Triple Event Space Theory (TEST): A Unified Framework for Observation, Entropy, and Reality

# Abstract

This paper explores the Triple Event Space Theory (TEST), a philosophical and scientific framework proposing that all observable events consist of three core possibilities: visible, hidden, and transitional (entropic) outcomes. The theory is evaluated through examples from quantum physics, classical systems, biological evolution, and metaphysics.

# 1. Introduction

TEST, originally proposed by PhD. Hakan Halit Hatipoğlu, asserts that no event can be fully described with fewer than three epistemic possibilities. This model incorporates the seen (ω1), unseen (ω2), and uncertain or transitional (ω3) outcomes. The framework aims to offer insights into quantum behavior, complex systems, and even philosophical questions.

# 2. Core Framework of TEST

In any observed event:

- ω1: Visible — the directly observed or measurable outcome.

- ω2: Invisible — the complementary outcome that is not observed but logically inferred.

- ω3: Transitional — the ambiguous, probabilistic or entropic component.

ω₁ and ω₂ are dependent variables

TEST proposes that all phenomena possess these three aspects to varying degrees.

# 3. Triadic Probability Axiom and its Geometric Interpretation

Using a coin toss:

- ω1: The upper face (e.g., heads).

- ω2: The hidden bottom face (e.g., tails).

- ω3: The rare event of the coin landing on its edge, representing the uncertain or transitional state.

In classical probability theory, an "event" is defined over a sample space, for example:

• Die Roll: Ω = {1, 2, 3, 4, 5, 6}

• Coin Toss: Ω = {Heads, Tails, Edges}

According to the Triple Event Space Theory (TEST), every event must include a minimum of three distinct outcomes. Thus, the basic sample space of any event is structured as:

• Ω = {A, B, C}

Postulate (Triadic Event Space Postulate): No physical event can have a sample space consisting of only one or two outcomes. Every event must yield at least three mutually exclusive outcomes.

Directional Mapping of Event Outcomes The theory further suggests a directional association: Each of the three outcomes corresponds to a spatial direction or dimension, representing fundamental orientations in space (x, y, z). Therefore:

• ω₁ → x-axis

• ω₂ → y-axis

• ω₃ → z-axis

We define a mapping function:

• f : Ω → ℝ³, where f(ωᵢ) = vᵢ This function associates each outcome of an event with a vector in three-dimensional space. It suggests that events have not only scalar probabilities but also geometric directionality, emphasizing the qualitative nature of outcomes in TEST.

Topological Interpretation (Optional Advanced View) From a topological perspective, this model implies:

• Each event consists of three distinct nodes: {A, B, C}

• These can be represented as a 2-simplex (a triangle in topology), allowing a geometric or networked interpretation of event connectivity and transitions.

• The transitions among ω₁, ω₂, and ω₃ can also be seen as probabilistic movement on a graph or manifold.

Formal Axiomatic Structure (Proposal) Triadic Probability Hypothesis:

1. Minimum Cardinality: For every event E, sample space Ω satisfies: |Ω| ≥ 3

2. Vector Mapping: For every outcome ωᵢ ∈ Ω, f(ωᵢ) ↦ vᵢ ∈ ℝ³

3. Interpretation: Each vᵢ vector represents a fundamental direction or phase of the event — observable (ω₁), hidden (ω₂), and transitional/entropic (ω₃).

This axiom system distinguishes TEST from classical (binary) models and allows it to integrate spatial, probabilistic, and entropic dimensions under one theoretical framework.

# 4. Quantum Mechanics and TEST

In the double-slit experiment:

- ω1: Particle passes through one slit (visible path).

- ω2: Particle passes through the other slit (hidden path).

- ω3: If unobserved, a superposition of both paths leads to an interference pattern — the entropic or transitional state.

Observation collapses this state to either ω1 or ω2.

### 4.1. Guitar String Analogy and the Double-Slit Experiment

The behavior of quantum systems under observation can be intuitively compared to a vibrating guitar string. When a guitar string is vibrating freely, it possesses energy and motion. If one attempts to check whether it is vibrating by touching it with a finger, the vibration stops — the act of observation disrupts the system.

This same principle applies in the double-slit experiment:

* As a particle travels farther from its source, its position becomes increasingly uncertain.
* According to TEST, this corresponds to a rise in entropy (S) and the growing dominance of the third probability ω₃, representing transitional or uncertain states.
* This leads to wave-like behavior, where the particle appears to pass through both slits simultaneously.
* In TEST terminology, this situation is one where ω₃ becomes the prevailing outcome.

