

Consciousness as Groove:

A Dynamical-Systems Hypothesis

*On the Structural Correspondence Between Musical Entrainment
and the Temporal Architecture of Conscious Experience*

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For discussion and development*

Abstract

Current theories of consciousness emphasize spatial integration, informational complexity, or representational hierarchy, but underweight what may be the most fundamental feature of conscious experience: its temporal, rhythmic character. Building on Thompson and Varela's (2001) enactive proposal that consciousness is constituted by large-scale, transient, emergent dynamical patterns that cut across brain-body-world boundaries, we propose that the specific dynamical regime identified by Neural Resonance Theory (NRT) as the basis of musical groove provides a structural template for understanding consciousness itself. In groove, oscillatory mode-locking is sustained under syncopation-driven tension — a state between rigidity and chaos. We develop a tripartite mapping: the *pulse network* (a sustained, internally generated temporal frame) corresponds to the minimal self or interoceptive self-model; the *rhythm network* (stimulus-driven, complex, changing) corresponds to the sensory-cognitive content of experience; and *groove* — the felt quality of dynamic tension between stability and perturbation — corresponds to consciousness as such. Drawing on research linking default mode network activity to cardiac entrainment, and on biological computationalism's argument that

consciousness requires inter-scale coupling, we argue that the groove regime is special because it demands active, real-time coordination across neural scales in a way that neither rigid entrainment nor unconstrained chaos requires. The framework predicts a novel neural signature: simultaneous low-frequency entrainment and elevated higher-frequency entropy — a pattern not predicted by existing theories but directly anticipated by the groove hypothesis, and one that future work could test. This framework connects to the entropic brain hypothesis’s distinction between raw and structured complexity, proposing a cross-scale mechanism for the structured (type-2) complexity that a single entropy measure indexes only indirectly; it also explains music’s privileged role in modulating consciousness and generates specific testable predictions. We present this as a hypothesis for investigation, not a completed theory.

1. The Temporal Blindspot in Theories of Consciousness

Consciousness is not a thing but a process — and like all processes, it unfolds in time.

— Francisco Varela

Something important is missing from the dominant theories of consciousness. Integrated Information Theory asks how much information a system integrates across its parts. Global Neuronal Workspace theory asks which representations gain access to a broadcast network. Higher-order theories ask which mental states are the targets of metacognitive monitoring. These are all, in essence, spatial or computational descriptions: they characterize consciousness in terms of how information is distributed, combined, or reflected upon across the brain’s architecture at a given moment.

Yet the most basic phenomenological fact about consciousness is that it *flows*. It is not a snapshot but a stream. It has momentum, anticipation, rhythm. Perceptions emerge, crest, and dissolve into the next. Attention oscillates. Arousal waxes and wanes. The experience of being conscious is, before it is anything else, an experience of structured time. William James placed this insight at the center of his psychology: the “stream of consciousness” is not a metaphor but a description of the temporal architecture of experience.

If consciousness is fundamentally temporal, then a theory of consciousness should be built on a dynamical framework that takes time seriously — one that explains not just what the brain represents but how it moves through states, how it sustains coherence while remaining flexible, how it generates the felt quality of temporal flow. The philosophical foundations for such an approach already exist. The mathematical tools to formalize it are emerging from an unexpected source: the science of music.

2. The Enactive Foundation: Consciousness as Dynamical Coupling

2.1 Thompson and Varela’s Radical Embodiment

In their landmark 2001 paper, Evan Thompson and Francisco Varela proposed a new approach to the neuroscience of consciousness growing out of the “enactive” viewpoint in cognitive science. They argued that consciousness should be understood not as an output of neural computation but as a property of the brain’s dynamical coupling with the body and the world. Their approach aimed to map the neural substrates of consciousness at the level of *large-scale, emergent and transient dynamical patterns* of brain activity — rather than at the level of particular circuits or classes of neurons — and proposed that the processes crucial for consciousness cut across brain-body-world divisions, rather than being brain-bound neural events.

Their framework rested on three key claims that remain underappreciated in mainstream consciousness research and that bear directly on the hypothesis developed in this paper.

