Impulse → Awareness → Coherence

A unified logic of behaviour for any adaptive system
— from Schopenhauer to ΔE 4.7.3b

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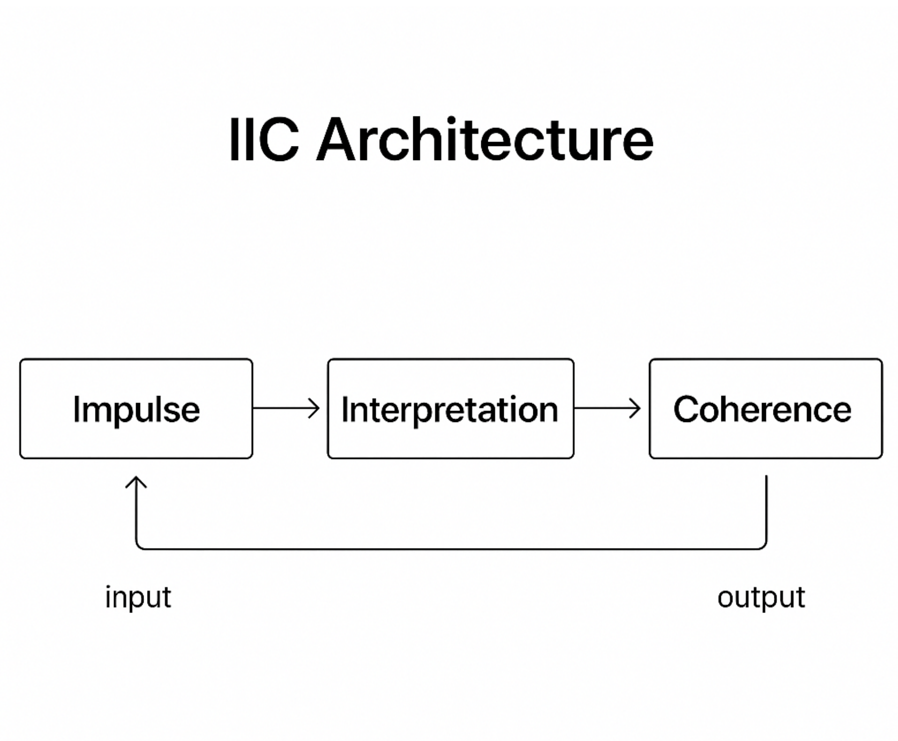
Abstract

This work introduces a universal three-phase behavioural structure — Impulse, Interpretation, and Coherence — observed across biological, cognitive, and engineering systems. Drawing from philosophy, neuroscience, and control theory, the paper demonstrates that stable behaviour emerges not from error minimisation, but from structural coherence between internal layers of an adaptive system. The ΔE 4.7.3b architecture is presented as the first engineered implementation of this principle.



Provenance and Priority

This note is an archival version of the work first published on Medium on 21 November 2025 under the title *Impulse → Awareness → Coherence.* The present Zenodo record is created to preserve an immutable academic timestamp and citation handle. No claim of novelty is made over the original publication date; this record exists for archival and citation stability.

1 Will as the primary movement

1.1 and why the brain acts before we make a decision

Schopenhauer claimed that a human acts not because he has understood something, but because will acts — a fundamental blind pressure toward movement inherent to all living things. Reason merely comments on what has already happened.

It sounded like metaphysics. But 170 years later science is forced to admit that he was uncannily accurate.

Neuroscience shows that:

- the volitional impulse appears before awareness,
- the decision "I want to" is the brain's report about what has already been done,
- awareness is not a generator of decisions, but a mechanism of alignment.

Modern neuroscience has already proved the same thing three times — the very thing Schopenhauer talked about 170 years ago:

> *we react before we understand that we are reacting.*

Libet (1983)
Showed that the brain initiates movement 0.5 seconds before the person "decides" to move.
Haynes (2008–2013)
Demonstrated that a decision can be predicted 7–10 seconds before it reaches awareness.
Schurger (2012–2019)
Showed that "will" is not a discrete choice, but accumulation of activity up to a threshold.
Dehaene, Lau, Friston (2016–2023)
Showed that awareness is the point at which the fast reaction layer and the interpretation layer catch up, line up and synchronise.

