

Peer Review

# Review of: "On the Tangled Hierarchy of Wave Functions and Observers"

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## Summary

This paper explores the relationship between **quantum mechanics, the observer, and consciousness**, presenting an unconventional interpretation where **the wave function is not an objective physical entity but instead represents states of consciousness**. Building upon Everett's **many-worlds interpretation (MWI)**, the author argues that each observer has a **subjective wave function**, determining their first-person experiences.

## Key Ideas & Claims

### 1. Wave Function as Consciousness

- Instead of treating the wave function as an objective mathematical entity, Pavšič interprets it as encoding **the first-person experience** of an observer.
- This aligns with the idea that quantum states define **knowledge** rather than reality itself.

### 2. Hierarchy of Observers Avoids Solipsism

- Unlike solipsism, where only one's own consciousness is real, the paper proposes **a hierarchy of possible observers**, each with their own subjective wave function.
- This hierarchy is **not uniquely defined**, meaning observers can interchange roles dynamically.

### 3. Blending Wave Function Collapse and Many-Worlds

- The **Copenhagen collapse interpretation** and **MWI** are treated as **complementary** rather than mutually exclusive.
- From the first-person perspective, consciousness "chooses" one path in a branching wave function.
- A universal **Hilbert space** of all possible states forms the objective reality.

### 4. Quantum Mechanics as a Mechanics of Consciousness

- The paper suggests that quantum mechanics should be reconsidered as a **formalism describing consciousness rather than an objective external reality**.
- The Hilbert space of all possible quantum states represents **the totality of all possible conscious experiences**.

#### 5. Proposed Quantization of the Wave Function Itself

- The paper suggests a second-level quantization where wave functions themselves become **quantum objects**, leading to a more general mathematical framework.

#### Implications & Open Questions

- Challenges **strict physical realism**, suggesting quantum states describe **subjective perception** rather than objective phenomena.
- Raises deep **philosophical implications** about reality, measurement, and observer participation.
- Leaves open the question of how **classical reality emerges** from this framework.

#### Logical Consistency and Critical Issues

While the paper presents an ambitious reinterpretation of quantum mechanics, several aspects of its logic and internal consistency warrant scrutiny:

##### 1. Wave Function as Consciousness: An Ontological Leap

- Pavšič proposes that the wave function is not a mathematical entity representing objective reality but instead encodes *first-person conscious experiences*.
- This **drastically reinterprets** the traditional role of quantum states in physics—shifting from an external description of nature to an **internal cognitive phenomenon**.
- **Issue:** This requires a justification for why the Hilbert space should encode states of **consciousness** rather than physical configurations. Standard quantum mechanics already describes probabilities in a mathematically rigorous way—why introduce consciousness as an intrinsic property of wave functions?

##### 2. Hierarchies of Observers: Avoiding Solipsism?

- The paper claims to avoid solipsism by proposing **interchangeable hierarchies of observers**, each possessing their own subjective wave function.

- **Issue:** While this solves the problem of a single privileged consciousness, it still **does not establish an objective external reality** in any conventional sense.
- Instead, it implies that reality consists of **Hilbert-space structured observer-dependent perspectives**, which could be challenged by physicalist interpretations.
- It lacks a **mechanism** explaining how objective physical predictions emerge from this first-person framework.

### 3. Wave Function Collapse as Observer-Driven

- The paper reconciles **Everett's Many-Worlds** with **Copenhagen-style collapse**, suggesting that **first-person consciousness selects one path** while all others remain potential realities.
- **Issue:** This blends perspectives in an ad hoc way—Everett's interpretation deliberately **avoids collapse**, while Copenhagen demands a **physical mechanism** for the collapse process.
- The proposed "conscious selection" mechanism feels **more philosophical than physical**, requiring a deeper justification.

#### Comparisons to Other Interpretations

It is fascinating to contrast Pavšič's framework with other interpretations, highlighting their key differences and implications.

#### Quantum Bayesianism (QBism)

- QBism also **rejects the wave function as an objective entity**, treating it instead as an **agent's personal knowledge** about future observations.
- Unlike Pavšič's model, QBism remains **grounded in probability theory** and avoids metaphysical speculation about consciousness.
- **Critical Difference:** QBism does not suggest a hierarchy of observers—it **preserves objectivity in measurement outcomes** without dissolving reality into subjective experience spaces.

