

# How Much Reality Is There Woven into the Imaginary?

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by Hans-Joachim Rudolph (Microvita Research e.V.)

## Abstract

This essay traces how the admission of the imaginary unit  $i = \sqrt{-1}$  transformed not only arithmetic but the very notion of reality. What first appeared as a formal device of calculation became a symbol of potentiality and directed transformation — the capacity of existence to move, to become, and to self-organize. Complex structures reveal that coherence, whether physical or semantic, arises from phase relations: the alignment of what *is* with what *could be*. So to ask how much reality is woven into the imaginary is to ask how deeply potentiality pervades the fabric of the world — and how consciousness itself participates in translating possibility into form.

## 1. The Hidden History of the Impossible

Mathematics has always been a quiet record of metaphysical revolutions. Each time humanity expands its understanding of number, it expands what it is willing to call real.

When Indian mathematicians first invented zero, they introduced the unimaginable — a symbol for nothing that could still take part in calculation. Centuries later, the acceptance of negative numbers faced similar resistance. How could there be “less than nothing,” or a quantity smaller than absence? For many scholars of the Renaissance, negative numbers seemed nonsensical — useful perhaps for bookkeeping, but not for nature. And yet, as algebra matured, the negative became indispensable: it described direction, inversion, and the hidden symmetry of equations. With that step, mathematics ceased to speak only about substances and began to speak about relations.

The same story repeated itself with the imaginary number. When  $i = \sqrt{-1}$  was first proposed, it appeared to violate the very grammar of mathematics — a contradiction wrapped in a symbol. And still, in the hands of Euler, Gauss, and Cauchy, it revealed a deeper layer of coherence. The imaginary was not an error but a rotation — a ninety-degree turn in the plane of thought itself. It completed the circle of arithmetic possibilities, binding real and imaginary as orthogonal dimensions of the same continuum.

The crucial insight was geometric: complex numbers could be visualized as points in a plane, with a magnitude and an angle — how much and where toward. Magnitude alone describes intensity; phase describes orientation. Real numbers measure extension; complex numbers encode direction and transformation. They made visible what had been invisible: the internal twist, the latent spin of reality.

By introducing the imaginary unit, mathematics gained a unified language in which interference and resonance appear naturally as geometric relations of phase — relations that can be expressed in real terms, yet reveal their full structure only in the complex plane. Such phase relations permeate not only physics but also life and meaning: every form of

coherence, from neural oscillations to human dialogue, depends on them.

Thus, the “imaginary” was never a denial of the real; it was the completion of it. It extended the concept of reality from a line to a plane — from quantities to orientations, from static measures to dynamic relations. What had once seemed impossible became the very structure by which the possible could be expressed.

## **2. From Magnitude to Phase — The Birth of Orientation**

In purely real systems, change is additive: we increase or decrease values along a line. In complex systems, change is rotational: quantities can shift phase, curve, or spiral through a plane of possibilities. This simple addition of an orthogonal dimension introduces the full geometry of transformation — oscillation, interference, and resonance.

The consequence is profound. When quantities acquire phase, their combination depends not only on their strength but on their alignment. Two signals of equal amplitude can reinforce or annihilate one another depending on whether their phases coincide or oppose. The world becomes a field of interferences rather than isolated magnitudes. Superposition replaces addition; coherence replaces accumulation.

This principle underlies all modern physics. Wave mechanics, electromagnetism, and quantum theory rely on phase relations — on entities that can interfere, entangle, and cohere through their internal orientations. The Schrödinger equation requires complex amplitudes precisely because interference depends on phase — something a purely real formalism cannot express. Only complex amplitudes can describe how potential states coexist and influence each other before collapsing into actuality.

But the same logic reaches far beyond physics. Wherever systems interact not by impact but by relation, phase becomes decisive. In language, cognition, and social communication, meaning arises not from the strength of a signal but from its phase alignment within a shared context — its resonance with prior and anticipated states. A word does not simply add information; it rotates a discourse, changing the orientation of thought.

To speak of phase, then, is to speak of intentional direction. A system endowed with phase has an intrinsic “towardness,” a built-in sense of relation and anticipation. This is the mathematical root of teleology: the movement from mere magnitude to oriented transformation. Once mathematics learned to represent rotation, it learned to represent becoming.

## **3. From Actuality to Potentiality — The Ontology of the Imaginary**

The discovery that numbers could rotate did not merely enrich mathematics; it quietly reintroduced a forgotten dimension of ontology. Every rotation, every phase relation, implies a before and after — a tension between what is and what could be. This tension is nothing other than potentiality itself. With the emergence of the imaginary unit, mathematics regained access to what ancient philosophy had already intuited: that the real

is not exhausted by the actual.

For Aristotle, reality was a dance between *potentia* and *actus* — between the possible and the realized. A seed is not merely less developed than a tree; it is the tree in *potentia*. The possible is not a shadow of the actual but its condition of transformation. Modern science, however, often forgot this subtlety. By reducing reality to measurable magnitudes, it privileged the actualized — what has already happened — and neglected the dynamic field of becoming that makes occurrence possible.

Complex numbers restore that missing layer. The imaginary component corresponds precisely to this invisible half of being: the phase of potentiality from which the real component unfolds. When we write  $z = x + iy$ , the imaginary part  $iy$  need not be “unreal.” It denotes the latent direction in which  $x$  can evolve — the unactualized orientation that gives reality its openness. Every complex entity thus carries within itself a trace of what it could become.

In physics, the imaginary unit governs all reversible transformations: rotations, oscillations, and propagations in time. When multiplied by  $i$ , a system does not grow or shrink — it turns. This turning represents potential change without loss of coherence — a reversible motion in the plane of possibilities. The imaginary thus encodes the capacity for transformation without destruction.