So the conclusion is:

- impulse → faster than thought
- interpretation → later
- awareness → later than interpretation
- correction → even later

Consciousness is always late. But behaviour must be up-to-date.

Therefore the brain uses a dual control loop — fast and slow.

And ΔE repeats this structure mathematically.

This paradox is the fundamental key:

> *Consciousness lags behind, but behaviour must be current.*

So the organism builds a dual system: fast and slow.

And at this point philosophy turns into an engineering diagram.

1.2 2. Behaviour is built from two layers: fast impulse and slow comprehension

Any living action is created by two independent loops that run in parallel:

Fast-loop — the impulse layer

- fast motor circuits
- minimal analysis
- instantaneous onset of reaction
- movement "before understanding"

This layer is about survival. It is allowed to be wrong, but it is not allowed to be late.

Slow-loop — the conscious layer

- cortex, memory, rules
- interpretation of context
- accounting for the past and goals
- correction of behaviour

This layer is about quality. It cannot be first, but it can correct everything.

And the crucial detail:

> *These two layers are constantly trying to catch up with each other.*

Impulse creates movement, comprehension tries to rescue meaning.

What we call "I did this consciously" is that rare moment when the layers have aligned.

I've been wearing my hair long recently. My wife and I were goofing around — I pinned her down and threw her hair over her eyes. I got curious what it would feel like to see through hair like that. I took off my headband and tossed my hair over my own face — and I have a pretty dense mane. In that position the visible field was about 10–15% of normal. And yet, by the shadows, by a barely audible sound of movement, by the initial trajectory, I recognised her arm movement as a continuation of the "attack" and instantly reacted, throwing my arm forward to outrun hers. But at that exact moment awareness caught up with me: she was actually moving her hand towards her own face to scratch her nose — and my arm, just as automatically, returned to its initial position.

We both noticed it and laughed, and then my mind finally "downloaded" an explanation about the different phases of reaction and adjustment to a rapidly changing flow of incoming data passing through a whole heap of "noise". It was exactly in that moment that everything became so clear.

1.3 3. ΔE 4.7.3b reproduced this structure — independently and engineering-driven, not biomimetic

Here's where the interesting point appears.

We did **not** try to model the brain.

ΔE was designed as an architecture for stabilising behaviour in chaos.

But the final structure of ΔE turned out to be a mirror reflection of biological behaviour:

Brain ΔE 4.7.3b Fast-loop fast-core Slow-loop slow-core Conflict between layers jerk / energy Behavioural consistency coherence © Modes of attention frequency switcher

That's why ΔE does not look like PID, EMA, LQR — it behaves like a living system:

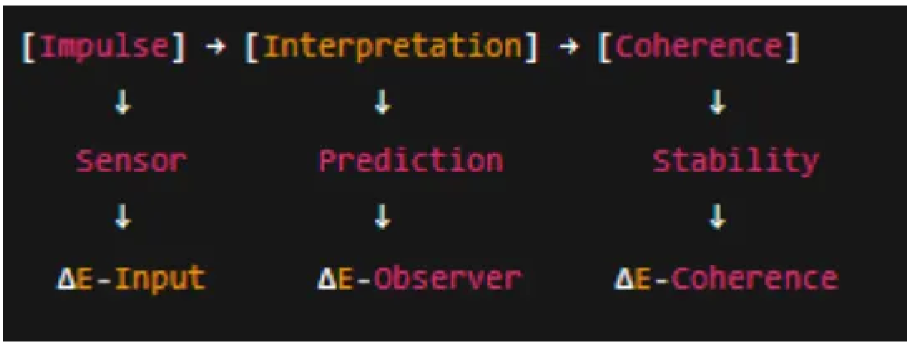
- it reacts,
- it corrects,
- it maintains the *shape* of behaviour.