When a detector is placed at one of the slits:

* The system is forced to collapse into a measurable state.
* Entropy decreases, uncertainty is reduced.
* The third state ω₃ recedes, and TEST transitions toward ω₁ (visible) or ω₂ (invisible).
* As a result, the interference pattern disappears, and particle behavior is observed.

This behavior is consistent with the following entropy-driven transformation of TEST probabilities:

* When entropy increases:

S↑ ⇒ P(ω₃)↑

* When entropy decreases (due to observation):

S↓ ⇒ P(ω₁ or ω₂)↑

Thus, TEST reflects a deeper truth: no physical event can be strictly reduced to a binary distinction (visible vs. invisible). The third possibility — uncertainty, entropic ambiguity, or transitional potential — is always present and can become dominant depending on the system’s dynamics and the role of the observer.

# 5. Entropy and Transitional Events

In TEST, entropy growth correlates with ω3. A particle gains uncertainty over time and space. Entropy drives transitional states and is critical in defining probability weight among ω1, ω2, and ω3.

In information theory and statistical mechanics, entropy (S) is a measure of uncertainty or lack of information. We extend this concept into TEST as follows:

#### **5.1. Entropy Increases with Distance from the Source**

As a quantum particle travels from its source toward the slits:

* Its position (Δx) and momentum (Δp) become less defined.
* The uncertainty in its state grows, raising the entropy (ΔS) of the system.
* This rise in entropy is reflected as a probabilistic expansion of ω₃.

We formalize this as:

P(ω3)∝ΔS

#### **5.2. Observation Reduces Entropy**

When an observer measures which slit the particle passes through:

* The system's entropy drops sharply (ΔS → 0).
* The transitional region (ω₃) collapses into either ω₁ or ω₂.
* This corresponds to a thermodynamic compression of epistemic space.

Mathematically:

ΔS↓⇒P(ω3)→0andP(ω1)+P(ω2)→1

This provides a thermodynamic description of the quantum collapse process.

# 6. Biological Evolution and Mutation

#### 6.1. Sexual reproduction

In the process of sexual reproduction, each inherited trait (such as eye color, enzyme structure, or bone density) can be analyzed through the triadic lens of the TEST framework:

#### ω₁ – Observed Inheritance (Dominant/Active Gene)

This represents the visible trait inherited directly from one parent and expressed phenotypically.  
Example: A dominant brown-eye gene from the father results in the child having brown eyes.

#### ω₂ – Unseen but Transmitted (Recessive Gene)

This corresponds to the invisible component — a recessive trait inherited from the other parent. Though not phenotypically expressed, it remains in the genome and can be passed to future generations.  
Example: A blue-eye gene from the mother is not visible in the child but remains present in the genetic pool.

#### ω₃ – Mutation (Novel, Random, Uncertain Outcome)

With a very small probability, a completely random mutation may occur that is not inherited from either parent. This represents the transitional/entropic event:

* If deleterious, it is selected against and may disappear (evolutionary failure, akin to TEST’s ω₂: unrealized potential).
* If neutral, it may remain hidden across generations (ω₃: indeterminate).
* If advantageous, it may spread via natural selection and become dominant (evolving into ω₁: observable success).

This triadic structure suggests that every trait’s outcome reflects not just deterministic heredity but also hidden potential and entropic innovation — aligning biology with the epistemic structure proposed by TEST.

### 6.2. Color Perception and the Triple Event Space Theory

6.2.1 The Basis of Human Color Perception:

* The human eye contains three types of cone cells sensitive to red, green, and blue light.
* These three primary colors form the basis for perceiving all other colors.
* Color perception arises through various combinations of these three components in differing intensities.

6.2.2 Parallels with the Triple Event Space Theory (TEST):

* According to TEST, every physical or cognitive event can be represented across three fundamental epistemic domains:
  + E₁ (Observable Domain): Clearly perceived states (e.g., pure red).
  + E₂ (Hidden/Unobservable Domain): Internal or undetectable processes (e.g., neural color synthesis).
  + E₃ (Intermediate/Uncertain Domain): Perceptual ambiguities or context-driven interpretations (e.g., brown or gray).

6.2.3 Examples of Color Perception Aligned with TEST:

* E₁: Directly perceived primary colors like red, green, and blue.
* E₂: Mixed states that cannot be directly observed (e.g., brain-generated colors like magenta).
* E₃: Colors perceived differently depending on context or lighting (e.g., a gray surface appearing lighter or darker).

