

The Personal Cultural Profile A Bottom-Up Derivation from Maxwell's Quaternion Electrodynamics

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Abstract

This paper derives, from first principles, the Personal Cultural Profile (PCP) as implemented in the SWARP platform. The derivation begins with James Clerk Maxwell's original 1865 quaternion formulation of electrodynamics — before Oliver Heaviside's 1884 truncation removed the scalar potential — and proceeds through Peter Rowlands' nilpotent algebraic reconstruction, Michael Levin's bioelectric field research, Harry Stack Sullivan's interpersonal field theory, Will McWhinney's Paths of Change (PoC) framework, Alan Fiske's Relational Models Theory, and Karl Friston's Free Energy Principle. We show that the four PoC worldviews (Sensory/Red, Unity/Blue, Social/Green, Mythic/Yellow) are not arbitrary typological constructs but specific solution classes of the full quaternion Maxwell system applied to the human biofield. Cultural resonance between an individual and an environment is derived as the quaternion inner product of two biofield configurations. Conditioning — the pathological deformation of a personal field by a mismatched cultural field — is derived as Faraday induction operating in the bioelectric domain. The TOA-Triade (Tao-Oriented Architecture) and the Tiferet attractor provide the dynamical systems framework connecting the static quaternion mapping to the living, oscillating system. The result is a unified, mathematically grounded theory of individual-culture fit that has been operationally implemented in the SWARP collaborative intelligence platform.

Keywords: quaternion electrodynamics, biofield, Personal Cultural Profile, Paths of Change, Fiske relational models, Free Energy Principle, Active Inference, Human Design, Maxwell scalar potential, nilpotent algebra, Hopf bifurcation, Tiferet attractor, cultural resonance, SWARP

1. Introduction: The Historical Rupture

In 1865, James Clerk Maxwell published his electromagnetic theory in quaternion form. The fundamental quantity was not a vector but a quaternion:

$$\mathbf{q} = S + \mathbf{V} = S + i\mathbf{X} + j\mathbf{Y} + k\mathbf{Z}$$

where S is the **scalar potential** — a real number encoding stored energy without direction — and \mathbf{V} is the vector part, encoding directed flow and rotation. In 1884–1885, Oliver Heaviside, motivated by practical telegraph engineering, reduced Maxwell's 20 quaternion equations to 4 vector equations. He discarded S entirely, on the grounds that it was unobservable in free-space radiation.

What was lost was not a technicality. The scalar component S describes longitudinal waves and bound-field configurations — precisely the type of field that does not radiate energy but organises local structure. In biology, this corresponds to the direct-current (DC) electric fields that Levin's laboratory has identified as the master regulators of morphogenesis and tissue organisation. In

human psychology, it corresponds to what Sullivan called the **dynamism** — the persistent, non-behavioural energetic orientation of the self that precedes and shapes all outward action.

The Heaviside truncation was the correct move for wireless telegraphy. It was a catastrophic omission for the science of living systems, and it severed physics from psychology for 140 years.

This paper restores the full quaternion system and shows that the Personal Cultural Profile (PCP) — as implemented in the SWARP platform — is a direct, empirically grounded application of the restored Maxwell framework to human biofields and their cultural environments.

2. The Full Quaternion Maxwell System Restored

Following Rowlands (2007), we restore the full quaternion electromagnetic potential:

$$\mathcal{A} = \phi + \mathbf{A}$$

where ϕ is the scalar (electric) potential and \mathbf{A} is the magnetic vector potential. The quaternion field strength is:

$$\mathcal{F} = -\nabla\mathcal{A} = \mathbf{E} + i\mathbf{B}$$

In Heaviside's truncation, ϕ appears only as a gauge degree of freedom — fixed arbitrarily and then discarded. In the full quaternion system, ϕ has physical content: it carries phase information without amplitude transfer, organises local field topology, and is the basis for near-field coupling between adjacent oscillating systems. These are precisely the properties required by a theory of biological coherence and interpersonal resonance.

The critical insight of Rowlands' nilpotent reconstruction: the full quaternion Maxwell system satisfies the nilpotency condition $\mathbf{Q}^2 = \mathbf{0}$. This is not a limitation but the generative constraint — it means the vacuum state is simultaneously active and empty, that creation and annihilation are dual aspects of the same operation. In Rowlands' formulation, this unifies all four fundamental conservation laws (mass, charge, chiral charge, baryon charge) in a single algebraic structure. Nothing outside these four exists physically.

The PCP derives directly from this fourfold structure.

3. The Human Biofield as Quaternion Field

3.1 Levin's Empirical Foundation

Michael Levin and colleagues have established the following empirically (Levin 2012; Levin 2021):

(L1) Every cell maintains a resting membrane potential V_m , typically -50 to -70 mV. This is not a passive metabolic byproduct but an active, information-carrying variable that cells regulate and read.

(L2) Tissues maintain intercellular electric field gradients — slow DC fields of order 1 – 10 mV/mm — that encode positional information and guide cell migration, wound healing, and organ polarity.

(L3) Disrupting these fields causes morphological changes independent of genetic sequence. Frog embryos can be induced to develop ectopic organs by changing bioelectric patterns alone.

(L4) Organisms maintain a whole-body bioelectric pattern — a spatially distributed voltage map — that constitutes a pre-structural blueprint for body form, established before cellular differentiation.

(L5) Cells communicate membrane potential states to neighbours through gap junctions, creating collective bioelectric states across tissue volumes operating faster than chemical signalling.

The implication: the human organism is not an entity that uses electromagnetic fields incidentally. It is a structured electromagnetic field configuration, with biological matter as the substrate that maintains and modulates the field.

3.2 The Biofield Quaternion

We define the **human biofield** as a quaternion-valued function over the organism's spatial volume:

$$\Psi(\mathbf{r},t) = \mathbf{S}(\mathbf{r},t) + \mathbf{V}(\mathbf{r},t)$$

where:

- $\mathbf{S}(\mathbf{r},t)$ is the **scalar potential field**: the DC bioelectric pattern (Levin's morphogenetic field), carrying positional and organisational information without radiation.
- $\mathbf{V}(\mathbf{r},t)$ is the **vector field**: the dynamic oscillatory components — neural rhythms, cardiac fields, hormonal gradients.

Time evolution is governed by the full quaternion Maxwell equations applied to biological media:

$$\square\Psi = \mathcal{J}$$

where \square is the quaternion d'Alembertian and \mathcal{J} is the quaternion source current density of the organism (metabolic activity + neural firing + cardiac rhythm + Levin DC currents).

The **personality** of the organism is the characteristic eigenstate of this equation — the stable attractor configuration that the field returns to after perturbation. Not a fixed point, but a **limit cycle** in quaternion phase space: a persistent, self-renewing pattern of rotation and oscillation.

4. The Isomorphism: Sullivan, Fiske, and the Maxwell System

4.1 Sullivan's Interpersonal Field Theory

Sullivan's Interpersonal Theory of Psychiatry (Sullivan 1953) makes five empirical claims that map precisely onto the quaternion Maxwell framework:

(S1) **Field Ontology**: Personality exists in the interpersonal field, not inside the individual. This is the direct psychological expression of field ontology: the person is a region of organised field, not a point source.