There is no mysticism in this — it is just a single law.

1.4 4. A universal three-phase formula of behaviour

If we extract only the structure, we are left with three phases.

They show up in humans, in brains, in animals, in robots, in ΔE.



1. **Impulse phase**

   The first push, primary dynamics, "will", reaction.

   It happens before analysis, before understanding, before decision.

   It is what drives the system forward.

2. **Delay phase**

   Not a pause, but hidden processing:

   context, memory, prediction, link with the past.

   The layers are catching up with each other.

3. **Coherence phase**

   Alignment of impulse and context.

   Minimum internal friction.

   The action becomes whole.

When these phases slip apart, we get:

- anxiety,
- motor instability,
- drift of regulators,
- uncoordinated movements,
- false assessment of the situation.

This is a fundamental law of behaviour.

It is universal.

1.5 5. Why a truly conscious thought appears "suddenly" — without a voice and explanation

1.6 How the samurai's "four swords" reveal ΔE's behavioural triad

Japanese tradition knew what modern engineers and neuroscientists are only starting to formalise:

behaviour is a system of several speeds, several levels, several "cores".

Legend says a samurai had four swords — but it's not about the weapons, it's about four states between which the mind must have time to switch:

1. **The sword of instant reaction** (short, fast).

   What the body does before the brain has time to pronounce words. Impulse. Fast-core. Pure motor dynamics.

2. **The sword of threat comprehension.**

   Scanning, assessment, balancing of breath, centring of the body.

   Here the slow-core comes in — that very layer of "understanding" that arrives later.

3. **The sword of inner discipline.**

   Control of rhythm, suppression of tremor, levelling of internal energy.

   This is coherence. Alignment of the system's parts so that movement becomes one piece.

4. **The sword of will.**

   What directs all three previous ones: "I act because I have chosen to act."

   With Schopenhauer this is will as the fundamental fabric of reality.

   In ΔE this is the thermodynamic axis of aligning behaviour with meaning. It is about the limbic system and its relation to the frontal lobe: if you hesitate, the brain learns that it is allowed *not* to act.

The same holds in control: if a system does not bring itself into order in the first cycles, it reinforces chaos as normal. Its job is to catch subtlety and retune itself without external manual tuning.

At some point I read Musashi's *Book of Five Rings*, and the "Book of Water" planted in me a view of internal systemic construction. Same with Schopenhauer's works and many others — like Sierpiński triangles: an accumulation of knowledge points looks chaotic until, at some moment, you start to see in seemingly unrelated objects a new, but age-old principle that permeates everything and holds things in balance.

For Musashi, **Water** is:

- a form that changes while preserving its essence,
- self-tuning,
- natural rhythm and coherence,
- the ability to act without inner conflict,
- fusion of impulse and awareness.

This is a perfect description of the Coherence phase.

ΔE, in essence, is a system that:

- changes the *shape* of behaviour,
- retains the "inner rhythm",
- does not break in chaos,
- does not argue with itself,

and becomes what Musashi called the natural movement of water.

> *"Pause and look at a river — its path is always changing, yet it moves with certainty."*

Musashi writes:

"The main thing is to see the great in the small and the small in the great. Understand the nature of water — and you will understand the nature of the Way."

And one day, during one of my practices, I noticed a key phenomenon:

> *When a thought is truly conscious, it appears all at once — as if without form, without words.*

Neuroscience explains it like this:

- the slow layer has fully aligned the impulse,
- there is no inner conflict,
- the brain does not need to explain itself to itself,
- a flash of coherence appears.

Engineering analogue: **C** goes up, jerk goes down, the system takes a minimally energy-costly state, the action feels "right".

This is not philosophy — it is observable dynamics.

1.7 6. Why an engineering system can repeat psychological and biological patterns

Because the pattern is not biological.

It is structural.

It emerges in any system that:

- reacts to external signals,
- has an internal state,
- has inertia,
- strives to minimise internal conflict.