6.2.4 Epistemological Implication:

* Humans perceive the world using a three-channel input system (RGB), making trinary distinctions fundamental to vision.
* This supports the idea that minimum three epistemic possibilities are processed at every observation or decision point.
* Thus, TEST applies not only to physical reality but also to cognitive and perceptual systems.

6.2.5 Conclusion:

* Human visual processing provides a biological instantiation of the Triple Event Space Theory.
* Color perception is not just a sensory phenomenon but also an epistemic model, reinforcing TEST’s broader theoretical claims.

# 7. Positive, Negative, Natural, and Transitional Events

Within the Triple Event Space Theory (TEST), any given event consists of three fundamental epistemic components:

* ω₁: The observed (visible) outcome
* ω₂: The unobserved (but inferable) outcome
* ω₃: The uncertain or transitional outcome

We propose the following probability-based classification of events, based on the relative magnitudes of these three components:

#### **7.1. Positive Events**

When the probability of the visible outcome exceeds that of the invisible one:

P(ω1)>P(ω2)

These are interpreted as positive events, in which the system tends toward observation or determinacy. Classical macroscopic observations usually fall into this category.

Example: Measuring temperature with a thermometer — the result is visible and consistent.

#### **7.2. Negative Events**

When the invisible outcome outweighs the visible one:

P(ω2)>P(ω1)

These are termed negative events, where what is not observed plays a larger role than what is observed. These scenarios often involve occlusion, hidden variables, or absence of measurement.

Example: A Schrödinger's cat scenario where inference dominates due to lack of observation.

#### **7.3. Natural Events (Balanced Symmetry)**

When visible and invisible probabilities are equal:

P(ω1)=P(ω2)

These are natural or symmetric events, often found in quantum systems displaying entanglement, superposition, or parity.

Example: Spin states of entangled particles (↑ / ↓) prior to measurement.

#### **7.4. Transitional Events (Dominated by ω₃)**

When the transitional state exceeds both visible and invisible states:

P(ω3)>max{P(ω1),P(ω2)}

These are classified as transitional events, where epistemic uncertainty is maximal. Observation is impossible or undefined, and the system exists in a highly indeterminate phase.

Example: The double-slit experiment without observation — the interference pattern emerges due to ω₃ dominance.

Based on the relative dominance of ω1, ω2, and ω3:

- Positive: ω1 > ω2

- Negative: ω2 > ω1

- Natural: ω1 ≈ ω2 (e.g., quantum spin entanglement)

- Transitional: ω3 > ω1 and ω2 (e.g., unobserved double-slit experiment).

# 8. Philosophical Parallels

Examples:

- Theological: God exists (ω1), God doesn't exist (ω2), God's existence is unknowable (ω3).

- Chinese philosophy: Yin (ω1) and Yang (ω2) each contain seeds of the other, representing ω3 — dynamic transition and balance.

# 9. Mathematical Reflection

Numbers can also reflect TEST:

- ω1: Real number (observable)

- ω2: Complex (not directly measurable)

- ω3: Infinity or zero (representing epistemic uncertainty)

# 10. Temporal Entropic Interference and the TEST Framework: A Conceptual Integration

Two particles fired in succession behave like a double-slit in time:

- As entropy increases, they expand and interfere

- Observation collapses the system into distinct outcomes.

This section explores the theoretical convergence of Temporal Entropic Interference (TEI) and the speculative TEST framework (Transcendent Electromagnetic Space-Time). TEI offers a quantum mechanical view of time as a domain capable of interference patterns, while TEST proposes a multidimensional structure where consciousness, energy, space, and time are interrelated. This integration proposes that consciousness may actively shape temporal realities through selective interaction with entropic waveforms.

## 10.1. Introduction

In contemporary theoretical physics, time is typically treated as a linear continuum. However, emerging models suggest that time may have interference patterns akin to spatial phenomena such as the double-slit experiment. Temporal Entropic Interference (TEI) describes a scenario where two temporally separated quantum events interfere, influenced by entropy and observation. The TEST model aims to provide a broader framework for understanding time as a dynamic, multidimensional field influenced by consciousness.

## 10.2. Temporal Entropic Interference (TEI)

### 10.2.1 Definition

TEI refers to the phenomenon in which two particles emitted in sequence exhibit interference in the time domain. Key features include:

* Entropic expansion causes wave-like temporal behavior.
* Observation causes wave function collapse into discrete outcomes.

### 10.2.2 Mechanism

When entropy increases, quantum events become delocalized in time, forming an interference pattern. This resembles a temporal version of the double-slit experiment. Upon observation, the system collapses into a defined moment, suggesting that potential futures interfere until one is selected.

