli, C. *Quantum Gravity*. Cambridge University Press, 2004.

13. Weinberg, S. *Dreams of a Final Theory*. Pantheon Books, New York, 1993.

14. Fuchs, C.A., Mermin, N.D., Schack, R. An introduction to QBism with an application to the locality of quantum mechanics. *Am. J. Phys.* **82**(8), 749–754 (2014). DOI: 10.1119/1.4874855.

15. Fuchs, C.A. QBism, the perimeter of Quantum Bayesianism. Preprint arXiv:1003.5209 (2010).

16. Mensky, M.B. Quantum mechanics, consciousness, and a bridge between the two cultures [in Russian]. *Voprosy Filosofii* (6), 64–74 (2004).

17. Mensky, M.B. Concept of consciousness in the context of quantum mechanics [in Russian]. *Usp. Fiz. Nauk* **175**(4), 413–435 (2005).

18. Rovelli, C. Relational quantum mechanics. *Int. J. Theor. Phys.* **35**(8), 1637–1678 (1996). DOI: 10.1007/BF02302261.

19. Popper, K. *The Logic of Scientific Discovery*. Routledge, London, 1959.

20. Born, M. Zur Quantenmechanik der Stoßvorgänge. *Z. Phys.* **37**, 863–867 (1926). DOI: 10.1007/BF01397477.

21. Gödel, K. Über formal unentscheidbare Sätze der Principia Mathematica und verwandter Systeme I. *Monatsh. Math. Phys.* **38**, 173–198 (1931). DOI: 10.1007/BF01700692.

22. Vladimirov, Yu.S. The metaphysical trinity of physics, mathematics, and philosophy [in Russian]. *Metafizika* (2(48)), 8–22 (2023). DOI: 10.22363/2224-7580-2023-2-8-22.

23. DeWitt, B.S., Graham, N. (eds.) *The Many-Worlds Interpretation of Quantum Mechanics*. Princeton University Press, 1973.

24. Belinsky, A.V., Dzhadan, I.I. Nonlocal correlations and the relativity of physical quantities [in Russian]. *Metafizika* **48**(2(48)), 49–75 (2023). DOI: 10.22363/2224-7580-2023-2-49-75.

25. Vladimirov, Yu.S. A meta-relational approach to the foundations of fundamental physics [in Russian]. *Metafizika* (1(51)), 10–32 (2024). DOI: 10.22363/2224-7580-2024-1-10-32.

26. Posner, M.I., Petersen, S.E. The attention system of the human brain. *Annu. Rev. Neurosci.* **13**, 25–42 (1990). DOI: 10.1146/annurev.ne.13.030190.000325.

27. Thayer, J.F., Lane, R.D. A model of neurovisceral integration in emotion regulation and dysregulation. *J. Affect. Disord.* **61**(3), 201–216 (2000). DOI: 10.1016/S0165-0327(00)00338-4.

28. Yakovlev, V.A. Metaphysical foundations of the model of consciousness [in Russian]. *Metafizika* (4), 31–45 (2024). DOI: 10.22363/2224-7580-2024-4-31-45.

29. Greenwald, A.G., McGhee, D.E., Schwartz, J.L.K. Measuring individual differences in implicit cognition: The Implicit Association Test. *J. Pers. Soc. Psychol.* **74**(6), 1464–1480 (1998). DOI: 10.1037/0022-3514.74.6.1464.

30. Jaynes, E.T. *Probability Theory: The Logic of Science*. Cambridge University Press, 2003.

31. Pechenkin, A.A. Conference "Two Days of History and Epistemology of Quantum Interpretations" [in Russian]. *Metafizika* (4), 78–86 (2023). DOI: 10.22363/2224-7580-2023-4-78-86.

32. Green, M.B., Schwarz, J.H., Witten, E. *Superstring Theory. Vol. 1: Introduction*. Cambridge University Press, 1987.

33. Greenstein, G., Zajonc, A.G. *The Quantum Challenge: Modern Research on the Foundations of Quantum Mechanics*. Jones and Bartlett, Sudbury, 2006.

34. Kant, I. *Critique of Pure Reason*. Transl. by N. Kemp Smith. Macmillan, London, 1929.

35. D'Espagnat, B. *Veiled Reality: An Analysis of Present-Day Quantum Mechanical Concepts*. Westview Press, Boulder, 2003. DOI: 10.4324/9780429501395.

36. Zeilinger, A. A foundational principle for quantum mechanics. *Found. Phys.* **29**(4), 631–643 (1999). DOI: 10.1023/A:1018820410908.

37. Prigogine, I., Stengers, I. *Order Out of Chaos: Man's New Dialogue with Nature*. Bantam Books, New York, 1984.

38. Zurek, W.H. Quantum Darwinism. *Nat. Phys.* **5**, 181–188 (2009). DOI: 10.1038/nphys1202.

39. Husserl, E. *Logical Investigations*, Vol. II. Transl. by J.N. Findlay. Routledge, London, 2001.

40. Schlosshauer, M. Decoherence, the measurement problem, and interpretations of quantum mechanics. *Rev. Mod. Phys.* **76**(4), 1267–1305 (2004). DOI: 10.1103/RevModPhys.76.1267.