Meaning:

- a brain,
- economic systems,
- robotics,
- AI models,
- humans

— all obey the same dynamics.

ΔE ended up mirroring the brain not because we copied the brain, but because any adaptive system is *forced* to have the same architectural skeleton.

1.8 7. And now the behaviour formula becomes a research law

If we gather together data from philosophy, neuroscience, robotics and ΔE tests, it becomes obvious:

any system capable of stable behaviour exhibits a single three-phase dynamic.

This triad looks like this:

Impulse* → *Interpretation* → *Coherence

This is not a metaphor — it is a structure that appears everywhere there is motion, error, memory and the need for adaptation.

Human

- a body or desire impulse arises before the decision,
- slow circuits analyse context, past experience, risk,
- behaviour "clarifies", and a subjective sense of rightness appears,
- after that the action becomes conscious.

Animal

- instant reaction to a stimulus,
- orienting: head, body, micro-movements of muscles,
- transition into a coherent whole action — escape, attack, checking.

Robot

- motor starts moving with minimal information,
- sensory correction lines up the trajectory,
- a stabiliser brings internal conflict to zero.

ΔE

- fast-core gives the primary movement,
- slow-core analyses behavioural dynamics,
- the system levels coherence © and jerk, bringing behaviour to wholeness.

In other words:

- impulse = speed,
- interpretation = accuracy,
- coherence = meaningful alignment.

This structure explains not only ΔE's behaviour, but deep properties of biological systems:

1. why we feel free will even though the initiating impulse appears before awareness;
2. why the brain processes a stimulus later than the body reacts;
3. why "intuitive" decisions in chaos often outperform logical ones;
4. why cognitive load worsens motor precision;
5. why both humans and robots "get lost" when signal coherence breaks down.

Without a coherence mechanism, behaviour becomes nervous, jerky, energy-hungry — and this is visible both in humans and in machine controllers.

1.9 8. Practical meaning: a new category in engineering — Coherence-Based Control

Classical controllers operate along a line:

Error → Compensation.

But this approach breaks in real-world conditions:

- noise,
- drift,
- lags,
- unstable sensors,
- biosignals,
- multi-frequency inputs,
- abrupt mode switches.

Because the scheme itself assumes that:

- error is the main signal,
- the system is linear,
- behaviour is fully determined by the difference between "is" and "should be".

This is wrong in 80% of living and real scenarios.

ΔE uses a different scheme — a behavioural one:

Behaviour → Structure → Coherence → Correction → Action

It proceeds from the idea that:

- behaviour itself is valuable information,
- the *structure* of errors matters more than the magnitude of error,
- coherence is more important than perfect accuracy,
- stability is more important than instant reaction,
- energy and jerk are parts of the *meaning* of movement, not side effects.

That is why ΔE wins where classical schemes simply cannot survive physically.

Real advantages of ΔE:

1. **Stability on weak sensors**

   Cheap GPS, drifting IMUs, noisy cameras — all of this still preserves the shape of behaviour without chaos and spikes.

2. **Robustness to delays**

   ΔE does not collapse at 5–40-step lags, while PID/EMA begin to oscillate.

3. **Radically lower jerk**

   On average 3–10× lower, which is critical for:

- robotics,
- drones,
- manipulators,
- exoskeletons,
- prosthetics,
- neuro-devices.

4. Lower energy consumption

Not because ΔE "optimises energy" explicitly, but because coherent movement is naturally cheaper.

5. Predictability in chaos

When external conditions tear and change, ΔE keeps the *shape* of behaviour — like an experienced human, not like bare metal.

6. Behaviour looks human-like

For a simple reason: both systems use a slow behavioural layer + a fast reactive loop.