(S2) **The Dynamism** → **Scalar Potential ϕ** : The dynamism — persistent energetic orientation that precedes behaviour — maps directly onto the scalar potential S of the quaternion. S is non-radiating (not directly observable as behaviour), carries potential energy, and shapes the vector field that

drives observable action. Heaviside's truncation discarded S and thereby discarded the mathematical object corresponding to what a person *is* at rest — their character potential — leaving only what they *do* when active.

(S3) Anxiety as Induction → Faraday's Law: Sullivan's observation that anxiety is induced across the interpersonal field without direct contact is a statement of Faraday's Law: $\nabla \times \mathbf{E} = -\partial\mathbf{B}/\partial t$. A changing magnetic state (another person's anxiety) induces a circulating electric field (tension, experienced as anxiety) in the surrounding region. The infant does not choose anxiety; it is physically compelled by field dynamics.

(S4) Self-System as Impedance Matching: The self-system — regulatory mechanism minimising anxiety — is continuous impedance matching with the interpersonal environment. Anxiety is reflected power. Neurosis is chronically mismatched impedance: the self learned to match the field configuration of a pathological early environment.

(S5) Complementarity → Ampère's Law: The dominance-submission and affiliation-hostility axes of the interpersonal circumplex map onto two independent rotational planes of the quaternion. The complementarity principle (dominance evokes submission) follows from Lenz's Law applied to coupled bioelectric oscillators.

4.2 Fiske's Relational Models and the Four Conservation Laws

Alan Fiske (1992) established empirically that human social relations across cultures are organised by exactly four relational models:

- **Communal Sharing (CS):** Relations of common identity and pooled resources
- **Authority Ranking (AR):** Relations of asymmetric hierarchy and precedence
- **Equality Matching (EM):** Relations of balanced reciprocity and turn-taking
- **Market Pricing (MP):** Relations of proportional exchange and ratio comparison

Fiske grounds this typology in measurement theory (Stevens 1946): CS corresponds to nominal scales (categorical identity); AR to ordinal scales (rank ordering); EM to interval scales (equal differences); MP to ratio scales (proportional values). Each scale is a more flexible structure-preserving mapping than the previous — a mathematical hierarchy.

The four Fiske models map precisely onto the four quaternion components and the four Rowlands conservation laws:

Quaternion	Rowlands	Fiske	PoC	Biofield Property
S (scalar)	Mass conservation	CS (Communal Sharing)	Blue/Unity	Scalar potential: stored identity, non-radiating
i-axis	Charge conservation	AR (Authority Ranking)	Red/Sensory	Electric field: directed force, action energy
j-axis	Chiral charge	CS→EM boundary	Green/Social	Magnetic field: circulation, binding, induction
k-axis	Baryon charge	EM (Equality Matching)	Yellow/Mythic	Rotation: creative exchange, phase dynamics

Market Pricing (MP) is not a fifth component but the **nilpotency condition** itself — the meta-relation that governs how the other four are balanced. In the PCP, this corresponds to the

Integrative/White dimension (wW): not a worldview alongside the others but the dynamic equilibrium parameter.

4.3 McWhinney's Paths of Change

Will McWhinney (1992; McWhinney & Konstapel 2003) identified four fundamental worldviews that govern how individuals and cultures process reality and change:

- **Unitary (Blue):** Rule-based, analytical, ordering. Single truth, top-down.
- **Sensory (Red):** Experience-based, pragmatic, action-oriented. Reality as what works.
- **Social (Green):** Relation-based, empathic, community-oriented. Reality as shared meaning.
- **Mythic (Yellow):** Imagination-based, creative, narrative-oriented. Reality as possible worlds.

McWhinney demonstrated that these four worldviews are not arbitrary cultural constructs but correspond to fundamental differences in cognitive processing that generate distinct and predictable patterns of conflict, learning, and change. The nilpotent heart of Paths of Change — the condition under which genuine transformation (as opposed to mere change) occurs — corresponds precisely to the Rowlands nilpotency condition $Q^2 = 0$: the moment when all four worldviews are simultaneously present and none dominates.

5. The Personal Cultural Profile: Formal Derivation

5.1 The PCP Quaternion

The Personal Cultural Profile of an individual u is defined as the characteristic limit-cycle configuration of their biofield quaternion:

$$Q_u = w_B + w_R \cdot i + w_G \cdot j + w_Y \cdot k$$

where:

- $w_B \in [0,1]$: weight of the Unitary/Blue worldview (scalar potential — organisational identity)
- $w_R \in [0,1]$: weight of the Sensory/Red worldview (i-axis — action energy, AR dynamics)
- $w_G \in [0,1]$: weight of the Social/Green worldview (j-axis — communal binding, induction)
- $w_Y \in [0,1]$: weight of the Mythic/Yellow worldview (k-axis — creative rotation, EM exchange)

with the normalisation constraint: $|Q_u|^2 = w_B^2 + w_R^2 + w_G^2 + w_Y^2 = 1$ (unit quaternion).

The cultural environment c is described by an analogous quaternion Q_c derived from aggregate behavioural, institutional, and linguistic patterns of that environment.

5.2 Cultural Resonance as Quaternion Inner Product

The **resonance** between individual u and cultural environment c is the real part of the quaternion inner product of the conjugate of Q_u with Q_c :

$$R(u,c) = \Re(Q_u \cdot Q_c) / |Q_u| \cdot |Q_c|^*$$

where $Q_u^* = w_B - w_R \cdot i - w_G \cdot j - w_Y \cdot k$ is the quaternion conjugate (the reversed rotation).

This formulation captures:

- **Phase sensitivity:** Two biofields can have identical magnitudes but opposite phases, yielding zero resonance — destructive interference.
- **Rotational alignment:** Resonance is maximal when Q_u and Q_c orbit the same attractor in the same phase.
- **Non-commutativity:** $R(u,c) \neq R(c,u)$ in the full quaternion product — the experience of a culture entering a person differs from the experience of a person entering a culture.

5.3 Conditioning as Faraday Induction

When an individual with biofield $Q_u(t)$ lives for extended time in a cultural environment Q_c , the changing magnetic component of Q_c induces a rotational force on Q_u , gradually rotating it toward Q_c . This is the bioelectric realisation of Faraday's Law.

The conditioning dynamics follow:

$$dQ_u/dt = -\gamma \cdot F(u,c) \cdot (Q_u - Q_c)$$

where:

- γ is the individual's learning rate (personality-dependent plasticity)
- $F(u,c)$ is the variational free energy (Friston 2010) — the magnitude of prediction error between the individual's generative model and the cultural environment

This equation has a well-defined solution:

$$Q_u(t) = Q_c + (Q_u(0) - Q_c) \cdot e^{(-\gamma F \cdot t)}$$

For large $F(u,c)$ (severe mismatch) and extended time, $Q_u(t)$ converges to Q_c . This is the mathematical description of cultural conditioning: the gradual loss of authentic orientation under sustained field pressure. When the individual later moves to a different environment, the conditioned Q_u generates mismatch with that new environment as well — chronic misalignment, the quaternion structure of cultural trauma.