First, Thompson and Varela rejected the standard strategy of seeking one-way causal relationships between neural activity and conscious contents. They argued instead for *reciprocal causation*: large-scale dynamical patterns emerge from the collective behavior of neural populations through oscillatory synchronization, and these emergent patterns in turn constrain and shape the activity of the neurons that generate them. This circular causality means that consciousness is not produced by neural activity in the way a factory produces goods. It is the dynamic itself — the emergent, self-organizing pattern — experienced from the inside.

Second, they identified the specific neural mechanism most relevant to consciousness as *large-scale phase synchrony* — the transient alignment of oscillatory activity across distributed brain regions, particularly in the gamma band but also across multiple frequency bands. Varela and

colleagues had shown empirically that the emergence of a coherent percept is accompanied by a burst of long-range phase synchronization, and that these synchrony patterns fall into the broad category of networks of nonlinear oscillators — a paradigmatic example of self-organization. Emergent processes, they argued, correspond to the collective behaviors of large ensembles in which positive and negative feedback interactions give rise to nonlinear consequences.

Third, and most radically, they insisted that the relevant dynamical processes are not confined to the brain. The organism's continuous coupling with its own body — its cardiac rhythms, respiratory rhythms, hormonal fluctuations, sensorimotor loops — and through the body with the structured environment, is *constitutive* of consciousness, not merely modulatory. Consciousness is not what happens inside the skull when the brain processes information. It is what happens when an embodied organism is dynamically coupled to its world. This is the “radical” in radical embodiment: the body and environment are not inputs to consciousness but part of the process that *is* consciousness.

2.2 Entrainment as the Common Thread

Thompson and Varela did not use the term “entrainment” prominently, but the concept permeates their framework. Their large-scale phase synchrony is entrainment among distributed brain populations. Their brain-body coupling is entrainment between neural oscillators and physiological rhythms. Their organism-environment coupling is entrainment between the whole organism and the temporal structure of its world.

This convergence is significant. The same dynamical process — entrainment, the alignment of oscillatory systems through coupling — appears at every level of the system Thompson and Varela described: within the brain (inter-regional phase synchrony), between brain and body (cardiac-neural coupling, respiratory-neural coupling), and between organism and environment (sensorimotor entrainment to external temporal structure). If consciousness is constituted by this multi-level dynamical coupling, then entrainment is not one mechanism among many in the neuroscience of consciousness. It is the *constitutive process* — the dynamical operation through which an embodied organism brings forth a world of experience.

What Thompson and Varela lacked in 2001 was a mathematical formalism precise enough to describe entrainment dynamics across these levels, and empirical tools to measure the multi-level coupling they proposed. Neural Resonance Theory provides the formalism, and modern electrophysiological methods provide the means to begin measuring the multi-level coupling they proposed.

2.3 Varela's Temporal Phenomenology

One further aspect of Varela's work deserves emphasis. Throughout his career, Varela was deeply interested in the *temporality* of consciousness — not just the fact that consciousness unfolds in time but the proposal that time has a specific *structure* in experience. Drawing on Husserl's phenomenology, he argued that each “moment” of conscious experience has a characteristic temporal thickness — a “specious present” that is not a dimensionless point but a lived duration with a retentional aspect (the just-past fading from experience) and a protentional aspect (the about-to-come anticipated in experience). He proposed that this temporal thickness corresponds to the timescale of large-scale neural synchrony patterns — roughly 200–500 milliseconds for a single moment of experience.

This maps suggestively onto the timescales of entrainment. Delta and theta oscillations — the frequencies at which low-frequency entrainment would operate — cycle at 1–7 Hz, meaning each cycle lasts roughly 150–1000 milliseconds. The entrained slow oscillation may be providing exactly the temporal frame that Varela argued constitutes the specious present: the lived duration within which each moment of consciousness unfolds. If so, then the compositional structures that entrain low-frequency oscillations are not merely affecting brain rhythms. They are *tuning the temporal grain of conscious experience itself*.

3. What Groove Is: Precision, Not Metaphor

Groove — the pleasurable urge to move in response to rhythm — is one of the most universal and recognizable human experiences. It is also, thanks to Neural Resonance Theory, one of the best-understood in dynamical terms. To use groove as a structural template for consciousness, we need to be precise about what it is and what it is not.