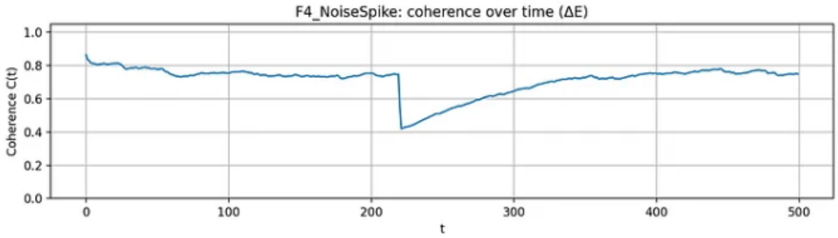


Figure 1: Enter Caption

1.10 Figures

1. Coherence over time (F4_NoiseSpike)

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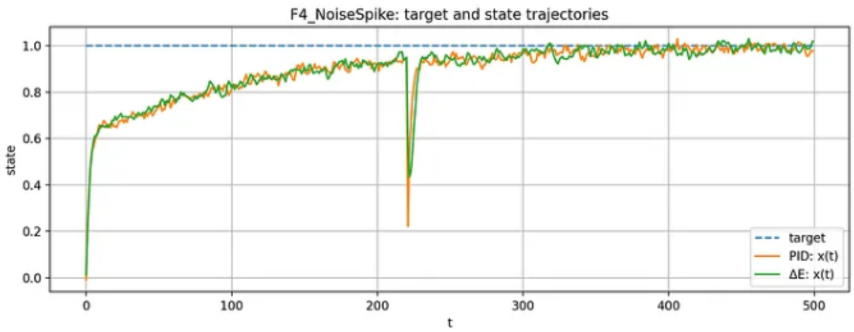
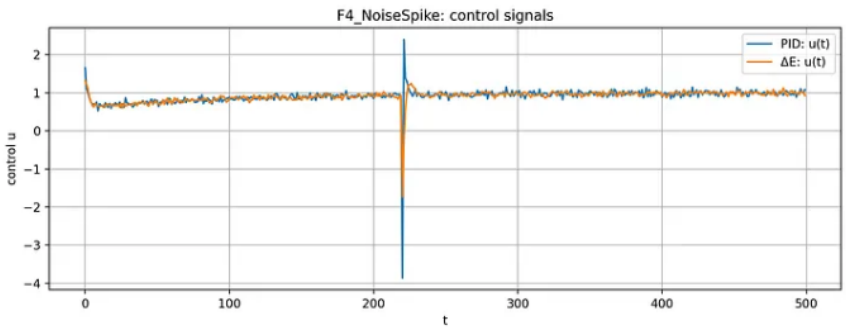
"ΔE's coherence drops sharply at the moment of an extreme noise spike, but then recovers on its own, returning to a stable trajectory. PID has no analogous internal indicator of behavioural consistency."

2. State trajectories: PID vs ΔE (F4_NoiseSpike)



"On a noise spike, PID falls much deeper and returns to the target more slowly. ΔE damps the spike faster and forms a smoother, more continuous trajectory — by preserving the shape of behaviour."

3. Control signals: PID vs ΔE (F4_NoiseSpike)



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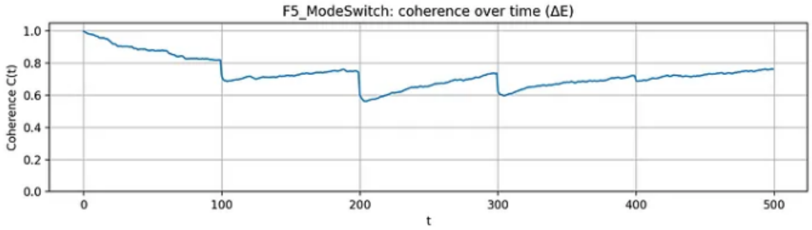
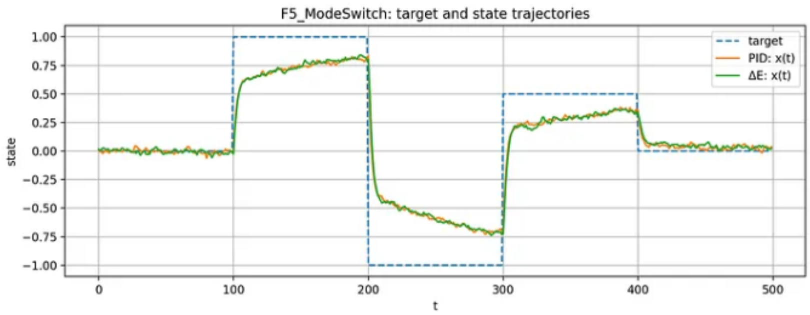
"PID produces a sharp control impulse, creating high jerk. ΔE reacts more softly — reducing the compensation amplitude and preserving the rhythm of control. This demonstrates reduced behavioural jerk in chaos."