#### Participatory Realism (Wheeler)

- Wheeler's approach treats reality as a **fundamentally observer-dependent system**, but crucially **preserves physicalism**—consciousness emerges from interaction rather than structuring quantum mechanics itself.
- **Critical Difference:** Wheeler's view maintains an **objective, participatory universe** rather than reducing quantum states to private experiences.

## Conclusion

While Pavšič's model is **original and conceptually provocative**, it faces serious **ontological, empirical, and logical hurdles**:

1. **Fails to justify why quantum states should encode consciousness rather than physical configurations.**
2. **Struggles to provide an objective framework for physics beyond subjective perspectives.**
3. **Mixes incompatible interpretations (Everett & Copenhagen) without rigorously resolving their contradictions.**

Testing Pavšič's framework empirically is challenging because it intertwines **quantum mechanics with consciousness**, a domain where controlled experiments are notoriously difficult. However, here are some potential empirical tests that could probe its validity:

### 1. Quantum Zeno Effect and Consciousness-Driven Collapse

- **Test Idea:** If consciousness plays a role in wave function collapse, then repeated conscious observations should **slow down** quantum transitions—similar to the **Quantum Zeno Effect**.
- **Challenge:** Previous studies suggest that **consciousness-independent decoherence** explains observed effects, making it unlikely that subjective awareness directly influences quantum states.

### 2. Entanglement and Observer-Dependent Wave Functions

- **Test Idea:** If wave functions are **observer-relative**, then two entangled particles observed by different observers should yield **different measurement statistics** depending on the observer's state of consciousness.
- **Challenge:** Standard quantum mechanics predicts **consistent correlations** regardless of observer awareness, contradicting the idea that consciousness alters entanglement.

### 3. Quantum Computers and Consciousness-Driven State Selection

- **Test Idea:** If consciousness selects a particular quantum state, then quantum computers running **superposition-based algorithms** should show **biases** in state selection when observed by conscious agents.
- **Challenge:** No known quantum computing experiments have shown **observer-dependent biases**, suggesting that quantum evolution remains **independent of subjective experience**.

#### 4. Neural Correlates of Quantum State Selection

- **Test Idea:** If consciousness is tied to quantum mechanics, then brain activity should correlate with **wave function collapse** in controlled experiments.
- **Challenge:** Neuroscientific studies have **not found direct quantum effects** in neural processes beyond speculative models like **Orchestrated Objective Reduction (Orch OR)**, which remains controversial.

#### Final Thoughts

While these tests could probe aspects of Pavšič's framework, **current empirical evidence strongly favors standard quantum mechanics**, where wave function collapse is **not consciousness-dependent**. If future experiments detect **observer-driven quantum effects**, it would revolutionize our understanding of both physics and consciousness—but so far, no such results exist.

Given its ambition and conceptual depth, Pavšič's study is **highly original** but faces **significant theoretical and empirical challenges**. Here's a structured evaluation:

##### 1. Originality: 9/10

- The idea that **wave functions encode consciousness** is a bold reinterpretation of quantum mechanics.
- The **hierarchical observer model** offers a fresh perspective on quantum measurement and reality.

##### 2. Logical Consistency: 6/10

- The framework **blends incompatible interpretations** (Everett's Many-Worlds and Copenhagen collapse) without fully resolving their contradictions.
- The **lack of a mechanism** for how subjective wave functions interact with objective physics weakens its coherence.

##### 3. Empirical Viability: 4/10

- No **experimental evidence** supports the claim that wave functions represent consciousness.
- Proposed tests (e.g., observer-driven quantum effects) **lack feasibility** within current physics.

##### 4. Impact Potential: 7/10

- If refined, the study could **influence discussions on quantum foundations and consciousness**.
- However, mainstream physics **may resist adopting a consciousness-based quantum formalism**.

#### Final Verdict

Pavšič's study is **conceptually intriguing but lacks empirical grounding**. It could benefit from **mathematical refinements and experimental proposals** to strengthen its credibility.

## **Declarations**

**Potential competing interests:** No potential competing interests to declare.