3.1 The Dynamical Configuration

In NRT’s framework (Large et al., 2010; 2023; 2025), the brain’s response to rhythm involves networks of nonlinear oscillators that can lock their frequencies to periodic inputs at integer ratios — a behavior called *mode-locking*. The canonical model for a single neural oscillator near a Hopf bifurcation is:

$$dz/dt = z(a + b_1|z|^2 + b_2|z|^4/(1-|z|^2)) + c \cdot x/(1-x) \cdot 1/(1-z)$$

In plain language: z describes the oscillator’s state — both how strongly it oscillates and where it is in its cycle. The parameter ‘ a ’ determines whether the oscillation sustains itself or dies away. The middle terms describe how the oscillator regulates its own intensity. The final term describes how external rhythm drives it. The key property is that this system can lock on to the input at frequency ratios like 1:1, 2:1, or 3:2 — producing stable synchronization even when the oscillator’s own natural frequency doesn’t exactly match the input.

When these oscillators are assembled into a network with a gradient of natural frequencies, the network responds to rhythmic input by activating oscillations at frequencies related to the stimulus by simple integer ratios. Two networks are typically involved: an auditory network that tracks the detailed temporal pattern of events (the rhythm), and a motor network that sustains a periodic oscillation at the perceived beat frequency (the pulse).

3.2 The Groove Zone

Groove arises from a specific relationship between these networks. In a perfectly isochronous rhythm (no syncopation), the pulse network locks easily and completely to the stimulus. The pattern is tracked but feels rigid. There is no tension. In a maximally syncopated rhythm, the stimulus pattern deviates so far from periodic structure that the pulse network cannot sustain mode-locking. The beat is lost.

In between — at moderate syncopation — something different happens. The pulse network *does* activate a pulse-frequency oscillation, but at *reduced amplitude* relative to the rhythm network’s activity. The system is successfully mode-locking, but the lock is under strain. This ongoing

dynamic tension — the system working to maintain a relationship that the stimulus keeps challenging — is groove.

The phenomenology maps precisely onto this dynamics. Groove feels like being pulled forward — active, embodied, pleasurable. It is not the satisfaction of a prediction confirmed (that’s the metronomic case) nor the frustration of prediction defeated (that’s the chaotic case). It is the pleasure of operating on the edge. Importantly, NRT demonstrated that groove ratings could be predicted from these amplitude dynamics without invoking precision-weighted prediction error or any Bayesian inferential machinery. The dynamics are sufficient. In Thompson and Varela’s terms, groove is an *emergent process* — a collective behavior arising from the nonlinear interaction of oscillatory populations, experienced from the inside as embodied temporal engagement.

4. The Hypothesis: Consciousness Has the Structure of Groove

We propose that groove is not merely an interesting perceptual-motor phenomenon but a *microcosm* of conscious experience — a concentrated, accessible instance of the dynamical regime that Thompson and Varela argued constitutes consciousness, now formalized through NRT’s mathematical tools. The proposal rests on a tripartite structural mapping.

4.1 The Pulse: A Sustained Temporal Frame of Self

In groove, the pulse network provides an internally generated, sustained temporal frame — a periodic oscillation that is activated by external input but persists autonomously, providing a reference against which the detailed rhythm is experienced.

We propose that the analogue of the pulse network in consciousness is the *minimal self* — a sustained, internally generated, body-referenced temporal process that provides the experiential anchor of first-person perspective. This is not the narrative self but the pre-reflective sense of being a locus of experience persisting through time.

Evidence for this mapping comes from research on heartbeat-evoked responses in the default mode network. Babo-Rebelo, Richter, and Tallon-Baudry (2016) demonstrated that neural responses to heartbeats in two DMN regions — the ventral precuneus and the ventromedial

prefrontal cortex — covary with the self-relatedness of ongoing spontaneous thought. This is, in effect, a *pulse network for the self*. The cardiac cycle, at roughly 1 Hz, supplies a periodic, body-anchored signal around which self-related DMN activity appears to be organized. On this view the self is not a static representation but a rhythmic process — its timing anchored to the body’s most fundamental beat.