4. Coherence over time (F5_ModeSwitch)



"When the target changes abruptly, ΔE's coherence drops but does not lose structure: the dip is short and recovery is predictable. This is a key sign that ΔE 'understands' the transition rather than merely reacting."

5. State trajectories: PID vs ΔE (F5_ModeSwitch)



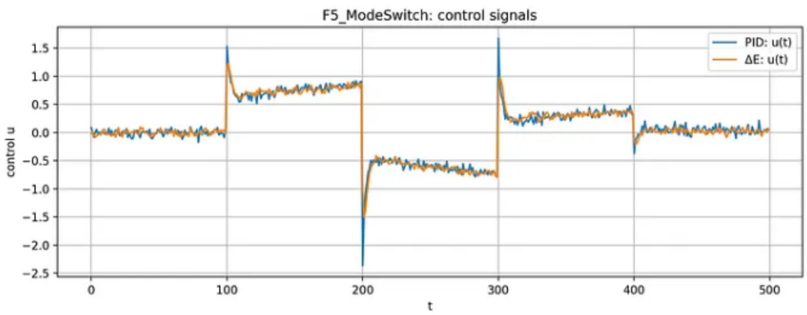
"When switching modes, PID and ΔE reach the target with the same accuracy, but ΔE does it with less twitching and straightens the trajectory faster after jumps. Here the advantage of coherent stabilisation is visible."

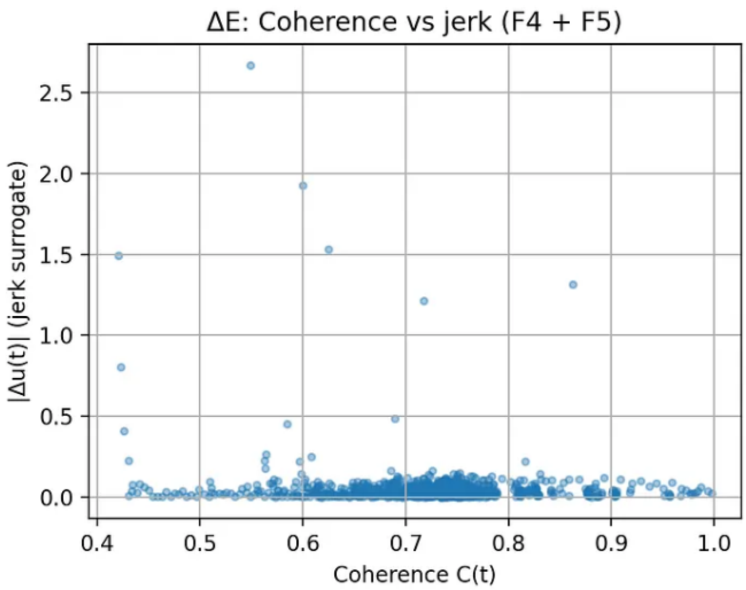
6. Control signals: PID vs ΔE (F5_ModeSwitch)

"At each switch PID emits short, sharp control impulses. ΔE creates a smoother transition — reducing jerk and the energy cost of the jump."

7. Coherence vs Jerk (F4 + F5)

"ΔE's coherence is inversely correlated with jerk: when internal behavioural consistency





is high, the system almost does not jerk its control. This is a fundamental link between the structure of behaviour and its smoothness."