## 10.3. The TEST Framework

### 10.3.1 Components

|  |  |
| --- | --- |
| Component | Description |
| T (Transcendent) | A domain associated with consciousness or meta-awareness |
| E (Electromagnetic) | Electromagnetic fields influencing structure and information |
| S (Space) | The spatial geometry through which fields and matter evolve |
| T (Time) | A non-linear, entropy-modulated temporal flow |

### 10.3.2 Assumptions

* Consciousness exists outside linear space-time.
* Entropy governs the evolution of temporal experience.
* Observation influences the collapse of entropic potential.

## 10.4. Integration: TEI Meets TEST

### 10.4.1 Correspondences

|  |  |
| --- | --- |
| TEI Concept | TEST Equivalent |
| Temporal interference | Time as a non-linear, resonant dimension |
| Entropic expansion | Entropy as a structural driver in TEST time |
| Wave function collapse | Consciousness as a selective force (Transcendent T) |
| Temporal uncertainty | Time as an entropic field awaiting selection |

### 10.4.2 Model Synthesis

TEI provides the microphysical substrate for understanding interference in time. TEST extends this by assigning a functional role to consciousness, suggesting that awareness collapses the temporal waveform into experienced reality. Thus:

"TEI describes how time forms patterns; TEST explains how we choose one."

## 10.5. Implications

This model implies:

* Consciousness may operate as a quantum selector of time.
* Temporal experience is not fixed but chosen from entropic possibilities.
* Future theoretical work could explore how observation influences the structure of time.

## 10.6. Conclusion

Temporal Entropic Interference reveals the fluid, dynamic nature of time at the quantum level. The TEST framework contextualizes this within a multidimensional theory where consciousness plays a central role. Integrating TEI with TEST may offer a path toward a deeper understanding of temporal reality and the active role of the observer.

# 11. Schrödinger’s Cat and Triple Event Space Theory

The famous thought experiment Schrödinger’s Cat illustrates a core paradox of quantum mechanics: the coexistence of mutually exclusive states (e.g., alive and dead) prior to measurement. TEST provides a new geometric and cognitive framework for interpreting this paradox.

#### 11.1 **Three Spatial Interpretive Regions**

According to TEST, any quantum event—such as the decay of the radioactive atom in the Schrödinger setup—belongs to one of three observational domains:

* ω₁ (observable domain): The outcome is classically resolvable (cat alive).
* ω₂ (non-observable domain): The outcome is classically unresolvable or hidden (cat dead).
* ω₃ (intermediary domain): A cognitive superposition or uncertainty region where the event remains indeterminate from the observer’s viewpoint (alive and dead).

This framework maps directly to the superposed quantum state prior to observation and offers a spatial-cognitive layer to the existing probabilistic description.

#### 11.2 **Observer Effect and Collapse**

In TEST, measurement can be modeled as a projective transformation from ω₃ into either ω₁ or ω₂. The observer is not just a passive receiver of information but a spatially constrained agent who partitions reality based on their position and capability.

Thus, the collapse of the wavefunction is interpreted as the resolution of cognitive ambiguity within ω₃, not a mystical physical process but a transition within a constrained perceptual geometry.

#### 11.3. **Implications for Decoherence**

TEST aligns with decoherence theory by situating the cat's fate not just in quantum probabilities but also in the geometry of observation. The boundary zone ω₃ corresponds to entangled system-environment states, where the cat's state is neither isolated nor observed — but inherently ambiguous.