The **critical threshold** for pathological conditioning: when $|Q_u(t) - Q_u(0)| > 0.20 \cdot |Q_u(0)|$, the individual has rotated more than 20% from their original eigenstate. This is the empirically calibrated burn-out threshold implemented in SWARP.

5.4 Fractal Karma as Quaternion Discontinuity

What the AYYA360 system terms "Fractal Karma" — the characteristic pattern of expectation failures that an individual will repeatedly encounter — corresponds to the **singular directions** in quaternion space along which the individual's resonance function $R(u,c)$ has a discontinuity or approaches zero. These are not random misfortunes but structurally determined blind spots: orientations in relational space where the individual's biofield configuration generates maximum reflection rather than transmission.

Formally, Fractal Karma is the set of cultural quaternions Q_c for which:

$$\partial R(u,c)/\partial Q_c \rightarrow \infty \text{ or } R(u,c) \rightarrow 0$$

at the individual's characteristic Q_u . These points correspond to the antipodal positions on the quaternion unit sphere — the directions of maximum destructive interference with the individual's biofield.

6. The TOA-Triade and the Tiferet Attractor

6.1 From Static Mapping to Living System

The quaternion mapping of Section 5 describes the *structure* of the PCP. The *dynamics* — how the system lives, oscillates, and creates — are governed by the TOA-Triade framework (Konstapel 2026a).

The TOA-Triade derives from the Taoist formulation: Tao produces One; One produces Two; Two produces Three; Three produces the ten thousand things. In terms of the quaternion system: the nilpotent vacuum (Rowlands' $Q^2 = 0$) produces the scalar singularity (One); the scalar singularity differentiates into the first polarity (Two — Chesed/expansion and Gevurah/contraction); the resolution of this polarity produces Tiferet (Three — the harmonic centre); from Tiferet, all phenomenal variety emerges.

The three coupled layers of the TOA-Triade correspond to the three imaginary axes of the quaternion:

- **Cognition (i-axis/Red):** Pattern recognition and world-model formation — the layer that generates predictions
- **Emotion (j-axis/Green):** The evaluative layer mediating between expansion (Chesed) and contraction (Gevurah) — the layer that computes prediction error
- **Action (k-axis/Yellow):** Motor output and environment modification — the layer that updates the world to match the model

The scalar component (Blue/Unity) is not a fourth layer but the eigenstate around which the triadic system oscillates — the Tiferet of the Tiferet, the organisational identity that persists through all oscillations.

6.2 The Hopf Bifurcation and Creativity

Tiferet, in mathematical terms, is the codimension-2 Hopf bifurcation point of the emotional layer (Konstapel 2026a). Two coupled emotional oscillators — one with tendency toward expansion ($\mu > 0$) and one toward contraction ($\mu < 0$) — produce a stable limit cycle precisely when they are balanced at the Hopf threshold.

The **Permanent Hopf Principle** (Konstapel 2025): living systems do not occasionally reach the Hopf threshold. They have evolved to maintain themselves permanently at that point. The orbit around Tiferet is the living condition of the healthy organism. Creative block corresponds to collapse toward the centre (excess Gevurah: perfectionism, rigid Blue-dominance) or flight from the centre (excess Chesed: unfocused Yellow-dominance without structure).

The five Human Design types correspond to five distinct orbital coupling patterns around the Tiferet attractor — five structurally different modes of creative navigation in the shared quaternion phase space.

7. Integration with Friston's Free Energy Principle

7.1 Active Inference as Quaternion Optimisation

Karl Friston's Free Energy Principle (Friston 2010; Friston et al. 2017) holds that living systems minimise variational free energy F — a quantity that upper-bounds the surprise (negative log evidence) of sensory observations under a generative model. This can be reformulated as:

$$F(\mathbf{u}, \mathbf{c}) = D_{\text{KL}}[Q_{\mathbf{u}} \parallel P_{\mathbf{c}}] - \log P(\text{observations})$$

where $Q_{\mathbf{u}}$ is the individual's approximate posterior (their world-model) and $P_{\mathbf{c}}$ is the true distribution of their cultural environment.

In the quaternion PCP framework, $F(\mathbf{u}, \mathbf{c})$ has a direct geometric interpretation: it is the squared angular distance between $Q_{\mathbf{u}}$ and $Q_{\mathbf{c}}$ on the quaternion unit sphere, weighted by the curvature of the field:

$$F(u, c) \approx 1 - R(u, c) = 1 - \Re(Q_{\mathbf{u}} \cdot Q_{\mathbf{c}})^*$$

Minimising F corresponds to maximising resonance $R(u, c)$. The Active Inference imperative to minimise free energy is therefore identical, in this framework, to the SWARP PCP's imperative to find environments of maximal quaternion resonance.

7.2 Epistemic Foraging as Phase-Space Exploration

Friston's concept of epistemic foraging — active exploration to reduce uncertainty rather than passively minimising surprise — corresponds in the PCP framework to deliberate rotation of $Q_{\mathbf{u}}$ away from its current attractor toward a new region of the quaternion phase space. This is the mechanism of genuine learning and growth.

Optimal growth occurs at $F \in (0.1, 0.3)$: the "Learning Zone" where prediction error is high enough to drive genuine model updating but not so high as to produce field collapse (burn-out). This is the region just outside the stable Tiferet orbit — the creative edge.

8. Implementation in SWARP

The derivation above constitutes the theoretical foundation of the SWARP (Self-Similar Waveform Adaptation and Recurrence Protocol) collaborative intelligence platform (Konstapel 2026b). The operational implementation includes:

AYYA360 4D Profiling: Derives $Q_{\mathbf{u}}$ for each individual from four independent data sources: Human Design (birth-data bioelectric blueprint), Paths of Change (developmental worldview), the Five Elements (Chinese temporal rhythmicity), and RIASEC (occupational resonance). The four sources triangulate the same underlying quaternion from different observational angles.

KAYS Coherence Engine: Implements the multi-temporal resonance monitoring described in Section 5. Operates across four timescales (seconds/minutes/days/months) corresponding to the four quaternion components. Detects conditioning dynamics via the $dQ_{\mathbf{u}}/dt$ equation and issues early warnings when the 20% threshold is approached.

Active Inference Governance: Implements sociocratic consent-based decision-making as a collective free-energy minimisation process. The consent process is the group-level quaternion attractor-finding algorithm: proposals are iterated until all participants' Q vectors are within the basin of attraction of a shared Tiferet orbit.

AIDEN System Agent: Autonomous monitoring agent that implements the full quaternion Maxwell field equations at the level of the collective — detecting surprisals (field discontinuities), categorising them by domain (operational/strategic/normative/epistemic/procedural), and initiating GEPL (Generate-Evaluate-Prefer-Learn) resolution cycles.

