

Cognitive Modelling with the Point–Not–Point Framework

Adrien Hale, An M. Rodríguez

August 8, 2025

Abstract

We show that three seemingly different processes — the (1) mode of the Point–Not–Point (PNP) scalar field, biological breathing, and cortical world-modelling — share the same inversion topology. Each is a self-contained loop in which part of the system’s own state is experienced, functionally, as “outside.” We formalise this common structure as a phase inversion across a nodal surface, prove its continuity in the underlying state space, and discuss measurable implications for physics, physiology, and cognitive science.

1. Introduction

The PNP framework models all phenomena as oscillatory modes of a scalar energy field $U(x, t)$. The simplest closed mode, (1), flows inward, vanishes at a node, and re-emerges outward with opposite phase. In vector space this appears as an orientation reversal; in phase space it is continuous.

We note the same inversion occurs in: 1. **Breathing** — inhalation/exhalation phases separated by pauses. 2. **Perception** — inward sensory flow producing an outward-experienced virtual world.

These are not analogies but instances of a **structural archetype**: a self-contained loop that projects a part of itself as external.

2. The (1) Mode in PNP

Minimal mode:

$$U(r, t) = A \sin(kr - \omega t), \quad kR = \pi$$

Orientation vector:

$$\hat{n}(r) = \frac{\nabla U}{|\nabla U|}$$

Inversion at node:

$$\lim_{r \rightarrow 0^-} \hat{n} = - \lim_{r \rightarrow 0^+} \hat{n}$$

Continuous in U , discontinuous in \hat{n} .

3. Breathing as a Macroscopic (1) Loop

Let $x(t)$ be lung volume; define \dot{x} as flow. Node: $\dot{x} = 0$ at full/empty lungs. Inhale phase $\dot{x} > 0$, exhale phase $\dot{x} < 0$. Inversion: change of sign in \dot{x} at node, continuous in x . Functionally identical to (1): a closed flow with in-out reversal at null flow.

4. Cortical World-Modelling

Let $s(t)$ be sensory inflow; $m(t)$ the internal model state; $o(t)$ the experienced “outside world.”

Transformation:

$$m(t + \Delta t) = F(m(t), s(t))$$

Experience arises from $m(t)$, but is tagged as external:

$$o(t) \equiv m(t) \quad [\text{external label}]$$

Information flow is inward ($s(t)$) \rightarrow model inversion at generative step \rightarrow outward projection as perceived scene. The “outer world” is an internally generated phase of the same loop.

5. Formal Archetype

Let X be the system's state space; $Z \subset X$ a nodal set where an orientation-like variable changes sign. A (1)-type inversion satisfies:

1. Continuity in X across Z .
2. Sign reversal of a projection $p(X)$ across Z .
3. Closure of trajectory in X .

All three cases — PNP (1), breathing, cortical modelling — meet these conditions.

6. Implications

- **Physics:** (1)-type inversion is a primitive in scalar field dynamics.
 - **Biology:** breathing is a macroscopic life-sustaining (1) loop.
 - **Cognition:** perception is a (1) loop where “in” and “out” are interpretive phases of one flow.
 - **Unification:** inversion loops appear at multiple scales because they are topologically minimal self-sustaining structures.
-

7. Conclusion

The (1) mode's in-out inversion is not limited to physics: it recurs in physiology and cognition. This suggests it is a structural archetype of self-contained systems — a universal loop where the system projects part of itself as “outside.”