Re-evaluating the Structure of Consciousness through the Symintentry Hypothesis

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Consciousness has long been one of the most elusive subjects in science and philosophy. Although it is a fundamental aspect of human experience, it remains one of the most challenging to understand and define. Central to this model is the concept of intentionality, which is traditionally viewed as the foundation of consciousness because it encapsulates the other essential characteristics. However, the Neurologist Dr David Rail and the mathematician and modeller Mr Andrew Selby have proposed a radical new hypothesis that challenges existing theories on the origins of consciousness.

Challenging the Primacy of Intentionality

Philosophers and scientists have long grappled with the nature of consciousness – that elusive, subjective experience of being aware. Many theories have proposed that intentionality – the 'aboutness' or directedness of our mental states – is the cornerstone of consciousness. The influential Projective Consciousness Model and the Phenomenal Selfhood Model, for instance, identify intentionality as the most fundamental of five key invariants underlying conscious experience.

Dr David Rail, a consultant neurologist in Sydney, and Mr Andrew Selby, an independent practitioner from the UK, have put forward a provocative new hypothesis that turns this view on its head. They argue that intentionality emerges from an even more basic process – 'symintentry', or symmetry-based modelling. Therefore, they argue, intentionality is not the most fundamental basis for consciousness. Instead, they raise the radical hypothesis that intentionality has a more primitive origin, arguing that the human ability to detect and model symmetries in the environment gave rise to intentionality and, ultimately, conscious experience.

Symmetry and Consciousness

To understand the symintentry hypothesis, we need to take a step back and consider the role of symmetry in how we perceive and interact with the world. Symmetry is ubiquitous in nature, from the bilateral symmetry of many animals to the rotational symmetry of snowflakes. Our brains are remarkably adept at detecting these symmetries, which help us make sense of our environment.

Rail and Selby build on the work of two philosophers. First, Immanuel Kant, whose Transcendental Structuralist thesis proposed that our perceptions and thoughts conform to models prescribed by the inherent structure of the phenomenal mind. Second, the neo-Kantian philosopher Ernst Cassirer proposed that symmetry groups play a transcendental role in mediating between self and object. Rail and Selby propose that the ability to model symmetries in the environment was a crucial evolutionary step that laid the groundwork for more complex cognitive abilities, including intentionality. Therefore, they argue that the evolution of intentionality can be better understood through AEEN symmetrybased modelling (AEEN stands for Adaptation and Evolution of Symmetry based on Emergence in the Now).

At the heart of the symintentry hypothesis is a mathematical construct known as the quaternion-dual quaternion operator. Quaternions are a number system that extends complex numbers and are particularly useful for representing rotations in three-dimensional space. Dual quaternions, an extension of quaternions, can represent both rotations and translations and also support a vector form that is differentiable, leading to a type of mathematical field. The researchers propose that this mathematical framework evolved within consciousness as a powerful tool for modelling the world. The quaternion-dual quaternion operator, they argue, provides a robust way to model all movements in 3D space and to describe mathematical fields - capabilities that are crucial for conscious experience.

The Structure of the 'Now'

One of the most intriguing aspects of the symintentry hypothesis is its explanation of how we experience the present moment, or the 'Now'. The researchers describe three dynamic boundary conditions that define the Now: the interplay between noumena (things as they are in themselves) and phenomena (things as we perceive them), the relationship between future and past, and the distinction between self and other.



Within this framework, consciousness emerges through a process of symmetry breaking and restoration. Each moment of conscious experience begins with a symmetry-breaking event, projecting the 'phenomenal self' (our subjective sense of self) into a threedimensional space. This phenomenal self then engages in symintentry-based modelling, using imagination to optimise future outcomes. This process is facilitated by what Rail and Selby term the symintentry operator, which ensures that the phenomenal self can dynamically adapt and integrate experiences, leading to a cohesive and unified conscious experience.

Rail and Selby propose that our 'phenomenal self' can be understood as having four different levels: transcendental (the basic conditions that make it possible for us to have any experience); semiotic (how we interpret and make sense of the world around us using language, signs, and cultural symbols; epistemic (our beliefs, our reasoning processes, and how we justify what we think we know); and ontic (our experience of raw, uninterpreted sensory data and physical interactions with the world).

Importantly, these four levels aren't separate parts of our self, the researchers argue, but are different aspects or ways of looking at our conscious experience. They work together to create our complete sense of self and our experience of the world. Rail and Selby call this cyclical and self-referential process the Ouroboros loop (named after the ancient symbol of a serpent eating its own tail). They conceive of this loop as a Möbius strip, which they dub the 'Mouroboros'. This construct helps explain how the phenomenal self maintains continuity and contiguity, reconciling apparent paradoxes in our experience of consciousness.