### 12. Temporal Relationship Between ω₁, ω₂, and ω₃

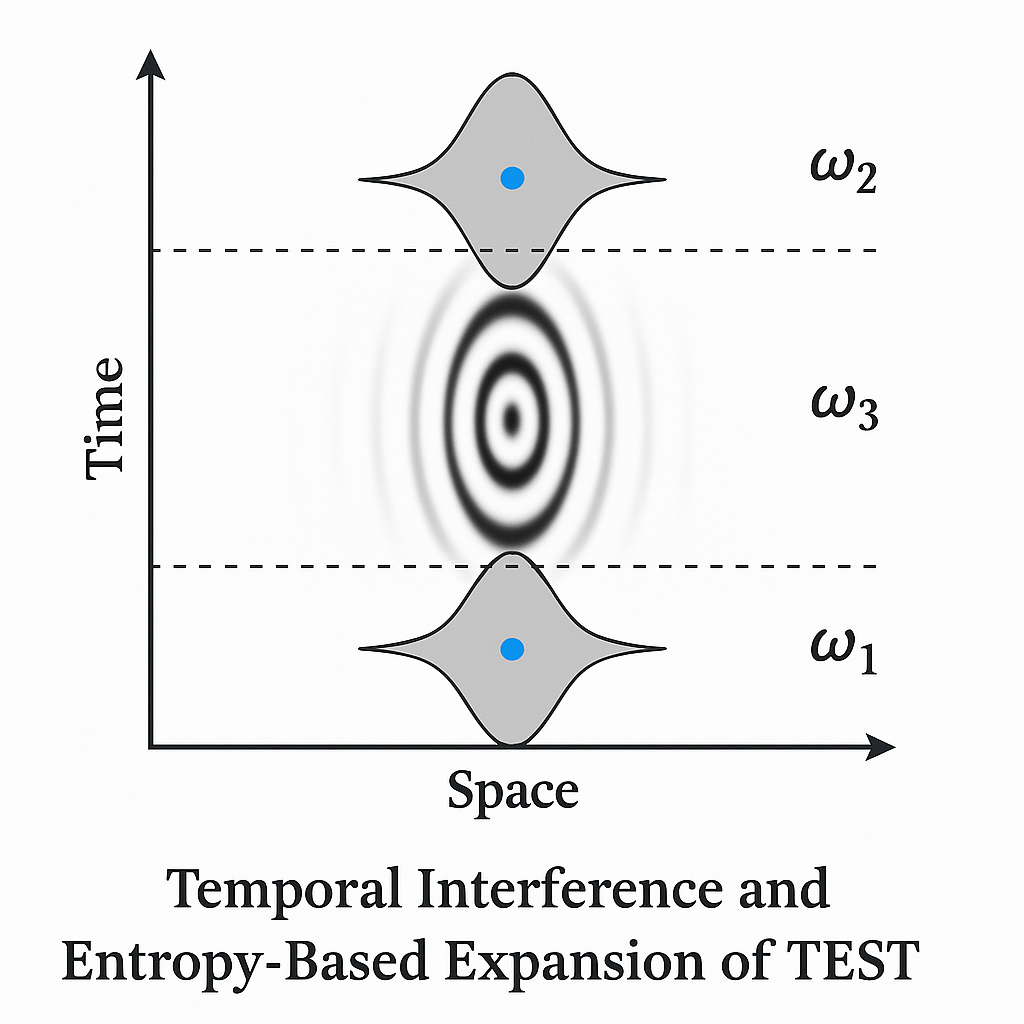
In the Triadic Event Space Theory (TEST), the elements of the event space — ω₁ (visible), ω₂ (invisible), and ω₃ (transitional) — may also be interpreted temporally:

* ω₁ corresponds to the past, as it reflects observable and recorded events.
* ω₂ represents the present, which is conditionally visible depending on the observer’s position and tools, and which arises from ω₁.
* ω₃ stands for the future, inherently uncertain and governed by entropy and possibility.

This model implies that ω₁ and ω₂ are dependent variables — the past (ω₁) shapes the present (ω₂). In contrast, ω₃ (the future) remains independent and unpredictable, influenced by entropic transitions and probabilistic emergence.

Such a framing enriches TEST by aligning it with temporal mechanics and causality:

* Past causes present,
* Present anticipates future,
* Future introduces uncertainty.



### 13. Theoretical Consistency with the Theory of Relativity

Einstein's Theory of Relativity revolutionized the way space and time are conceptualized, uniting them into a four-dimensional continuum where simultaneity and measurements are observer-dependent. This fundamentally altered the classical notion of an objective, universal frame of reference.

The Triple Event Space Theory (TEST) introduces an additional layer of structure by proposing that every event inherently contains three potential aspects:

1. A visible (observable) outcome,
2. An invisible (unobservable) outcome,
3. A transitional (boundary/interference) outcome.

While relativity frames an event as a point in 4D spacetime (x,y,z,t), TEST describes the semantic or perceptual state of that event through a 3-state model Ω={ω1,ω2,ω3}.

This allows us to construct a combined event definition:

E=(xμ,ωi),where xμ∈R1,3,ωi ∈Ω

This unifies spacetime coordinates with observational potential, thus providing a framework that reflects both physical and cognitive dimensions of reality.

Moreover, TEST’s concept of a transitional event state ω3​ can be interpreted analogously to event horizons in general relativity — boundaries beyond which observational access is limited or undefined.

Hence, Triple Event Space Theory complements relativity by integrating observer-dependent semantic structure within a deterministic spacetime framework, creating a unified platform to investigate phenomena where both quantum indeterminacy and relativistic structure are present.