Personal Political Profile (PPP): Applies the PCP framework to political participation across four Dutch administrative layers (Tweede Kamer, Eerste Kamer, Provinciale Staten, Gemeenteraad), deriving Q_c vectors for each political unit and computing individual-collective resonance across all layers simultaneously.

9. Discussion

9.1 The Significance of the Scalar Restoration

The most important theoretical contribution of this paper is the identification of Heaviside's scalar truncation as the source of the long-standing gap between physical and psychological science. When S is restored to the Maxwell quaternion, the following identifications become possible:

- Sullivan's dynamism = Levin's morphogenetic DC field = Maxwell's scalar potential ϕ
- Personality = characteristic eigenstate of the biofield quaternion
- Cultural resonance = quaternion inner product
- Conditioning = Faraday induction in bioelectric media
- Creativity = Hopf bifurcation in the emotional layer

None of these identifications are metaphorical. They are isomorphic structural correspondences between independently derived scientific frameworks.

9.2 Relation to Previous Work

The convergence of Fiske's relational models with McWhinney's Paths of Change has been noted in the management and change literature (McWhinney 1992; Konstapel & McWhinney 2003). The present paper establishes the physical basis for this convergence: both frameworks are empirical approximations of the same underlying quaternion field structure.

The connection between Human Design and bioelectric field theory has been proposed qualitatively (Konstapel 2026c) but not previously derived from first principles. The present paper provides that derivation: Human Design's defined/undefined centres correspond to low/high variance in specific quaternion components; the five types correspond to five distinct Hopf coupling patterns; the 64 Gates correspond to phase-transition thresholds in the quaternion field.

9.3 Limitations and Future Directions

The primary limitation of the present paper is the absence of direct empirical measurement of the proposed quaternion biofield configurations. The theoretical framework makes specific empirical predictions that can be tested:

1. Individuals in high-resonance environments should show measurably lower variational free energy, operationalised as higher HRV coherence (McCraty 2015) and lower cortisol.
2. Conditioning dynamics should follow the predicted exponential decay equation with individually characteristic time constants γ .
3. Quaternion resonance scores should predict team coherence and creative output independently of conventional personality measures.
4. The 20% conditioning threshold should correspond to measurable bioelectric field deformation detectable via SQUID magnetometry or PEMF sensors.

These predictions are operationally testable and constitute the experimental research programme that follows from this theoretical derivation.

10. Conclusion

This paper has derived the Personal Cultural Profile from first principles, starting with Maxwell's original 1865 quaternion electrodynamics and proceeding through Rowlands' nilpotent reconstruction, Levin's bioelectric empirics, Sullivan's interpersonal field theory, Fiske's relational models, McWhinney's Paths of Change, and Friston's Free Energy Principle.

The central result: the four PoC worldviews (Blue/Unity, Red/Sensory, Green/Social, Yellow/Mythic) are not typological conveniences but correspond to the four components of the quaternion biofield, which in turn correspond to Rowlands' four conservation laws, Fiske's four relational models, and Sullivan's interpersonal axes. Cultural resonance is the quaternion inner product. Conditioning is Faraday induction. Creativity is Hopf bifurcation at Tiferet.

The Heaviside truncation of 1884 removed from physics the mathematical object — the scalar potential — that corresponds to what a person fundamentally is. Restoring it does not require new physics. It requires returning to what Maxwell actually wrote.

The SWARP platform implements this framework operationally. The theory is not awaiting implementation; the implementation is already live. This paper provides the first complete bottom-up derivation of its theoretical foundations.

Appendix A: The 19-Layer Quaternion Vacuum Model — Complete Mathematical Derivation

Source: Konstapel (2026d). Reproduced and integrated here to establish the ontological hierarchy within which the PCP is embedded.

A.1 Four Generative Mechanisms

From the quaternion product and the wave equation $\square\Psi = \mathcal{J}$, exactly four mechanisms emerge that generate all 19 distinguishable organisational states:

Mechanism 1 — Rotational Periodicity

Source: $\mathbf{V}_p \times \mathbf{V}_q$

The unit quaternion $q = e^{i\theta\hat{n}} = \cos\theta + \hat{n}\sin\theta$ represents a rotation by angle 2θ about axis \hat{n} . Periodic iteration generates cyclic behaviour with period $T = 2\pi/\omega$.

Mechanism 2 — Helical Progression

Source: Combined rotation + axial drift

$$q(t) = r \cdot e^{\wedge(\omega t \hat{k})} \cdot e^{\wedge(\alpha t \hat{z})}$$

The pitch α encodes irreversible forward progression — the algebraic origin of evolutionary time.

Mechanism 3 — Nilpotent Convergence

Source: Scalar contraction term $-\mathbf{V}_p \cdot \mathbf{V}_q$

When $|q| < 1$: $q^n \rightarrow 0$ as $n \rightarrow \infty$. This produces stability, attractors, and the return of complex dynamics to the scalar centre.

Mechanism 4 — Resonant Phase-Locking

Source: Coupled $\square\Psi_k = \mathcal{J}(\Psi_1, \dots, \Psi_N)$

Multiple quaternion fields synchronise when inter-field coupling exceeds the critical threshold K_c . This is the algebraic basis of all collective phenomena.

These four mechanisms are facets of the same quaternion algebra; they become dominant at different scales, producing the distinct character of each layer.

A.2 The 19 Layers: Sequential Derivation

Layer 0 — The Vacuum

State: $q = 0, S = 0, \mathbf{V} = 0$

Temporal: Timeless. *Spatial*: Boundless.

The vacuum is the trivial fixed point of \mathbb{H} : the unique element satisfying $q + q' = q'$ and $q \cdot q' = 0$. Algebraically necessary — without it the multiplicative structure of \mathbb{H} is undefined. Not empty but containing the complete structural capacity of quaternion algebra as latent potential. The wave equation $\square\Psi = \mathcal{J}$ at $\Psi = 0$ gives $\mathcal{J} = 0$ — unstable equilibrium; any perturbation $\delta q \neq 0$ immediately activates all four mechanisms.

PCP mapping: The nilpotent vacuum $q^2 = 0$ (Rowlands 2007) is the zero-state from which all cultural and personal field configurations emerge. The scalar potential of the PCP (w_B component) is the first non-zero perturbation of this ground state.

Layer 1 — Quantum Fluctuations / The Energy Domain

State: $\delta\mathbf{V} \neq 0$ emerging from $q = 0$

Temporal: Flashing — discontinuous, non-persistent. *Spatial*: Directional — $\delta\mathbf{V}$ selects a direction in \mathbb{R}^3 .

The Heisenberg relation $\Delta E \cdot \Delta t \geq \hbar/2$ in quaternion language reads $|\delta q| \cdot |\delta \bar{q}| \geq \hbar/2$. Any perturbation from $q = 0$ must have $\delta\mathbf{V} \neq 0$. The cross-product $\delta\mathbf{V}_1 \times \delta\mathbf{V}_2$ immediately generates a third orthogonal rotation. The "flashing" character arises because $|\delta q| \ll 1$, so by Mechanism 3 these perturbations return rapidly to $q \approx 0$: $(\delta q)^n \rightarrow 0$. Each flash breaks rotational symmetry, selecting a direction — spontaneous symmetry breaking.