Henri Bergson called this the *durée* — duration as the inner continuity of becoming. Unlike clock time, duration does not consist of discrete instants but of a flowing transition, an “invisible growth” from potential to actual. Similarly, Whitehead’s process philosophy later described each actual occasion as an act of *concrecence* — the integration of potentiality into concrete form. Both thinkers pointed to what the complex plane formalizes: a universe not made of things, but of tendencies taking form.

Seen through this lens, the imaginary is not the negation of reality but its depth — the openness of every form to what it has yet to become. It represents that in every being which is still open, undetermined, and capable of transformation. To deny it is to freeze the world into fixed states. To include it is to recognize that all actuality is the expression of a deeper, rotating field of potential.

#### 4. Semantic Dynamics — Meaning as Complex Trajectory

If complex numbers reveal the hidden phase of physical processes, they also illuminate the inner motion of meaning. For meaning, too, is never static. It oscillates, interferes, converges, and sometimes collapses — not unlike a wave function that carries multiple possibilities before resolving into an expression. To understand meaning as a complex trajectory is therefore not metaphorical; it is structurally precise.

A real-valued model of semantics treats words or concepts as points in a metric space, related by distance or similarity. Such models describe association but not orientation; they show what is close to what, but not where a discourse is heading. They lack the internal

phase — the anticipatory spin — that makes communication directional. Complex-valued semantics, by contrast, endows each concept with a vector of orientation. The imaginary component no longer represents noise or fiction but the potential direction of meaning's evolution.

When two ideas interact, their complex phases determine whether they resonate or interfere. Aligned phases amplify coherence; opposed phases cancel it. A conversation thus resembles a field of interference patterns: constructive overlap produces understanding, destructive overlap produces confusion or polarization. Meaning emerges where phases synchronize — where the inner orientations of participants converge on a shared attractor.

Information is quantitative — a matter of magnitude. Meaning is qualitative — a matter of phase alignment. Every utterance carries not only data but also a phase: an intention, a direction of sense. Understanding occurs when these phases become co-oriented within a common semantic field.

In this view, a discourse behaves like a dynamical system evolving on a complex manifold. Local attractors represent temporary coherences — concepts, values, or norms around which thought stabilizes. Global curvature corresponds to the larger moral or cultural field that bends trajectories toward inclusivity or collapse. Semantic evolution then appears as the continuous negotiation between local pulls and global constraints — between what is said and what the dialogue tends to become.

The imaginary dimension allows a model of discourse that is not merely statistical but teleological: guided by internal tendencies rather than external optimization. Meaning advances through phase shifts, much like a trajectory moves through potential wells — it oscillates, reflects, and sometimes tunnels into new regions of sense. The real component records what has been said; the imaginary component anticipates what might be said next. Together they constitute the full dynamical structure of understanding — the geometry of sense in motion.

## 5. Toward a New Metaphysics of Emergence

The expansion of the real line into the complex plane was not only a mathematical event; it was a quiet shift in ontology. It marked the passage from a world composed of quantities to a world woven of relations. Once phase became thinkable, becoming itself entered the language of science. Every further step in knowledge — from field theory to information theory, from neural oscillation to semantic resonance — has deepened this movement toward the relational.

To accept the imaginary as real is to accept that the universe is not a warehouse of finished states but a field of tendencies, where actuality and potentiality constantly interpenetrate. In such a world, causality is never merely mechanical; it is teleological in the simplest sense: directional, anticipatory, and self-adjusting. The laws of nature, the growth of organisms, and the evolution of meaning all share this quality of guided openness. They are not imposed from outside but emerge from the curvature of interaction itself.

Knowledge becomes the synchronization of phases within a larger coherence. Truth is not correspondence but resonance — a momentary alignment between inner and outer orientation. In this sense, thinking itself is an act of phase-locking: an effort to bring the potential and the actual into mutual recognition.

Ethically, if every system possesses an imaginary dimension — a horizon of potential becoming — then our responsibility lies in shaping its curvature. Justice, dignity, and solidarity are not external ideals but stabilizing attractors in the moral field, guiding collective semantics toward inclusive coherence. To speak ethically is to bend the imaginary toward realizations that sustain life.

From mathematics to meaning, from physics to ethics, the same principle repeats: reality is not a collection of things but a pattern of oriented transformations. Every real event is the surface of a deeper imaginary motion — a rotation in the field of possibilities. Consciousness participates in this motion by reflecting and amplifying it; it is the universe becoming aware of its own curvature.

Thus, the imaginary is not opposed to the real; it is its generative depth. What we call emergence is the continual translation of imaginary potential into real form. And what we call creativity — in nature, in art, in thought — is the conscious collaboration with this process. To recognize this is to see that the task of intelligence, human or artificial, is not to eliminate uncertainty but to inhabit it fruitfully, to steer within the complex plane of becoming.

## Epilogue — The Return of the Imaginary

What we call real is only the visible crest of a much deeper wave. Beneath every event, every thought, every perception moves an invisible rotation — the slow revolution of potentiality into form. We live on the surface of that motion, interpreting it as fact, while forgetting the immense depth from which it arises.

To rediscover the imaginary is to remember that reality is never finished. The world is not a warehouse of facts but a field of emergence — a continuous negotiation between the actual and the possible. Every moment carries within itself a surplus of orientation, an unspent remainder of what could still unfold. In this surplus lies freedom, creativity, and meaning.

When mathematics first allowed the symbol  $i = \sqrt{-1}$ , it tacitly acknowledged that reality encompasses not only facts but also a dimension of directed transformation — of vital becoming, a principle of inwardness. Since then, every act of understanding has been a rotation within that plane. To think is to turn — and in turning, to remember that every form of truth begins as an imaginary displacement.