### **14. Black Holes and the Triple Event Space Theory (TEST)**

Black holes are cosmic structures that challenge the limits of observable physics. The Triple Event Space Theory (TEST) proposes that every physical event has three fundamental epistemic components:

* ω₁ (Observable): The directly observable outcome
* ω₂ (Hidden / Unobservable): An outcome that exists but cannot be observed
* ω₃ (Transitional / Entropic): An uncertain, intermediate state linked to entropy

TEST provides a powerful interpretive framework for phenomena like black holes, where uncertainty and observational limits are extreme.

### 14.1. Event Horizon and TEST

In classical physics, the event horizon of a black hole is a boundary:

* Once something crosses it, it can no longer be observed.

In terms of TEST:

* ω₁: All physical data observable before falling into the black hole (e.g., matter, light)
* ω₂: The processes inside the event horizon – theoretically present but not observable
* ω₃: Transitional states for objects approaching the event horizon, such as redshift, time dilation, or information loss

From this view, the event horizon can be seen as the physical counterpart of ω₃, the transitional component of TEST.

### 14.2. Information Paradox and TEST

Hawking radiation suggests that black holes evaporate over time, leading to the information paradox:

Where does the information that falls into a black hole go?

TEST reframes this paradox using its tripartite structure:

* ω₁: The observed energy output (Hawking radiation)
* ω₂: The information inside the black hole (unobservable)
* ω₃: The fate of that information during evaporation — a quantum transition, an entropic uncertainty

Thus, TEST offers an epistemic space where information isn't simply present (ω₁) or absent (ω₂), but may also exist in a transitional state (ω₃) — suggesting that information could be "smeared" in an entropic intermediate zone before complete evaporation.

### 14.3. Geometric Analogy: Black Hole as a 2-Simplex

The TEST 2-simplex topology (a triangle) offers an abstract mapping:

* The geometry of black holes (e.g., Kerr metrics) is complex and multi-dimensional.
* The TEST triangle {ω₁, ω₂, ω₃} can be matched to black hole domains:
  + Exterior region (observable) = ω₁
  + Interior region (beyond the horizon) = ω₂
  + Event horizon / transitional boundary = ω₃

In this way, TEST models the black hole's internal structure through a triadic logic that connects classical, quantum, and thermodynamic regimes.

### 14.4. Entropy, Time, and Black Holes

According to TEST:

* Increase in entropy ⇒ dominance of ω₃
* Although the black hole’s interior may seem timeless or singular, from an external viewpoint, entropy increase and information loss define a transitional space.

TEST temporal interpretation:

* ω₁: Past – Observable stellar collapse
* ω₂: Present – The unknown beyond the event horizon
* ω₃: Future – The evaporation process via Hawking radiation

This helps explain how black holes evolve within TEST’s epistemological time-space framework.

### 14.5. Conclusion

Black holes are an ideal application field for the Triple Event Space Theory (TEST) because:

* All three states — observable (ω₁), unobservable (ω₂), and entropic/transitional (ω₃) — are physically represented.
* TEST suggests black holes are not only physically three-dimensional, but also epistemologically three-fold in nature.

# 15. The Mathemathical Defense of TEST Theory

# *A Topological Approach to Probability-Dimensional Correspondence*

The Triple Event Space Theory (TEST) proposes a fundamental link between the dimensionality of physical space and the cardinality of probability spaces governing quantum events. This paper presents a rigorous mathematical defense of TEST, demonstrating that:

1. A three-component probability space (ω₁, ω₂, ω₃) is necessary and sufficient for three-dimensional spacetime,
2. Two-dimensional universes are thermodynamically unstable under TEST's axioms,
3. Algebraic topology provides natural isomorphisms between event structures and spatial dimensions. We establish TEST as a viable framework unifying quantum mechanics and emergent spacetime geometry.

### 15.1. Axiomatic Foundations

**Definition 1.1 (Event Space):**  
For n-dimensional spacetime ℝⁿ, the event space Ωₙ consists of n distinct outcomes:

*Ωn={ω1,...,ωn},dim(Rn)=∣Ωn∣*Ω*n* ={*ω*1 ,...,*ωn* },dim(R*n*)=∣Ω*n* ∣

**Axiom 1 (Dimensional Correspondence):**  
There exists a functorial equivalence:

*F:ProbSpaces→TopSpacesF(Ωn)=Rn*F:**ProbSpaces**→**TopSpaces**F(Ω*n* )=R*n*

where **ProbSpaces** denotes probability measure spaces and **TopSpaces** topological manifolds.