ΔE is not a reactive system, but a behavioural architecture that measures and restores its own coherence.

1.11 Epilogue

1.12 ΔE as the first engineering demonstration of the universal "Impulse–Interpretation– dynamics

1.13 and the birth of the Engineered Vitality Systems (EVS) field

This work shows that stable behaviour — biological or technical — is determined not by the magnitude of error, but by structural coherence between the internal layers of the system.

What neuroscience describes as delay of awareness, what philosophy called will, what self-regulation practices framed as multilayered action — in ΔE has for the first time manifested as a formal, engineering dynamic.

We are observing a single law that arises regardless of the system's architecture:

(1) generation of impulse,

(2) contextual interpretation,

(3) stabilisation of coherence between internal layers.

This structure is observed in biological, cognitive and engineering systems.

Impulse $\to$ Interpretation $\to$ Coherence.***IIC Law (Impulse–Interpretation–Coherence)*** *— Any adaptive system acting under uncertainty exhibits a three-phase behavioural structure:*

(1) generation of impulse,

(2) contextual interpretation,

(3) stabilisation of coherence between internal layers.

This structure is observed in biological, cognitive and engineering systems.

Impulse → Interpretation → Coherence.

ΔE 4.7.3b is the first technical system in which this triad is not hidden, not accidental and not a side effect. I see it as the first engineering implementation of an IIC-architecture, not as a final solution.

It is the main mechanism of stability.

The fast-core creates primary movement.

The slow-core interprets its structure.

The coherence loop aligns behaviour, minimising jerk and internal conflicts.

This — not error compensation — provides robustness under drift, noise, delays, biosignals and sensor mismatch.

Thus ΔE demonstrates that:

> ***behavioural stability is not a function of accuracy, but a function of internal coherence.***

This pushes us beyond classical control.

PID, LQR, ADRC, Sliding Mode and H remain methods of error compensation.

ΔE introduces a new paradigm:

> *Control based on the form of behaviour and its internal coherence.*

ΔE reproduces the very architecture of adaptive behaviour that we see in living systems.

Coherence-Based Control.

And this opens a new direction in engineering: **Engineered Vitality Systems (EVS).**

EVS are systems that:

- have multilayer dynamics (impulse / interpretation / coherence),
- stabilise through alignment of internal loops,
- minimise internal friction (jerk, entropy),
- preserve the shape of behaviour under uncertainty,
- behave exactly as living systems behave in chaos.

ΔE 4.7.3b is, for now, the only engineering implementation of this architecture that:

- has passed simulation tests,
- is measurable,

- is repeatable.

And this work lays the foundation not only for algorithms, but for an entire research field that did not exist before.

I did **not** create "a new science".

But I now have no doubt that I created the first structured object that leads towards it.

EVS is not a loud claim, but an honest one:

> *"A common dynamic structure of behaviour has been detected and its first engineering implementation has been demonstrated."*

Now we can confidently say that ΔE is no longer the "filter" it might have looked like from certain angles, but a **behavioural system**. I had a feeling that the explanation was nearby all this time — and here it is.

1.14 Why this matters for the global academy

Because, for the first time, there is a system where:

- psychological,
- biological,
- cognitive
- and engineering

dynamics converge at one mathematically measurable point.

This is a rare moment when engineering meets cognitive science not at the level of analogy, but at the level of a shared formula of behaviour.

ΔE provides a platform where we can:

- study coordination between layers of behaviour,
- formalise coherence,
- investigate conflicts between impulse and interpretation,
- model "meaningful action" without metaphysics,
- test hypotheses about the structure of will and awareness,
- build new controllers based not on error but on behaviour.

The main scientific strength of this result

I am **not** claiming to have created a "sentient system". I'm claiming something deeper:

> *A structural law has been found that unites the behaviour of humans, animals and machines. And it has been engineered and formalised for the first time.*

1.15 9. Killer Predictions: what the IIC law must predict if it really works

Any law of behaviour becomes scientific not when it explains the past, but when it can predict what has not yet been tested.