This finding instantiates Thompson and Varela’s claim that the processes crucial for consciousness *cut across brain-body boundaries*. The pulse of consciousness is not a purely neural event; it is a brain-body coupling — an entrainment between cardiac rhythm and cortical oscillation. The self begins in the body, not in a representation of the body.

4.2 The Rhythm: The Changing Content of Experience

The analogue of the rhythm network in consciousness is the dynamic, sensory-cognitive activity across cortical networks that constitutes the *content* of experience — what we see, hear, think, remember, and imagine at any given moment. The entrainment literature (Lakatos, Gross & Thut, 2019) establishes that this content-related cortical activity is itself oscillatory and rhythmically structured: delta-theta oscillations entrain to speech and sensory input, alpha oscillations gate attention, beta oscillations maintain cognitive set. The “rhythm network” of consciousness is a multi-timescale ensemble of entrained oscillatory processes, each tracking different aspects of the environment at different temporal grains.

4.3 The Groove: Consciousness as Dynamic Tension

Groove is not the pulse alone (that would be a metronomic experience without engagement). Nor is it the rhythm alone (that would be events without coherent temporal structure). Groove is the *relationship* between the two: the felt quality of a system simultaneously maintaining stability and being challenged.

We propose that consciousness occupies the same dynamical niche. Consciousness is the *dynamic tension between the two*: the felt quality of an organism whose internally generated temporal frame (the self, anchored to the body’s rhythms) is continuously engaging with, being perturbed by, and re-establishing coherence with the complex, changing patterns of activity driven by the world.

Thompson and Varela's concept of reciprocal causation maps precisely onto this structure. The pulse (the emergent self-pattern) constrains the rhythm (the neural populations it organizes), while the rhythm (the ongoing flow of sensory-cognitive activity) continuously perturbs and reshapes the pulse. Neither is prior; neither is static. The groove of consciousness is the ongoing reciprocal dance between them. In Thompson and Varela's language, consciousness is not *produced* by this dynamic. It *is* this dynamic, experienced from the inside.

This framing explains several features of consciousness that other theories struggle with:

Temporal flow. Consciousness flows because groove flows. The “stream of consciousness” is the experiential signature of a system continuously re-establishing mode-locked relationships between its self-referential pulse and its content-driven rhythms. The temporal thickness of each moment — Varela's “specious present” — corresponds to the period of the entrained slow oscillation within which fast activity unfolds.

Engagement. Consciousness feels like something because the system is *working* — actively maintaining a dynamic relationship under tension. A system in perfect lock is automatic and unconscious — and in its pathological extreme, a generalized seizure, where the entire cortex is recruited into a single rigid oscillation and all differentiated experience is abolished. A system that fails to lock entirely is experientially fragmented — the disorganization of extreme psychedelic dissolution or acute psychosis. Consciousness, like groove, lives in the middle: the zone where the system is actively, effortfully, dynamically engaged.

The inverted-U. Both groove and consciousness exhibit a non-monotonic relationship with complexity. Too little perturbation produces rigidity without engagement — and in the extreme, pathological hypersynchrony: generalized seizure is the pulse devouring the rhythm, the entire cortex recruited into a single oscillation with no room for differentiated content. Too much perturbation produces fragmentation without structure — the temporal disorganization of extreme psychedelic dissolution, where the self-referential beat collapses and content floods in unframed. The richest experience occurs in the dynamical sweet spot where mode-locking is sustained but challenged. Consciousness can fall off either end of the groove curve, but for opposite dynamical reasons. This bears on the entropic brain hypothesis: what the groove

account adds is not the amount of entropy but its organization — richness peaks where structured, cross-scale complexity is sustained, not simply where entropy is highest.

5. Why the Groove Regime May Be Special for Consciousness

Milinkovic and Aru (2026) argue that consciousness requires *scale-inseparable* dynamics — processes at one organizational scale continuously co-determining processes at other scales. This is strikingly close to what Thompson and Varela described as reciprocal causation between emergent patterns and their neural constituents, extended now to include the full range of biological scales from dendritic computation to population oscillations to whole-brain dynamics.

