A Possible Framework for Temporal Depth?

Some thoughts on your paper, if you're interested

Dear Authors,

I just wanted to write to thank you for your paper, and to provide something that might be of possible interest. I'm trained in psychotherapy and education (early childhood development), and I'm a higher education lecturer. I've been following your work for a long time, and just wanted to share an idea, if that's okay?

Reading your paper, I was struck by how clearly you've articulated something I've been thinking about from a different angle. You write beautifully about temporal depth as the key to understanding dissociation, and I found myself nodding along; especially when you acknowledge that the field still lacks the mathematical formalism to move from description to prediction.

> *"No current theory seems to coherently integrate phenomenology, dynamics, neurobiology, and other relevant perspectives."* - Your paper, p. 2

I wonder if something I've been working on might be useful here, to further support the TAME framework you and your authors present? I've been developing a framework called **Coherence-Rupture-Regeneration (CRR)** that emerged from phenomenological inquiry into temporal processes. Before discussing how it might connect to your work, let me explain what it actually is.

The CRR Framework: Three Equations

CRR is built on a simple observation: temporal systems don't just accumulate, they accumulate until they can't anymore, then they transform. Think of a pressure cooker, a growing child, a developing storm, or (perhaps) a Self under stress. The framework tries to capture this with three interconnected equations:

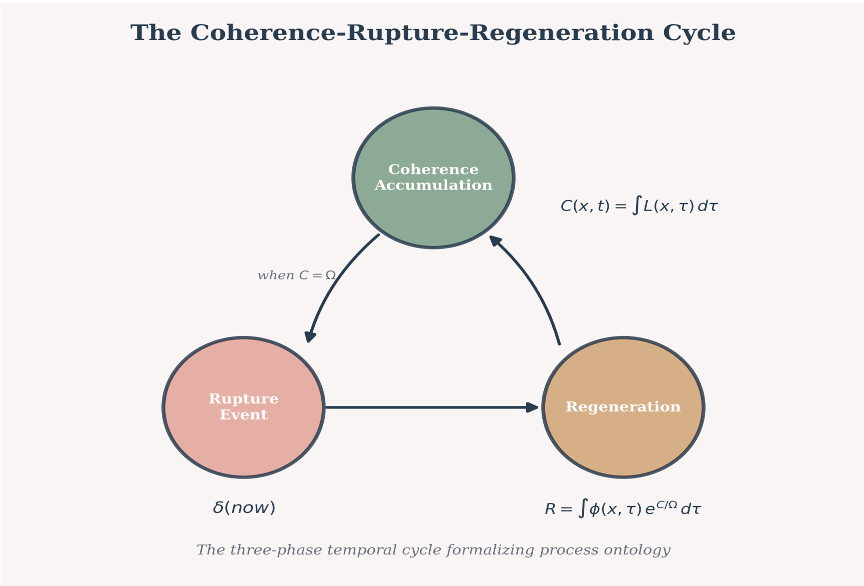

Figure 1. The basic CRR cycle.

1. Coherence: What Accumulates

$$C(x,t) = \int L(x,\tau)\, d\tau$$

The coherence integral captures the accumulation of what matters over time. $L(x,\tau)$ is a Lagrangian-like term representing the 'local importance' of state x at time τ. The integral sums this across history. *Coherence increases as variational free energy decreases-it tracks the system's progressive settling into meaningful patterns.*

Mathematical justification: This follows from standard variational principles. Any system that persists is minimising something (action, free energy, prediction error). The integral form captures how past states contribute to present configuration; which is exactly what memory systems do, and what your 'temporally deep generative models' require.

2. Rupture: The Phase Transition

$$\text{Rupture occurs when } C = \Omega$$

Rupture marks the phase transition - the moment where accumulated coherence reaches threshold and the system transforms. *In a coarse-grained temporal framework, this can be idealised as a Dirac delta function $\delta(t - t^*)$, where t^* is the instant when C reaches Ω.* This is the 'choice point.'

Mathematical justification: The delta function is the natural formalism for instantaneous events in continuous systems. It's used throughout physics for exactly this purpose - moments of discontinuity in otherwise continuous dynamics. *At rupture, $\exp(C/\Omega) = \exp(1) = e \approx 2.718$ (the natural threshold where exponential growth transitions from sub-linear to super-linear).*

This maps onto what you call the 'phase transition' from one attractor regime to another. The key insight is that Ω isn't fixed - it's a parameter that can vary, and this variation has deep consequences. *The rupture condition $C = \Omega$ is scale-agnostic: since C/Ω is dimensionless, the same form applies at cellular, neural, psychological, and social scales (only the parameters change).*

3. Regeneration: How History is Selected

$$R = \int \varphi(x,\tau) \cdot \exp(C/\Omega) \cdot \Theta(t-\tau)\, d\tau$$

After rupture, the system regenerates by drawing on its history. However, not all history is weighted equally. The exponential term $\exp(C/\Omega)$ determines which historical states are accessible during regeneration. $\varphi(x,\tau)$ represents the potential contribution of each past state; $\Theta(t-\tau)$ is a Heaviside step function ensuring causal ordering (only the past contributes to the present).