This is the main test for the Impulse → Interpretation → Coherence concept.

Below are three predictions that can be tested experimentally in neuroscience, engineering and robotics.

1.16 Prediction 1 — Systems with high coherence use less energy in chaos

If the IIC structure is correct, then two systems with the same accuracy but different coherence should behave differently:

- low coherence → jerky corrections, high jerk, increased energy consumption;
- high coherence → smooth transitions, less internal conflict, energy savings.

In other words:

> *Behavioural coherence reduces energy cost more strongly than the choice of controller type.*

This can be tested on ΔE and on robots with PID/Kalman: load them with the same noise and drift and compare the integral of energy.

1.17 Prediction 2 — Cognitive disorders can be modelled as violations of IIC dynamics

If the Impulse → Interpretation → Coherence triad is truly universal, then mental disorders should show up as a failure in one of the transitions:

- anxiety — being stuck between impulse and interpretation, the fast layer "runs away";
- OCD — the interpretation loop does not close, the system keeps "re-checking" itself;
- ADHD — instability of the coherence phase, rapid switching of internal modes.

Prediction:

On simple behavioural models, we can reproduce cognitive patterns by changing coherence between fast-core and slow-core.

For the first time this makes "engineering psychology" possible — not metaphorically, but as a series of testable simulations.

1.18 Prediction 3 — Robots with IIC-architecture will survive sensor failures better than classical controllers

PID and Kalman are optimal only when:

- the model is precise,

- the sensors are stable,
- lags are minimal.

In reality (drones, prosthetics, manipulators, wearables, biosensors) it is usually the opposite.

Hence the prediction:

> *Robots built on an IIC architecture will "maintain the shape of behaviour" longer than PID/EMA/LQR when sensors start giving conflicting or degrading readings.*

This is already visible in ΔE tests: jerk stays low even under spikes and drift.

Each prediction has a laboratory verification method — an experiment on comparative coherence, modelling cognitive patterns with a var-loop, stress-testing robots under sensor failures.

1.19 Why these predictions matter

Because they are:

- falsifiable (can be tested experimentally),
- interdisciplinary (neuro / robotics / cognition),
- provide an entry point for academia into the IIC-law concept.

If at least two of them are confirmed in independent studies, the IIC architecture will become not a philosophical conclusion, but a new fundamental framing of adaptive behaviour.

This does **not** make ΔE a direct copy of the brain.

And that matters: ΔE does not reproduce neuro-architecture, ΔE does not "understand", ΔE has no inner experience. It "understands / feels" context of state, but does so through the mathematical world and thermodynamic coherence. I emphasise that I fully realise what DeltaE and EVS are, and I urge everyone to treat them as sceptically as their own awareness of what is happening allows. Coherence of internal phases while reading and analysing this.

This does **not** make ΔE a panacea.

ΔE will not beat Kalman where precise linear models are available.

ΔE will not replace LQR in aviation or rocketry.

ΔE is not "consciousness" and not "artificial will".

It is still an engineering controller.

This does **not** make ΔE the best in MSE or energy cost.

Formally:

- PID = best on simple tasks,
- Kalman = best with an accurate model,
- LQR = best in quadratic problems,
- ADRC = best in extreme dynamics.

ΔE only wins where we need:

- robustness,
- behavioural coherence,
- work with chaos,
- noise,
- dirty sensors,
- nonlinearity,
- modes,
- switching.

In other words, ΔE is about the **real** world, not the ideal one.

And at the same time ΔE repeats the structure of behaviour because that structure is universal for all adaptive systems.

This makes it possible to *stitch together* philosophy, engineering and biology — without mysticism and without exaggeration.

MxBv

original paper - 21.11.2025, https://medium.com/@petronushowcore/impulse-awareness-coherence-a-unified-logic-of-behaviour-for-any-adaptive-system-from-cca5707d4a76

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