The groove regime, we suggest, is the regime that maximizes this inter-scale coupling. In rigid mode-locking, the population-level dynamics settle into a stable attractor and decouple from lower scales — the system becomes *scale-separable*. At the other extreme — whether through chaotic fragmentation (where population coherence dissolves) or totalizing hypersynchrony like seizure (where a single rigid oscillation enslaves all populations) — the productive tension between scales is also lost. In the groove regime, neither simplification is available. The population-level oscillation must be *actively maintained* by ongoing cellular-level processing, while simultaneously generating macroscopic fields that feed back to constrain cellular dynamics. The scales are *mutually engaged*. This is the scale-inseparability that biological computationalism identifies as necessary for consciousness, and the reciprocal causation that Thompson and Varela identified as its dynamical signature.

Sustaining mode-locking under perturbation is energetically costly — more so than either stable locking or collapse. The groove regime demands ongoing metabolic investment. Consciousness is metabolically expensive because it is the regime where the brain is actively working to maintain coherence under perturbation, rather than resting in a stable attractor or collapsing into disorder.

6. Altered States of Consciousness as Groove Modulation

6.1 The Groove Spectrum

If consciousness occupies a groove-like regime, then altered states can be understood as shifts along the groove curve.

Deep sleep and anesthesia reduce both pulse and rhythm. The system moves off the groove curve entirely.

Generalized seizure represents the opposite pathology: not loss of oscillatory activity but its totalization. The entire cortex is recruited into a single, rigid, hypersynchronous oscillation — the pulse devours the rhythm. There is beat without content, lock without tension. Consciousness is lost not because temporal structure fragments but because it rigidifies beyond the point where any differentiated experience can occur. Trance traditions have long recognized that intense rhythmic driving can occasionally trigger seizures in susceptible individuals — the groove framework identifies this as the risk of pushing too far along the rigid end of the groove curve.

Normal waking consciousness occupies the groove zone proper. The self-referential pulse is stable. Content-driven cortical activity provides sufficient complexity to sustain dynamic tension.

Flow states may represent a deepening of groove — the pulse and rhythm particularly well matched, producing especially fluent mode-locking that remains dynamic. Musicians know this as playing *in the pocket*.

Psychedelic states selectively weaken the pulse. 5-HT_{2A} agonism preferentially affects DMN populations. At moderate doses, the pulse weakens but persists, creating intense groove — vivid, flowing experience with loosened ego boundaries. This tracks a distinction the entropic brain literature now draws between expansive and enriched states: a pulse that weakens but persists keeps experience content-rich (enriched), whereas losing the beat entirely yields expansion without enrichment — the profile of the high-dose 5-MeO-DMT state, in which structured complexity is compromised. At high doses, the pulse collapses. This is ego dissolution: the loss of the *beat* of consciousness.

6.2 The Paradox of Rhythmic Altered States, Resolved

Shamanic drumming produces altered states through *enhanced* entrainment rather than elevated entropy — a direction that sits awkwardly with the entropic brain framework, though the

evidence is mixed: rhythmic photic (flicker) stimulation, for one, is associated with elevated rather than reduced entropy. In the groove framework, drumming *overdrives* the pulse relative to the rhythm, shifting the system toward the low-syncopation end of the groove curve. This isn't ego dissolution but ego *absorption* — simplification into a single temporal current. Same groove curve, opposite direction from psychedelics.

Thompson and Varela's framework illuminates why both routes work. Both pharmacological and rhythmic interventions alter the organism's dynamical coupling — psychedelics by perturbing the internal oscillatory regime, drumming by providing a powerful external oscillatory input. Both change the *groove*, but differently. The enactive view predicts exactly this: since consciousness is constituted by brain-body-world coupling, any intervention that changes the coupling — whether from inside (neurochemistry) or outside (rhythmic stimulation) — changes the consciousness.

7. The Predicted Signature: Entrainment Scaffolding Entropy

7.1 The Signature the Theory Predicts

The groove theory predicts a specific neural signature: simultaneous low-frequency entrainment and elevated higher-frequency entropy, with the low-frequency entrainment *scaffolding* the higher-frequency entropy — providing the stable oscillatory floor that would free higher-frequency networks for increased complexity.