41. Tegmark, M. Importance of quantum decoherence in brain processes. *Phys. Rev. E* **61**(4), 4194–4206 (2000). DOI: 10.1103/PhysRevE.61.4194.

42. Hameroff, S., Penrose, R. Consciousness in the universe: A review of the 'Orch OR' theory. *Phys. Life Rev.* **11**(1), 39–78 (2014). DOI: 10.1016/j.plrev.2013.08.002.

43. Stepin, V.S. *Theoretical Knowledge* [in Russian]. Progress-Traditsiya, Moscow, 2000.

44. Prakash, C., Stephens, K.D., Hoffman, D.D., Singh, M., Fields, C. Fitness beats truth in the evolution of perception. *Acta Biotheoretica* **69**(3), 319–341 (2021). DOI: 10.1007/s10441-020-09400-0.

45. Hoffman, D.D., Singh, M., Prakash, C. The interface theory of perception. *Psychonomic Bull. & Rev.* **22**(6), 1551–1576 (2015). DOI: 10.3758/s13423-015-0890-8.

46. Hoffman, D.D. *The Case Against Reality: Why Evolution Hid the Truth from Our Eyes*. W.W. Norton, New York, 2019.

47. Hofstadter, D.R. *Gödel, Escher, Bach: An Eternal Golden Braid*. Basic Books, New York, 1979.

48. Hofstadter, D.R. *I Am a Strange Loop*. Basic Books, New York, 2007.

49. Hawking, S.W. Gödel and the end of physics. Lecture, Dirac Centennial Celebration, Cambridge, 2002.

50. Ben-Ya'acov, U. Gödel's incompleteness theorem and universal physical theories. *J. Phys.: Conf. Ser.* **1391**, 012067 (2019). DOI: 10.1088/1742-6596/1391/1/012067. Extended version: arXiv:1906.02724v3 (2021).

51. Aczél, J. *Lectures on Functional Equations and Their Applications*. Academic Press, New York, 1966.

52. Stanley, H.E. *Introduction to Phase Transitions and Critical Phenomena*. Oxford University Press, 1971.

53. Caves, C.M., Fuchs, C.A., Schack, R. Quantum probabilities as Bayesian probabilities. *Phys. Rev. A* **65**(2), 022305 (2002). DOI: 10.1103/PhysRevA.65.022305.

54. Saunders, S., Barrett, J., Kent, A., Wallace, D. (eds.) *Many Worlds? Everett, Quantum Theory, and Reality*. Oxford University Press, 2010.

55. Sornette, D. *Critical Phenomena in Natural Sciences*. 2nd ed. Springer, Berlin, 2006.

56. Kramers, H.A. Brownian motion in a field of force and the diffusion model of chemical reactions. *Physica* **7**(4), 284–304 (1940). DOI: 10.1016/S0031-8914(40)90098-2.

57. Hänggi, P., Talkner, P., Borkovec, M. Reaction-rate theory: Fifty years after Kramers. *Rev. Mod. Phys.* **62**(2), 251–341 (1990). DOI: 10.1103/RevModPhys.62.251.

58. Kubo, R. The fluctuation-dissipation theorem. *Rep. Prog. Phys.* **29**(1), 255–284 (1966). DOI: 10.1088/0034-4885/29/1/306.

59. Particle Data Group (Navas, S. et al.) Review of particle physics. *Phys. Rev. D* **110**(3), 030001 (2024). DOI: 10.1103/PhysRevD.110.030001.

60. Wheeler, J.A. Beyond the black hole. In: Woolf, H. (ed.) *Some Strangeness in the Proportion*, pp. 341–375. Addison-Wesley, Reading, MA, 1980.

61. Hawking, S.W., Hertog, T. Populating the landscape: A top-down approach. *Phys. Rev. D* **73**, 123527 (2006). DOI: 10.1103/PhysRevD.73.123527.

62. Schauder, J. Der Fixpunktsatz in Funktionalräumen. *Studia Math.* **2**, 171–180 (1930).

63. Banach, S. Sur les opérations dans les ensembles abstraits et leur application aux équations intégrales. *Fundamenta Math.* **3**, 133–181 (1922).

64. Tononi, G. An information integration theory of consciousness. *BMC Neurosci.* **5**, 42 (2004). DOI: 10.1186/1471-2202-5-42.

65. Moiseev, V.I. *Mirologiya: nauka o miropodobnykh sistemakh* [Mirology: The Science of World-Like Systems]. URSS, Moscow, 2022. ISBN 978-5-9710-9628-3.

66. Heidegger, M. Beiträge zur Philosophie (Vom Ereignis). In: *Gesamtausgabe*, Bd. 65. V. Klostermann, Frankfurt am Main, 1989.

67. Leibniz, G.W. Monadologie (1714). In: *Die philosophischen Schriften*, Bd. 6, pp. 607–623. Weidmann, Berlin, 1885.