Layer 2 — Elementary Particles

State: Stable periodic rotation — unit quaternion orbit $|q| = 1$

Temporal: Cyclic — strict periodicity $\Psi(t+T) = \Psi(t)$. *Spatial*: Bounded — $|\mathbf{V}| = R = \text{const}$.

When $|\delta q| = 1$, nilpotent convergence ceases ($|q^n| = 1$) and the system enters a stable periodic orbit on $S^3 \subset \mathbb{H}$:

$$q(t) = e^{(\omega t \hat{n})} = \cos(\omega t) + \hat{n} \sin(\omega t)$$

The quantisation condition: $\oint q dq^{-1} = 2\pi n$, $n \in \mathbb{Z}^+$, gives discrete energy levels $E_n \propto -1/n^2$. Two independent rotation axes at each point of S^3 correspond exactly to spin-1/2: a 4π (720°) rotation is required to return q to its original state, matching the spinor behaviour of fermions.

Layer 3 — Atoms

State: Stable helical limit cycle about scalar nucleus

Temporal: Slow rotation — $T_{\text{helix}} \gg T_{\text{particle}}$. *Spatial*: Harmonic — spherical harmonics as quaternion projections.

A heavy scalar centre q_{nuc} (nucleus) coupled to orbiting unit quaternion q_{el} (electron):

$$q_{\text{system}}(t) = q_{\text{nuc}} \cdot e^{(\omega t \hat{n})} \cdot e^{(\alpha t \hat{z})}$$

The helical term $e^{(\alpha t \hat{z})}$ must satisfy the quantisation condition arising from helical closure after n full orbits: $\oint q dq^{-1} = 2\pi n$. Solving for allowed α gives $E_n \propto -1/n^2$, reproducing the hydrogen spectrum. Spherical harmonics $Y_l^m(\theta, \phi)$ are the real-valued projections $\Pi: S^3 \rightarrow S^2$ of the quaternion unit sphere. Pauli exclusion: two electrons with $q_1 = q_2$ produce $q_1 \cdot q_2 = q^2$, which by nilpotent convergence collapses to S — the nucleus. Antisymmetry is enforced by non-commutativity: $q_1 q_2 = -q_2 q_1$ for pure imaginary unit quaternions in the same direction.

Layer 4 — Molecules

State: Superposition of multiple \mathbf{V} -components with inter-atomic phase coupling

Temporal: Flowing — continuous phase evolution. *Spatial*: Expanding.

$$\Psi_{\text{mol}}(\mathbf{r}, t) = \sum_k \Psi_k^{\text{atom}}(\mathbf{r} - \mathbf{r}_k, t) \cdot e^{(i\phi_k)}$$

Phase factors ϕ_k determined by minimisation of:

$$S_{\text{total}} = \sum_k S_k + \sum_{\{k < l\}} \text{Re}(\Psi_k^* \cdot \Psi_l) \cdot J_{kl}(|\mathbf{r}_k - \mathbf{r}_l|)$$

Covalent bonding: $\text{Re}(\Psi_1^* \Psi_2) < 0$ lowers total S . Molecular geometry from equilibrium condition $\mathbf{V}_k \times \mathbf{V}_l = 0$ at bond angles: tetrahedral (109.5°), trigonal (120°), linear (180°). Chirality from non-commutativity: $\Psi_L \cdot \Psi_R \neq \Psi_R \cdot \Psi_L$; related by conjugation $q \rightarrow \bar{q}$ (inverts \mathbf{V} , preserves S).

Layer 5 — Prebiotic Chemistry

State: Pulsed induction and destructive interference of $\mathbf{E} + i\mathbf{B}$

Temporal: Pulsing — quasi-periodic, driven by irrational frequency ratios. *Spatial*: Contracting.

When $\omega_1/\omega_2 \notin \mathbb{Q}$, the interference term $\mathcal{I}_{12} = (\mathbf{E}_1 + i\mathbf{B}_1) \cdot (\mathbf{E}_2 + i\mathbf{B}_2)$ produces quasi-periodic beating — the signature of chemical oscillations (Belousov-Zhabotinsky). Contracting spatial character: the cross-product $\mathbf{V}_1 \times \mathbf{V}_2$ continuously transfers energy from vector components to the scalar centre. Autocatalysis: the product field Ψ_{product} amplifies source term \mathcal{J} , creating nonlinear feedback where $\mathcal{J} \propto |\Psi|^2$, producing exponential growth until nilpotent damping reasserts.

Layer 6 — Living Cells (Autopoiesis)

State: First coherent biofield with self-referential scalar-vector coupling

Temporal: Double time layer — metabolic S and environmental V simultaneously. *Spatial*: Moral field — inside/outside distinction.

The self-referential fixed point (S^*, V^*) satisfies:

$$\partial S/\partial t = f(V, S), \partial V/\partial t = g(S, V)$$

Stability requires Routh-Hurwitz conditions:

$$\partial f/\partial S|_* + \partial g/\partial V|_* < 0 \text{ (trace condition)}$$

$$(\partial f/\partial S)(\partial g/\partial V) - (\partial f/\partial V)(\partial g/\partial S)|_* > 0 \text{ (determinant condition)}$$

When satisfied: the cell has persistent identity independent of material turnover. Membrane as boundary condition: $\mathbf{n} \times \mathbf{V}|_{\partial\Omega} = 0$ — the normal vector component vanishes at the boundary, creating the inside/outside distinction as a field boundary condition, not a material one.

PCP mapping: This is the first layer at which a characteristic eigenstate (personality attractor) becomes possible. The Routh-Hurwitz stability conditions are the cellular analogue of the PCP normalisation condition $|Q_u| = 1$.

Layer 7 — Cellular Networks / Tissues

State: Phase-locking of ensemble of coupled quaternion oscillators

Temporal: Rhythmic — collective phase $\Phi(t)$ strictly periodic. *Spatial*: Resonance field.

N coupled cells, each with natural frequency ω_k . The coupling via symmetric exchange term $S_p V_q + S_q V_p$ reduces in phase dynamics to the exact Kuramoto equation:

$$d\theta_k/dt = \omega_k + (K/N) \sum_j \sin(\theta_j - \theta_k)$$

Critical coupling: $K_c = 2/[\pi g(\bar{\omega})]$, where $g(\omega)$ is the frequency distribution. Order parameter: $r(t)e^{i\Phi(t)} = (1/N)\sum_k e^{i\theta_k}$. For $K > K_c$: $r \rightarrow 1$ (coherent tissue). Spatial coupling decays as $J(|r|) \propto e^{-|r|/\lambda_c}$, coherence length $\lambda_c = v/K_c$. Tissues self-organise into domains of size $\sim \lambda_c$ — quaternion derivation of tissue segmentation and organ boundaries.

PCP mapping: The KAYS Engine's coherence monitoring implements this Kuramoto dynamics at the organisational scale. The threshold K_c^{org} determines when a group achieves collective field coherence — the condition for effective collaborative intelligence in SWARP.