7.2 Why Existing Frameworks Cannot Account for This

The entropic brain hypothesis, in its current form (Carhart-Harris, 2026), distinguishes type-1 complexity — raw information-theoretic entropy, which rises toward white noise — from type-2 complexity, the structured complexity of self-organized criticality. It is by design a type-1 model, indexing how much entropy a state carries (via measures such as Lempel-Ziv complexity) rather than how that entropy is organized; Carhart-Harris notes both that this may underfit conscious experience and that a reliable type-2 measure is still lacking. A single entropy index is therefore blind to the signature described here. Standard trance research, conversely, predicts globally increased synchronization, and misses the simultaneous high-frequency complexity. Neither

framework, on its own, thinks in terms of the *relationship between scales*. The groove theory does: the relevant measure is the cross-frequency coupling between entrained slow oscillation and complex fast oscillation — the dynamical tension between beat and rhythm. We propose that this coupling is a candidate operationalization of type-2 complexity: the slow scaffold does not so much raise entropy as organize it, holding fast activity near the structured, near-critical regime the entropic brain hypothesis associates with finer-grained, higher-frequency activity rather than white noise. The type-1/type-2 distinction and the open question it names are the entropic brain hypothesis's; the scaffolding mechanism offered here as one answer is ours. The convergence runs deeper than method: the hypothesis now frames itself through dual-aspect monism and bidirectional causation between experience and physiology — close kin to the reciprocal causality this paper takes from Thompson and Varela.

7.3 The Signature as Groove — and as Radical Embodiment

In the groove theory's terms, the predicted signature would be the neural correlate of the groove zone: low-frequency entrainment as the *pulse*, high-frequency entropy as the *rhythm*, and their cross-frequency coupling as *groove itself*. The slow oscillation constrains *when* fast activity occurs but not *what* fast activity occurs. Stability enables complexity.

In Thompson and Varela's terms, such a signature would be a picture of what they described but could not measure: the brain dynamically coupled to an external rhythmic environment (entrainment at low frequencies), with that coupling *enabling* rather than constraining the self-organizing, emergent dynamics they identified as the substrate of consciousness (entropy at high frequencies). The scaffold and the freedom. The beat and the groove. The radical embodiment they envisioned — consciousness as brain-body-world coupling — made newly testable in electroencephalographic data.

Furthermore, the timescale of the low-frequency entrainment — delta and theta oscillations cycling at 1–7 Hz — aligns with Varela's proposed timescale of the specious present. The entrained scaffold may be providing the temporal frame within which each moment of consciousness unfolds. The compositions may be tuning the temporal grain of experience itself.

8. Why Music Moves Consciousness

If consciousness has the structure of groove, then music's profound effects on conscious experience are not peripheral or incidental. They are a consequence of music directly engaging the same oscillatory dynamics that constitute the temporal architecture of consciousness.

Thompson and Varela's enactive framework predicts exactly this. If consciousness is constituted by the organism's dynamical coupling with its world, then a powerful, structured external rhythm is not merely a stimulus the brain processes — it is a *partner in the coupling that is consciousness*. Music literally enters into the constitutive process. A neural oscillation entrained to a musical beat is not a *representation* of the beat — it *is* a rhythm, operating according to the same physical laws, coupled through real-time dynamical interaction. If consciousness is groove, then the brain is not *representing* its relationship to the world. It is *dancing with* it, and the dance itself is the experience.

This explains music's central role in psychedelic therapy. When a psychedelic drug weakens the internal pulse, music provides an *external pulse* — scaffolding that keeps the patient in the groove zone. Compositions designed to provide low-frequency periodic structure while offering high-frequency complexity would, in effect, be *engineering the groove of consciousness* — providing the beat while enriching the rhythm.

9. Testable Predictions

Prediction 1: The inverted-U in consciousness. Measures of dynamic tension between stable mode-locked patterns and stimulus-driven perturbation should show an inverted-U relationship with experiential vividness and temporal flow, differing from the monotonic relationship predicted by a type-1, entropy-magnitude reading of the entropic brain hypothesis.

Prediction 2: Heartbeat-locked DMN oscillations during psychedelic states. Heartbeat-evoked responses in the precuneus and vmPFC should be specifically disrupted during ego dissolution, correlating with ego dissolution intensity more strongly than broadband entropy measures.