Implications and Future Research

The symintentry hypothesis represents a significant departure from traditional theories of consciousness. Positioning symmetrybased modelling as the foundation of conscious experience offers a new lens through which to understand the mind's workings. If correct, this theory could have profound implications for our understanding of cognition, perception, and even artificial intelligence. It suggests that the ability to detect and model symmetries might be a crucial step in developing truly conscious Al systems.

Autopoiesis: Autopoietic systems are ones that are comprised of self-creating processes Allostasis: Maintaining homeostasis through internal adaptation to meet perceived and anticipated demands AEEN: Adaptation + Evolution + Emergence + NOW

Dissipative Structures: are open energy systems that constantly take in energy and matter as inputs and release them as outputs.



Symintentry Operator: Mathematical Framework

- 1. Quaternions (Q) and Dual Quaternions (DQ)
- Sy5 (Rotation, Translation, Scaling, Reflection, Inversion)
- 3. Exponential form of Q and DQ
- 4. DQ vectors, DQ Scalar and Vector Fields

SELF ~ OTHER

5. Del Operator: DQ vector calculus (Grad, Div, Curl)

Sy6: The six high-level modes of Sy5 (Mouchet)

- 1. To build (linear) algebraic representations
- 2. Constrain interactions in models of physics
- Extract universal properties in statistical physics and in non-linear dynamics.
- Solve dynamical equations by reducing the degrees of freedom between integrable and chaotic dynamics
- 5. To predict selection rules
- 6. To classify

Symintentry: The nexus of the Now – Unravelling the dynamics of real-time self-organization

In addition to exploring how their theory intersects with other significant research in the field, Rail and Selby are currently working on corroborating their hypothesis through further study. They are preparing a paper that aims to establish the structure of intentionality through the symintentry hypothesis, delving deeper into the interactions between the symmetry transformation operator and the four levels of the 'phenomenal self'.

Challenges, Critiques, and Further Research

While the symintentry hypothesis offers an intriguing new perspective on consciousness, it is not without its challenges. Critics may argue that the mathematical complexity of the quaternion-dual quaternion operator makes it difficult to relate directly to neural processes. Additionally, the abstract nature of symmetry-based modelling may be seen as too removed from the tangible, experiential aspects of consciousness that many researchers focus on.

Moreover, the hypothesis relies heavily on philosophical concepts from Kant and Cassirer, which some modern neuroscientists might view as outdated or too speculative. There is also the question of empirical testability - how can the predictions of the symintentry hypothesis be rigorously tested in laboratory settings?

Despite these potential criticisms, Rail and Selby's work represents an important contribution to the ongoing dialogue about the nature of consciousness. By bridging mathematics, philosophy, and cognitive science, they have opened up new avenues for exploring one of the most fundamental mysteries of existence. The symintentry hypothesis challenges us to reconsider our fundamental assumptions about consciousness and intentionality. While still in its early stages and requiring further validation, it represents an exciting new direction in consciousness research. As we continue to unravel the complexities of consciousness, theories like the symintentry hypothesis remind us that there is still much to discover about the nature of our own minds.

MEET THE RESEARCHERS



Dr David Rail, Consultant Neurologist, Sydney, Australia

Dr David Rail obtained his MB BS and MD from the University of New South Wales, Sydney. He trained in Neurology in London at the New Charing Cross and London Hospitals, and practised neurology in Sydney for over 40 years before retiring. Dr Rail is a Fellow of the Royal Australasian College of Physicians. His longstanding research focus is in Theoretical Cognitive Neurobiology, and he has presented research at meetings of the Chaos Society in the USA and internationally. For the past nine years, Dr Rail has collaborated with Andrew Selby to define a mathematical group called 'Cassirer's group' (CG), which underpins Kant's Transcendental Structuralist thesis. Their work extends the Kant-Cassirer conjectures to elucidate the interdependence of symmetry-based modelling and intentionality, which they term 'symintentry'.



FURTHER READING

D Rail, A Selby, <u>Re-evaluating the structure of consciousness through the symintentry hypothesis</u>, *Frontiers in Psychology*, 2023, 14, 1005139. DOI: <u>https://doi.org/10.3389/fpsyg.2023.1005139</u>



Andrew Selby, Kings Langley, United Kingdom

Andrew Selby qualified as a Civil Engineer (BSc(Hons)) in 1971 and worked for a large water company until 1997, specialising in design, water asset planning, strategy, and process modelling. He later audited water companies for Ofwat before joining AECOM in 2001, where he focused on water and wastewater asset failure modelling. He retired in 2020. Mr Selby has expanded his expertise through Open University studies, earning BSc (Hons) degrees in Mathematical Sciences (2004) and Natural Sciences (Physics) (2017). He has recently completed an MSc in Mathematics (Jul 2024). Since 2015, he has collaborated with Dr David Rail, developing a mathematical framework to model the structure of consciousness. Their work involves Quaternions, Dual Quaternions, and a novel vector calculus, aiming to bridge mathematics, engineering, and cognitive science in understanding consciousness.