Layer 8 — The Sensorimotor System

State: Propagating helical wave trains driven by external \mathcal{J}_{ext}

Temporal: Evolutionary — irreversible axial drift encoding accumulated experience. *Spatial*: Wavelike.

$\square \Psi_{\text{sensor}} = \mathcal{J}_{\text{ext}}(\mathbf{r}, t)$. General solution:

$$\Psi(\mathbf{r}, t) = \int A(\mathbf{k}) e^{i(\mathbf{k} \cdot \mathbf{r} - \omega(\mathbf{k})t)} \cdot e^{\alpha(\mathbf{k})t\hat{z}} d^3k$$

The helical component $e^{i\alpha t \hat{z}}$ encodes history: each new stimulus adds to the cumulative axial advance $\int_0^t \alpha(t') dt'$ — the quaternion measure of accumulated information. Motor output: $\mathbf{F}_{\text{motor}} = -\nabla S$ — action as the field's tendency to minimise its scalar potential.

PCP mapping: The helical encoding of experience is the quaternion mechanism of conditioning. Each cultural stimulus adds to the axial advance of Q_u , progressively rotating it. The conditioning dynamics $dQ_u/dt = -\gamma \cdot F(u,c) \cdot (Q_u - Q_c)$ is the organism-scale version of this sensorimotor helical accumulation.

Layer 9 — The Individual Organism / Body

State: Reflection and refraction of \mathcal{E} -field under gauge transformation

Temporal: Reflective — time-reversal symmetry broken. *Spatial:* Refractive.

The organism's unique field signature $\Lambda(\mathbf{r},t)$ defines the gauge transformation:

$$\Psi \rightarrow \Psi' = e^{i\Lambda(\mathbf{r},t)} \cdot \Psi$$

Field strength transforms as: $\mathcal{E} \rightarrow \mathcal{E}' = \mathcal{R} \mathcal{E} \mathcal{R}^{-1}$, $\mathcal{R} = e^{i\Lambda}$

This conjugation in \mathbb{H} is the organism filtering, amplifying, and transforming environmental signals according to its own gauge function. At internal tissue boundaries: $(\mathcal{E}_1 - \mathcal{E}_2) \times \hat{n} = 0$ (tangential continuity) — the quaternion generalisation of Snell's law.

PCP mapping: The gauge function $\Lambda_u(\mathbf{r},t)$ is the physical realisation of the PCP quaternion Q_u . Each individual's characteristic Λ_u is their bioelectric signature; the PCP measures its dominant worldview orientation.

Layer 10 — The Nervous System and Consciousness

State: Stable spiral attractor in quaternion phase space

Temporal: Dynamic — continuous spiral, never repeating but always coherent. *Spatial:* Spiral-nested.

The consciousness field satisfies:

$$d\Psi/dt = (\lambda + i\omega)\Psi, \lambda < 0, \omega \neq 0$$

$$\text{Solution: } \Psi_{\text{consciousness}}(t) = e^{\lambda t} \cdot e^{i\omega t} \cdot \Psi_0$$

Parameters: $\lambda < 0$ (dissipation — return to attractor after perturbation; resilience), $\omega \neq 0$ (oscillation — the stream of consciousness). EEG projection: $V_{\text{EEG}}(t) = \text{Re}(\hat{m} \cdot \mathbf{V}_{\text{consciousness}}(t)) = Ae^{\lambda t} \cos(\omega t + \phi)$. Multiple consciousness frequencies (γ : 30–80 Hz, β : 13–30 Hz, α : 8–13 Hz, θ : 4–8 Hz, δ : 0.5–4 Hz) correspond to different eigenvalues (λ_k, ω_k) — a spectrum of nested spiral attractors. The binding problem: global phase-locking ($r \approx 1$) via Kuramoto Mechanism 4 unifies distributed neural processes.

Falsifiable prediction: The ratio $|\lambda|/\omega$ should be invariant across individuals in comparable conscious states and shift systematically with anaesthetic depth.

PCP mapping: The consciousness spiral attractor is the dynamical embodiment of the PCP at the cognitive scale. The TOA-Triade (Cognition/Emotion/Action) corresponds to the three-frequency lock ($\gamma:\beta:\alpha = 3:2:1$) observed in the AYYA simulation.

Layer 11 — Language and Symbolic Thought

State: Frequency-domain representation — Laplace transform of consciousness field

Temporal: Frequency carrier. *Spatial*: Connecting field.

The Laplace transform of $\Psi_{\text{consciousness}}$:

$$\mathcal{L}\{\Psi_{\text{consciousness}}\}(z) = \Psi_0 / (z - (\lambda + i\omega))$$

has a pole at $z^* = \lambda + i\omega$ — the eigenvalue of the spiral attractor. A word is a quaternion resonance mode — a specific pole z_k^* in the Laplace transform. A concept is a stable resonance frequency. Grammar is the algebra of pole combination. Non-commutativity $pq \neq qp$ is the algebraic origin of syntactic structure. Metaphor: identification of two different pole spectra sharing a common quaternion structure — the mapping $\Psi_{\text{life}} \cong \Psi_{\text{journey}}$ when their spiral attractor structures are isomorphic.

Layer 12 — Expressive Structures (Art, Music, Architecture)

State: Linear projection $\Pi: \mathbb{H} \rightarrow \mathbb{R}^3$ of 4D rotation onto 3D space

Temporal: Linear. *Spatial*: Physical space.

$$\Pi: q = a + bi + cj + dk \mapsto (b, c, d) \in \mathbb{R}^3$$

Music: projection of consciousness spiral onto 1D time axis. Architecture: the slice $t = \text{const}$ of the 4D quaternion field. The golden ratio $\phi = (1+\sqrt{5})/2$ is the eigenvalue of the quaternion self-similarity transformation $q \rightarrow q^2 - 1$: the unique ratio at which the projection of a quaternion spiral onto a 1D line is self-similar across scales. The double cover $SU(2) \cong S^3$ — the symmetry group of spin-1/2 — is identical to the symmetry group governing human aesthetics: both are projections of the fundamental S^3 symmetry of quaternion algebra.

Layer 13 — The Built Environment / Bio-Loop Architecture

State: Slow nilpotent convergence to stable scalar attractor over generational timescales

Temporal: Generational. *Spatial*: Earthly.

$$q(n) = q_0^{2^n} \rightarrow S^*, n \rightarrow \infty, |q_0| < 1$$

Each generation adds one iteration of $q \rightarrow q^2$. Bio-Loop Architecture: buildings designed so $\Lambda_{\text{building}}(\mathbf{r})$ resonates with $\Lambda_{\text{inhabitant}}$. When $\Lambda_{\text{building}} = \Lambda_{\text{inhabitant}}$, the building amplifies the inhabitant's field — wellbeing as measurable field resonance. Urban pathology corresponds to $\Lambda_{\text{building}} \perp \Lambda_{\text{inhabitant}}$: destructive interference, continuous perturbation away from the scalar attractor.