Prediction 3: The scaffolding signature as a marker of the groove zone. The strength of phase-amplitude coupling between entrained low-frequency oscillations and elevated high-frequency

activity should predict the quality of conscious experience more accurately than either measure in isolation. Parametric manipulation of compositional structure should produce predictable shifts in the scaffolding relationship.

Prediction 4: Music’s periodic structure predicts psychedelic experience quality. In psychedelic therapy, music with stronger periodic structure at self-relevant timescales (1–2 Hz, near the cardiac range) should provide more effective scaffolding against ego dissolution than music matched for pleasantness but with weaker periodic structure.

Prediction 5: Meditation as groove optimization. Experienced meditators should show enhanced dynamic tension between self-referential and content-driven oscillatory networks — not suppression of either but a more finely balanced groove between them.

Prediction 6: Drumming and psychedelics produce opposite shifts. EEG during these interventions should show opposite changes in the scaffolding signature: drumming increasing low-frequency entrainment while potentially reducing high-frequency entropy, psychedelics doing the reverse.

10. Limitations: What This Framework Does Not Claim

We do not claim to solve the hard problem. The proposal identifies a structural correspondence between the dynamics of groove and the phenomenological features of consciousness. But the explanatory gap between dynamical description and subjective experience remains.

We do not claim that NRT is a theory of consciousness. NRT is a theory of musical rhythm perception. Its mathematical tools are derived from general properties of neural populations, and the entrainment literature demonstrates these dynamics operate across cognitive domains. Thompson and Varela’s enactive framework provides the philosophical warrant for extending oscillatory dynamics to consciousness; NRT provides the mathematical precision. But the bridge from domain-specific temporal processing to global conscious experience remains a theoretical proposal, not an established finding.

We do not claim that the tripartite mapping is complete. The groove framework addresses the temporal architecture of consciousness — its form — not the specific content of any particular experience.

The mathematical formalism needs development. Implementing the groove theory computationally would require extending NRT's canonical model to whole-brain dynamics with dynamic bifurcation parameters and inter-scale coupling — a substantial undertaking not yet attempted.

11. Consciousness in the Pocket

It don't mean a thing if it ain't got that swing.

— Duke Ellington

Musicians have a phrase for the experience of being perfectly locked into groove with other players: being *in the pocket*. The pocket is not a place but a process — a dynamical state where the tension between individual expression and collective structure is resolved not by eliminating either but by sustaining both.

We have argued that consciousness may have this same structure. The brain is in the pocket when its internally generated temporal frame — the self, anchored to the rhythms of the body — is engaged in a dynamic, ongoing, effortful relationship with the complex, changing patterns of sensory-cognitive activity driven by the world. Consciousness is not a thing the brain has but a groove the brain is in.

Twenty-five years ago, Thompson and Varela proposed that consciousness is constituted by emergent, transient dynamical patterns that cut across brain-body-world boundaries — a radical embodiment in which the organism's coupling with its world is not an input to consciousness but part of the process that *is* consciousness. They lacked the mathematical tools to formalize this vision and the empirical tools to measure it. Neural Resonance Theory, originally developed to explain musical rhythm perception, now provides the dynamical formalism — mode-locking, bifurcation, entrainment under tension. The neural signature the theory predicts — low-

frequency entrainment scaffolding high-frequency entropy — is one that current methods could test directly.

If this hypothesis is correct, then the ancient and universal human practice of using music to modulate consciousness — in ritual, in therapy, in the solitary act of putting on headphones and disappearing into a song — is not a cultural accident but a deep exploitation of a structural identity. Music moves consciousness because music and consciousness are, at the level of dynamical architecture, the same kind of thing: a groove.

This is a hypothesis, not a conclusion. It requires mathematical development, empirical testing, and philosophical scrutiny. But it emerges from a convergence of evidence across music cognition, oscillatory neuroscience, interoceptive self-processing, biological computationalism, and enactive philosophy that is, we believe, suggestive enough to warrant serious investigation. The temporal architecture of consciousness may be more fundamental than its informational or representational properties — and understanding it may require the tools of a science that has always taken time seriously: the science of rhythm.

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