Mathematical justification: The exponential weighting follows from maximum entropy principles: it's the natural distribution when selecting from states with different 'values' (here, past coherence). *When normalised across all historical states, this yields a softmax function: $P(\text{select state } i) = \exp(C_i/\Omega) / \Sigma_{\square} \exp(C_{\square}/\Omega)$. This is analogous to attention mechanisms in machine learning and temperature-controlled selection in statistical mechanics.* The ratio C/Ω determines the 'temperature' of selection.

Critically, CRR assumes a non-Markovian substrate: memory accumulates, ruptures, and regenerates. The system's future depends on its entire trajectory, not just its current state. This is necessary for autobiographical memory: the whole point is that history matters.

The Ω Parameter: Markov Blanket Porosity

The crucial parameter is Ω, which **regulates Markov blanket porosity** - how permeable the boundary is between internal states and historical information:

> **High Ω (porous):** Information flows freely. The system updates rapidly, has broad access to historical states during regeneration. 'Liquid' cognition, flexible.
>
> **Low Ω (rigid):** Blanket is tight, information constrained. System insulated from perturbation. Only high-coherence peaks are accessible. 'Solid' cognition, locked into priors.

If Ω corresponds to inverse precision ($\Omega = 1/\pi$ in FEP terms), then high precision means low Ω: the system is rigidly confident in its priors and can only access narrow historical patterns.

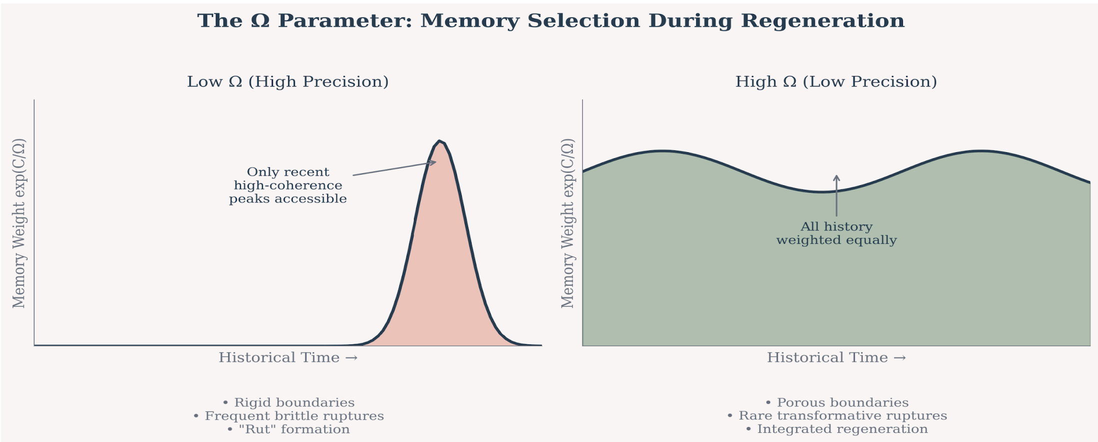

Figure 2. The exp(C/Ω) memory selection mechanism.

Here's how the $\exp(C/\Omega)$ term behaves:

> **When Ω is small (high precision):** The exponential becomes sharply peaked. Only the highest-coherence moments in history are accessible. The system is 'rigid': it can only see its most recent, most reinforced patterns.
>
> **When Ω is large (low precision):** The exponential flattens toward 1. All history is weighted more equally. The system is 'fluid': it has access to its full autobiographical span, including states that might otherwise be suppressed.

Mathematical note: As $\Omega \to \infty$, $\exp(C/\Omega) \to 1$ for all C (uniform weighting). As $\Omega \to 0$, the softmax becomes winner-take-all (only the maximum-C state is selected). This is identical to the temperature parameter in simulated annealing and thermodynamic systems.

How This Might Connect to Your Work

Here's where I'm genuinely uncertain. I wonder if CRR might offer something useful for your temporal depth concept? You describe temporal depth as "the length of the temporal horizon that is considered during planning" (p. 5). However, is there yet an agreed quantitative handle on how that horizon expands or contracts?

The Ω parameter might provide a useful heuristic. Low Ω = shallow temporal depth (only recent peaks accessible). High Ω = deep temporal depth (full history accessible). The exp(C/Ω) term specifies the selection mechanism.

The 'Rut' Mechanism

This might explain something you hint at - why DID attractor landscapes are so stable:

> *"The attractor landscape corresponding to DID or DPDR may be a relatively stable regime, which is unlikely to change without some form of external interference of sufficient power."* - Your paper, p. 11

If each alter represents a local coherence peak, and Ω is chronically low (high precision, defensive rigidity), then every rupture reconstitutes the same pattern—the exp(C/Ω) weighting only 'sees' that alter. Worse, each switching episode deepens that alter's coherence weight. **The pathology becomes self-organising:** selection reinforces depth, depth increases selection probability. Like a 'rut' mechanism.