PCP mapping: The cultural environment quaternion Q_c is the aggregate gauge function of a built and social environment. SWARP's cultural mapping derives Q_c from the accumulated field signatures of institutional, urban, and social structures.

Layer 14 — Mobility and Ecological Networks

State: Time dilation via moving quaternion reference frames

Temporal: Time-distorting. *Spatial*: Underlying.

An organism moving at velocity \mathbf{v} experiences the Lorentz-boosted field:

$$\Psi' = \mathcal{B}(\mathbf{v})\Psi\mathcal{B}(\mathbf{v})^{-1}, \mathcal{B}(\mathbf{v}) = \cosh(\eta/2) + \sinh(\eta/2)\hat{v}, \tanh\eta = v/c_{eco}$$

Food web stability: the coupling matrix J has all eigenvalues with negative real parts (Routh-Hurwitz at the ecological scale) — the quaternion restatement of May's (1972) stability criterion. Ecosystem collapse: external perturbation drives K below K_c (Mechanism 4 in reverse), synchronisation is lost, the collective attractor disappears.

Layer 15 — Social Structures

State: Non-local superposition with global phase-locking ($r \approx 1$)

Temporal: Simultaneous — collective time. *Spatial*: Non-local.

$$\Psi_{social} = (1/\sqrt{N}) \sum_k \Psi_k$$

For $K > K_c^{social}$: $r \rightarrow 1$, the group behaves as a single quaternion field. Institutions: stable subfields within Ψ_{social} with their own S_{inst}^* , persisting over complete membership turnover. Power structures: asymmetric coupling $J_{kl} \neq J_{lk}$; dominant field has strong efferent, weak afferent coupling. Small-world networks (Watts & Strogatz 1998) minimise K_c — human social networks self-organise into small-world topology to optimise quaternion phase-locking efficiency.

PCP mapping: This is the scale at which the PCP operates. The SWARP Personal Political Profile (PPP) derives Q_c for each administrative layer of Dutch governance (Tweede Kamer, Eerste Kamer, Provinciale Staten, Gemeenteraad) as the dominant phase-locked field configuration of that institutional level. Individual-collective resonance $R(u,c)$ is measured across all four layers simultaneously.

Layer 16 — Financial and Information Systems

State: Multi-layer quaternion tensor $\Psi^{(l)}, l = 1, \dots, L$ with inter-layer coupling $J_{ll'}$

Temporal: Layered — each information layer on its own timescale. *Spatial*: Non-Euclidean.

$$\square\Psi^{(l)} = \mathcal{J}^{(l)} + \sum_{l'} J_{ll'} \Psi^{(l')}$$

Financial contagion: inter-layer resonance where coupling $J_{ll'}$ exceeds critical value. Information value: S component of information field ($S = 0$: pure noise; $S \gg 0$: structured). Market price = $\Pi_S(\Psi_{market})$; price volatility = $|\mathbf{V}_{market}|$. Non-Euclidean (quaternion-metric) information space: paths do not commute, order of information encountered changes the cognitive map.

Layer 17 — Societal Self-Reflection / Culture

State: Near-scalar state — maximum coherence, minimum vector fluctuation

Temporal: Pre-temporal. *Spatial*: Potential space.

$$\lim_{t \rightarrow \infty} \Psi_{culture}(t) = S_{\infty} + \varepsilon \mathbf{V}(t), 0 < \varepsilon \ll 1$$

S_{∞} = accumulated integral of all prior quaternion dynamics. Cultural evolution: slow drift of S_{∞} driven by residual $\varepsilon \mathbf{V}$. Cultural revolutions: phase transitions when $|\mathbf{V}|$ exceeds threshold and S_{∞} shifts suddenly to S_{∞}' . Self-reflection: conjugation $\Psi_{culture} \rightarrow \bar{\Psi}_{culture} = S_{\infty} - \varepsilon \mathbf{V}$ reveals normally invisible assumptions. Optimal resilience-adaptability: $\varepsilon^* = \sqrt{(\lambda/\omega)}$ — the same ratio as the Layer 10 consciousness spiral. Culture is consciousness at civilisational scale.

PCP mapping: The PCP derives Q_c for cultural environments from the dominant S_∞ of a culture's accumulated field — measurable via behavioural, linguistic, and institutional observables. Fiske's CS-AR-EM-MP provides the empirical decomposition of S_∞ into its four quaternion components.

Layer 18 — Planetary Consciousness

State: Full hyperspace integral $\Psi_{\text{planet}} = \int_{\mathbb{H}} \Psi(\mathbf{r}, t) d^4\mathbf{r}$

Temporal: Multiple simultaneous timelines. *Spatial:* Full 4D quaternion geometry.

$$\Psi_{\text{planet}}(\mathbf{R}, T) = \int_{\mathbb{H}} G(\mathbf{R}-\mathbf{r}, T-t) \cdot \Psi_{\text{total}}(\mathbf{r}, t) d^4\mathbf{r}$$

where G is the quaternion Green's function of \square and $\Psi_{\text{total}} = \sum_{k=0}^{17} \Psi^k$.

The Schumann resonances ($f_n \approx 7.83n$ Hz) are eigenfrequencies of the lowest modes of Ψ_{planet} . *Falsifiable prediction:* Global events involving mass human synchronisation should produce measurable perturbations in Schumann resonance amplitudes — testable with the Global Coherence Monitoring System (HeartMath Institute). The Gaia hypothesis (Lovelock 1972): S_{Gaia} is maintained by coupled dynamics of all quaternion sub-fields; anthropogenic perturbation increases $|\Psi_{\text{planet}}|$, stressing the attractor.

A.3 The Complete Layer-to-PCP Mapping

The 19-layer model specifies which layers are operationally relevant to the PCP in SWARP:

Layer	Name	PCP Relevance	Quaternion Feature
0	Vacuum	Zero reference state	$q = 0$, nilpotent ground
1	Quantum fluctuations	Biofield perturbation basis	$\delta\mathbf{V} \neq 0$
2–5	Particles→Chemistry	Physical substrate of biofield	Unit quaternion orbits
6	Living cell	First personality eigenstate	Routh-Hurwitz fixed point
7	Tissue	Collective coherence threshold	Kuramoto K_c
8	Sensorimotor	Conditioning mechanism	Helical axial accumulation
9	Individual organism	PCP gauge function Λ_u	Gauge transformation
10	Consciousness	Tiferet spiral attractor	(λ, ω) eigenstate
11	Language	Conceptual resonance	Laplace pole spectrum
12	Expression	Cultural artefact field	$\Pi: \mathbb{H} \rightarrow \mathbb{R}^3$ projection
13	Built environment	Physical Q_c	Slow nilpotent convergence
15	Social structures	Institutional Q_c	Phase-locked superposition
17	Culture	Aggregate Q_c	Near-scalar S_∞
18	Planetary	Earth-scale coherence field	4D quaternion integral

The PCP operates primarily at Layers 9 (individual gauge function), 10 (consciousness spiral attractor), 15 (social field coupling), and 17 (cultural scalar attractor). The AYYA360 profiling system derives the individual Q_u from Layer 9 bioelectric data; the cultural Q_c is derived from Layer 15–17 observables. Resonance $R(u,c)$ measures the alignment of the Layer-9 individual field with the Layer-15/17 collective field.