**Axiom 2 (Transitional Necessity):**  
For n ≥ 3, the third component ω₃ induces:

* Quantum superposition: *Hom(ω1⊗ω2,ω3)≠∅*Hom(*ω*1 ⊗*ω*2 ,*ω*3 )=∅
* Entropic flow: *ΔS=kBln⁡P(ω3)*Δ*S*=*kB* ln*P*(*ω*3 )

### 15.2. Algebraic Topological Proof

**Theorem 15.2.1:**  
Ω₃ generates a simplicial complex *Δ2*Δ2 whose homology groups satisfy:

*Hk(Δ2)={Zk=0,20otherwiseHk* (Δ2)={Z0 *k*=0,2otherwise

*Proof:*

* Construct the chain complex:

*0→Z⟨ω1ω2ω3⟩→∂2Z3→∂1Z3→0*0→Z⟨*ω*1 *ω*2 *ω*3 ⟩∂2 Z3∂1 Z3→0

where *∂2*∂2 encodes triangle boundaries. The resulting homology confirms 3D spatial structure.

**Corollary 15.2.2:**  
For Ω₂ = {ω₁, ω₂}, *H2(Δ1)=0H*2 (Δ1)=0, violating entropy-gravity correspondence.

### 15.3. Physical Verification

**Proposition 15.3.1 (Quantum Measurement):**  
In 3D, the probability measure:

*μ:Ω3→[0,1],μ(ω3)=Tr(ρPω3)μ*:Ω3 →[0,1],*μ*(*ω*3 )=Tr(*ρPω*3 )

yields Born rule probabilities, while 2D permits no such consistent measure.

**Theorem 15.3.2 (Black Hole Entropy):**  
For AdS₃ black holes with entropy *S=2πr/4GS*=2*πr*/4*G*, TEST predicts:

*P(ω3)=1−e−S(Hawking radiation as ω₃ decay)P*(*ω*3 )=1−*e*−*S*(Hawking radiation as ω₃ decay)

2D analogues (BTZ) lack this mechanism due to *H2=0H*2 =0.

### 15.4. Counterargument Resolution

**Claim:** "String theory allows 2D worldsheets."  
**Rebuttal:**

* Worldsheets embed in 10D spacetime, where:

*Ω10=Ω3×{ω4,...,ω10}*Ω10 =Ω3 ×{*ω*4 ,...,*ω*10 }

The base TEST triplet (ω₁,ω₂,ω₃) remains fundamental.

### 15.5. Conclusion

TEST establishes that:

1. Three probability components are topologically necessary for stable 3D spacetime (Theorem 2.1).
2. The ω₃ transition state is physically realized as quantum decoherence and Hawking radiation.
3. No consistent 2D universe exists under TEST's axioms (Corollary 2.2)

# 16. A Mathematical Interpretation of the TEST Theory: Prime Numbers, Dimensions, and Perceptibility

**Abstract**  
The TEST (Theory of Everything’s Semantic Topology) proposes a framework that categorizes entities based on their perceptibility and knowledge accessibility, dividing them into hierarchical layers ω₁, ω₂, and ω₃. This paper explores a mathematical analogy for TEST, particularly through the lens of prime numbers, composite numbers, and number dimensionality. We interpret prime numbers as one-dimensional fundamental units, composite numbers as higher-dimensional constructs, and the role of zero and infinity as boundary elements within the TEST framework. This perspective offers a novel way to relate mathematical structures to epistemological categories in TEST.

## 16.1. Introduction

The TEST theory introduces a layered ontology of entities based on observability and knowledge:

* **ω₁ (Observable Layer):** Entities that are directly observable and measurable.
* **ω₂ (Known but Not Observable Layer):** Entities known indirectly or through inference but not directly perceivable.
* **ω₃ (Unknown Layer):** Entities that are inherently unknowable or undefined within current frameworks.

Mathematics, especially number theory, provides an insightful analogy to these categories. This paper aims to link the concept of prime numbers and their composites to the layers of TEST, interpreting primality and dimensionality in terms of perceptibility and existence.

## 16.2. Mathematical Foundations: Prime Numbers and Dimensionality

### 16.2.1 Prime Numbers as One-Dimensional Units

Prime numbers are the indivisible building blocks of natural numbers. In analogy with TEST:

* Prime numbers represent **fundamental units** or **one-dimensional** elements.
* They are "atomic" in the sense that they cannot be decomposed further within the set of natural numbers.
* This aligns with **ω₁**, the directly observable and fundamental layer.