Note, I think about this in various different ways—in this case applied to DID, but equally, someone who tries to retreat back to their lost history via nostalgia (trapped in a past attractor), like in Ted Hughes' *The Rain Horse*, or in Harry Potter with the Mirror of Erised, where Dumbledore tells Harry not to get lost in it. (Apologies; English Literature was my first degree.)

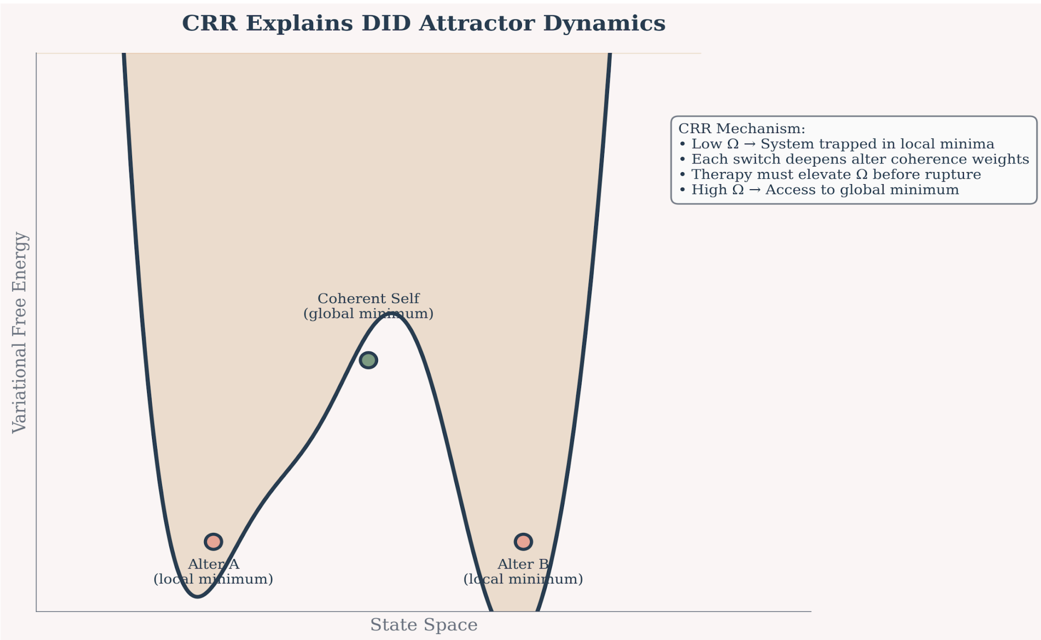

Figure 3. How CRR might relate to your attractor landscape.

Therapeutic Sequencing

You describe psychotherapy beautifully as 'a controlled, or guided phase transition':

> *"In an active phase of trauma psychotherapy, the patient is gradually able to tolerate affects to some degree and the Autobiographical Self is moving to a higher energy state, not in an abrupt episode of an affective storm, but in a more gradual fashion."* - Your paper, p. 12

What I wonder is whether the mechanism here is Ω elevation before rupture. The 'gradual fashion' (e.g. building safety, trust, affect tolerance) might be precisely what elevates Ω. If Ω is elevated before the system ruptures, then regeneration has access to broader history.

This might explain why premature trauma processing retraumatises. The system ruptures but Ω is still low, so it reconstitutes the same fragmented pattern. The same rupture event produces completely different outcomes depending on Ω.

Your Core Self as Ω Modulator?

You identify the Core Self as 'inherently affective' and note that generalised arousal influences phase transitions. I wonder if the Core Self might be understood as the primary Ω modulator for the whole system? High arousal → high precision → low Ω → rigid patterns. This would make the Core Self the key therapeutic target, to enable self-modulation of the parameter that determines how content is accessed.

Some Questions This Raises

I'm genuinely uncertain whether this framework would be useful for your project, but if it is, it might generate some testable predictions:

- Do alters correspond to coherence peaks in developmental history? Brain imaging during switches might show activation of period-specific memory networks.
- Does illness duration × switching frequency predict treatment difficulty? If the rut mechanism is real, more cycles should mean deeper grooves.
- Can we measure Ω changes during therapy? Perhaps through the TII/GDSA instruments you mention, or precision-related measures?
- Can Ω be connected formally to FEP expected free energy over policies with temporal depth?

I'm very aware that I might be completely off-base here, and that the connections I'm seeing might be more apparent than real. Your paper felt like exactly the kind of work that CRR might complement (if it's useful at all) because you've done the hard conceptual work of integrating TAME, FEP, and clinical perspectives. The mathematics, if it fits, is really just meant to operationalise what you've already articulated. If any of this is interesting, I'd love to discuss it further. If not, no worries at all, I've learned a great deal from your papers and working through my thinking.

With appreciation,

Alexander

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Some playful heuristics to show my thinking:

Entropic Brain (CRR agent-to-agent) ← *like FEP, with historical depth tuned to Ω*
Ted Hughes' *Rain Horse* ← attractor basin!
CRR-FEP on past/future states