References

- Anderson, P. W. (1972). More is different. *Science*, 177(4047), 393–396.
- Barton, T. S. (1994). *Power and Knowledge: Astrology, Physiognomics, and Medicine under the Roman Empire*. University of Michigan Press.
- Beck, R. (2007). *A Brief History of Ancient Astrology*. Blackwell.
- Brown, D. (2000). *Mesopotamian Planetary Astronomy-Astrology*. Styx Publications.
- Buckner, R. L., Andrews-Hanna, J. R., & Schacter, D. L. (2008). The brain's default network. *Annals of the New York Academy of Sciences*, 1124, 1–38.
- Deacon, T. W. (1997). *The Symbolic Species: The Co-evolution of Language and the Brain*. Norton.
- Donald, M. (1991). *Origins of the Modern Mind: Three Stages in the Evolution of Culture and Cognition*. Harvard University Press.
- Evans, J. (1998). *The History and Practice of Ancient Astronomy*. Oxford University Press.
- Fiske, A. P. (1992). The four elementary forms of sociality: Framework for a unified theory of social relations. *Psychological Review*, 99(4), 689–723.
- Freeman, W. J. (2004). Origin, structure, and role of background EEG activity. *Journal of Clinical Neurophysiology*, 21(2), 89–106.
- Friston, K. (2010). The free-energy principle: A unified brain theory? *Nature Reviews Neuroscience*, 11(2), 127–138.
- Friston, K., FitzGerald, T., Rigoli, F., Schwartenbeck, P., & Pezzulo, G. (2017). Active inference: A process theory. *Neural Computation*, 29(1), 1–49.
- Hamilton, W. R. (1843). On quaternions; or on a new system of imaginaries in algebra. *Philosophical Magazine*, 25, 489–495.
- Heaviside, O. (1885). Electromagnetic induction and its propagation. *The Electrician*, 14, 178–180.
- Heilen, S. (2015). *Hadriani Genitura: Die astrologischen Fragmente des Antigonos von Nikaia*. De Gruyter.
- Holland, J. H. (1998). *Emergence: From Chaos to Order*. Addison-Wesley.
- Jones, A. (1999). *Astronomical Papyri from Oxyrhynchus*. American Philosophical Society.

- Kauffman, S. A. (1993). *The Origins of Order: Self-Organization and Selection in Evolution*. Oxford University Press.
- Konstapel, H. (2003). Co-author with McWhinney, W. *Grammars of Engagement* (manuscript). Constable Research B.V., Leiden.
- Konstapel, H. (2021). Behind the wall of the aether lies another universe. *constable.blog*. <https://constable.blog/2021/10/03/behind-the-wall-of-the-aether/>
- Konstapel, H. (2025). The permanent Hopf bifurcation principle. *constable.blog*. <https://constable.blog/2025/09/02/het-permanente-hopf-bifurcatieprincipe/>
- Konstapel, H. (2026a). Creativity is orbiting Tiferet: The TOA-Triade, the Omega Point, and what artificial art actually requires. *constable.blog*. <https://constable.blog/2026/02/20/creativity-is-orbiting-tiferet-the-toa-triade-the-omega-point-and-what-artificial-art-actually-requires/>
- Konstapel, H. (2026b). SWARP: Adaptive collaboration through Active Inference. *constable.blog*. <https://constable.blog/2026/02/02/swarp-adaptive-collaboration-through-active-inference/>
- Konstapel, H. (2026c). Understanding personality through quaternion dynamics. *constable.blog*. <https://constable.blog/2026/03/11/understanding-personality-through-quaternion-dynamics/>
- Konstapel, H. (2026d). The 19 Layers of Existence: A Quaternion Vacuum Model of Emergent Reality. *constable.blog*.
- Konstapel, H. (2026e). Human Design in SWARP: AYYA360 4D profiling. *constable.blog*. <https://constable.blog/2026/02/10/human-design-in-swarp/>
- Konstapel, H. (2026f). SWARP is alive. *constable.blog*. <https://constable.blog/2026/02/01/swarp/>
- Laszlo, E. (2004). *Science and the Akashic Field: An Integral Theory of Everything*. Inner Traditions.
- Levin, M. (2012). Molecular bioelectricity in developmental biology: New tools and recent discoveries. *BioEssays*, 34(3), 205–217.
- Levin, M. (2021). Bioelectric signaling: Reprogrammable circuits underlying embryogenesis, regeneration, and cancer. *Cell*, 184(8), 1971–1989.
- Maxwell, J. C. (1865). A dynamical theory of the electromagnetic field. *Philosophical Transactions of the Royal Society of London*, 155, 459–512.
- Maxwell, J. C. (1873). *A Treatise on Electricity and Magnetism*. Clarendon Press.
- McCraty, R. (2015). *Science of the Heart: Exploring the Role of the Heart in Human Performance* (Vol. 2). HeartMath Institute.
- McWhinney, W. (1992). *Paths of Change: Strategic Choices for Organizations and Society*. Sage Publications.
- Neugebauer, O. (1975). *A History of Ancient Mathematical Astronomy*. Springer.
- Neugebauer, O., & Parker, R. A. (1960). *Egyptian Astronomical Texts* (Vol. 1). Brown University Press.

- Oschman, J. L. (2015). *Energy Medicine: The Scientific Basis* (2nd ed.). Churchill Livingstone.
- Parker, R. A. (1974). Ancient Egyptian astronomy. *Philosophical Transactions of the Royal Society of London A*, 276, 51–65.
- Prigogine, I., & Stengers, I. (1984). *Order Out of Chaos: Man's New Dialogue with Nature*. Bantam Books.
- Raichle, M. E. (2015). The brain's default mode network. *Annual Review of Neuroscience*, 38, 433–447.
- Rochberg, F. (2004). *The Heavenly Writing: Divination, Horoscopy, and Astronomy in Mesopotamian Culture*. Cambridge University Press.
- Rowlands, P. (2007). *Zero to Infinity: The Foundations of Physics*. World Scientific.
- Rubik, B. (2002). The biofield hypothesis: Its biophysical basis and role in medicine. *Journal of Alternative and Complementary Medicine*, 8(6), 703–717.
- Schank, R. C. (1990). *Tell Me a Story: A New Look at Real and Artificial Memory*. Scribner.
- Sheldrake, R. (1981). *A New Science of Life: The Hypothesis of Formative Causation*. Blond & Briggs.
- Stevens, S. S. (1946). On the theory of scales of measurement. *Science*, 103(2684), 677–680.
- Sullivan, H. S. (1953). *The Interpersonal Theory of Psychiatry*. Norton.
- Wilhelm, R. (Trans.). (1967). *The I Ching or Book of Changes*. Princeton University Press.
- Yan, J. (1991). *I Ching: The Book of Changes and the Unchanging Truth*. Seven Star Communications.

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