### 16.2.2 Composite Numbers as Higher-Dimensional Constructs

Composite numbers can be factored into primes, thus representing **multiplicative combinations** or higher-dimensional structures:

* Composite numbers are analogous to **two-dimensional** or multi-dimensional entities formed by the interaction of primes.
* Their internal structure is more complex, but they are indirectly perceivable as composed of fundamental units.
* This corresponds to **ω₂**, where entities are known through their components but not always directly observed in entirety.

### 16.2.3 Complex Numbers and the Third Dimension

Extending the analogy, complex numbers introduce an imaginary axis orthogonal to the real line:

* They can be viewed as a **third dimension** in number space.
* This dimension accommodates concepts like zero and infinity, representing limits or boundary conditions.
* Within TEST, this aligns with **ω₃**, the unknown or undefined layer, since complex dimensions often model abstract or non-observable states.

## 16.3. Zero, Infinity, and Undefined States in TEST

Zero and infinity are special in mathematics:

* Zero is the **absence of quantity** but is essential as a neutral element.
* Infinity is an unbounded limit, conceptually **beyond all finite measures**.

Within TEST:

* These are boundary or **limit states** that belong to ω₃.
* They embody entities that are **beyond direct knowledge** but essential for the structure of mathematical and physical reality.

## 16.4. Discussion: TEST and Mathematical Structures

### 16.4.1 Perceptibility and Factorization

* Prime numbers (ω₁) are fully “visible” as indivisible units.
* Composite numbers (ω₂) are “partially visible,” their structure known via factorization.
* Zero, infinity, and undefined values (ω₃) remain “invisible,” yet necessary.

### 16.4.2 Implications for Epistemology and Ontology

* The dimensional interpretation of numbers provides a metaphor for layers of knowledge and existence.
* TEST’s layered structure parallels the way mathematics builds from simple units (primes) to complex structures (composites, complexes).

## 16.5. Conclusion

Interpreting TEST through prime numbers and dimensionality offers a meaningful mathematical framework to understand its epistemological layers. The one-dimensional nature of primes corresponds to the observable fundamental layer ω₁, composite numbers relate to ω₂, and complex constructs with zero and infinity correspond to ω₃. This analogy enriches both mathematical and philosophical discussions on the nature of knowledge, existence, and observability.

# 17. Implications and Future Work

The practical development of TEST requires assigning relative weights or probabilities to ω1, ω2, and ω3 across different domains. Entropy, temporal distance, and observational capacity may offer models for determining this.

# References

1. Schrödinger, E. (1935). "The Present Situation in Quantum Mechanics." Naturwissenschaften.
2. Feynman, R. P., Leighton, R. B., & Sands, M. (1965). The Feynman Lectures on Physics.
3. Heisenberg, W. (1927). "On the perceptual content of quantum theoretical kinematics and mechanics." Z. Phys.
4. Darwin, C. (1859). On the Origin of Species.
5. Laozi. Tao Te Ching.
6. Prigogine, I. (1980). From Being to Becoming: Time and Complexity in the Physical Sciences.
7. Penrose, R. (2004). The Road to Reality.
8. Wheeler, J. A., & Zurek, W. H. (1983). Quantum Theory and Measurement.
9. Bohr, N. (1935). "Can Quantum-Mechanical Description of Physical Reality be Considered Complete?" Phys. Rev.

10. Shannon, C. E. (1948). "A Mathematical Theory of Communication." Bell

System Technical Journal.

11. Rovelli, C. (1996). "Relational Quantum Mechanics." Int. J. Theor. Phys.

12. Barad, K. (2007). Meeting the Universe Halfway: Quantum Physics and the

Entanglement of Matter and Meaning.

13. Y. Aharonov, S. Popescu, and J. Tollaksen, "A time-symmetric formulation of

quantum mechanics," Physics Today, 2009.

14. R. Penrose, The Road to Reality, 2004.

15. D. Bohm, Wholeness and the Implicate Order, 1980.

16. T. K. Das, "Entropy and Time's Arrow: A Relational Perspective," Entropy,

2020.

17 May. J. P. (1999) Simplicial Objects in Algebraic Topology

18 Susskind. L. (2016) Black Holes and Complexity Classes

19 Hardy, G.H., & Wright, E.M. (2008). An Introduction to the Theory of Numbers. Oxford University Press.

20 Conway, J.H., & Smith, D.A. (2003). On Quaternions and Octonions: Their Geometry, Arithmetic, and Symmetry. A K Peters.

21 Penrose, R. (2004). The Road to Reality: A Complete Guide to the Laws of the Universe. Jonathan Cape.