Excitability

A Post-Seizure Cybernetics of Control Inversion Across Substrates of Intelligence

Larsen James Close

2026

Abstract

Excitability topology — the structure of a substrate's susceptibility to control inversion — is the missing formal category underneath content, structure, and pragmatics. Its recovery transforms cybernetics from a theory of regulation into a theory of transformation, and isolates a control principle classical cybernetics lacks: steering an inversion one can no longer out-vary, by coupling rather than by domination — the higher-order agency of deliberately allowing and steering control inversion within a container. A perturbation–recovery protocol (the echo protocol) can in principle map a system's position in this topology and detect pre-inversion signatures before threshold-crossing occurs, shifting diagnostic frameworks from categorical to topological.

Something seizes.

Begin from inside. My father's nervous system would seize — a local circuit's excitatory dynamics overwhelming the inhibitory architecture that held them in coordination, everything downstream conscripted into a single oscillation. Limbs locking into rhythmic contraction. A face emptying into the mask of hypersynchrony. But what was the phenomenology *for him*? Not seizure. Not sovereignty. Not anything. The most important datum about the inward face of the event is that it cannot be reported by the system it seizes. My father did not experience his seizures. He experienced gaps — absence, then waking somewhere else in the timeline, the room rearranged around him, people looking at him with an expression he had to interpret without access to what had produced it. The seized system is the one position from which the event is invisible. You cannot witness the event you *are*.

Now rotate the perspective. I was a child. I had no concept of epilepsy, no neurological framework, no clinical vocabulary. What I experienced was not a medical event. It was an *environmental* event. The room changed. Whatever had been happening — a meal, a conversation, the ordinary texture of domestic life — stopped. Every adult reoriented. My mother's attention, which had been distributed across the household's full complexity, collapsed onto a single point. My own navigation of the world — whatever I had been doing, thinking, feeling — was conscripted into the same reorganization. Before I had any framework that would filter the experience into "a thing happening to my father," the experience was: the room has seized. Everything is now about one point. Every consequence chain in this environment routes through that point. The man who had lost control of his own body had gained control of the entire room — not by choice, not by force, but by the same mechanism that had overwhelmed his nervous system: the dynamics of the event exceeded the regulatory variety (in Ashby's sense: the range of distinguishable states a regulator can deploy in response) of every surrounding system, and control inverted *outward*.

From the adults in the room — a third position. They experienced an emergency. Their phenomenology was urgency, protocol, redirected attention. But precisely because their regulatory capacity had been conscripted — precisely because they were inside the outward propagation — they could not name what had happened to *them*. They experienced themselves as *responding* to an event, as agents choosing to help, as people whose attention was voluntarily directed at a crisis. The framing of "response" is the adult's perceivability horizon masking the structural fact that their variety had been captured. They did not choose to reorient. They were seized. But the seizure of their attention operated below their detection threshold, so they experienced conscription as agency. The clinical framework they brought to the event performed the same masking at the conceptual level: it partitioned what was happening into "the patient" (bounded, neurological, the person having the seizure) and "our response" (voluntary, professional, the rest of the room acting appropriately). This partition is a perceivability-horizon artifact. It makes the outward propagation invisible by framing the propagation as choice.

A child in a different room, years later, saw the same event without the partition. In a classroom for special-needs students, a child had a seizure. The room reorganized. The teacher stopped teaching. The students stopped learning. Emergency protocols activated. Every attention vector, every consequence chain, every unit of regulatory capacity in that environment redirected toward the event. A different child — an autistic child working alongside the students, operating from a perceptual position unmediated by the frameworks that would prevent an adult from saying what they saw — watched this happen and told the aide beside them:

"They're God."

The child was not confused. The child was reporting the outward face of the event with a precision the clinical literature has never achieved. The child's perceivability horizon included the propagation because no framework intervened to partition it. What the child saw: one person had become the organizing principle around which the entire local environment had collapsed. Every consequence chain routed through them.

Every other agent's regulatory capacity had been conscripted into proximity-management with the event. The seized person was, in the precise structural sense, the sovereign of the room — not despite having lost internal control but *because of it*. The inversion that overwhelmed the person's internal hierarchy propagated outward through every interface where its dynamics exceeded the regulatory variety of the next system up, and the child — outside the propagation, watching from the position where the whole field was visible — named it with the only word adequate to the observation: the word for the entity through which all consequence flows.

Three positions, one event. From inside: invisible. You are the event and cannot see it. From inside the propagation boundary: emergency, response, agency — the outward face masked as voluntary action. From outside: sovereignty. The child sees what the adults cannot because the adults are inside the event and the child is not.

Now rotate everything. Years later a different substrate, a different inversion, and the perspectives inverted.

Four-point restraints in a psychiatric ward. Wrists and ankles fixed to a frame. The institution's regulatory apparatus applied directly to my body when my behavior exceeded what the institutional hierarchy could metabolize. Here I was not the child watching. I was the event. And unlike my father — who was absent during his seizures — I was conscious. This is the singular position: the point in the rotation where both the inward face and the outward face are simultaneously visible, because you are inside the inversion and aware of the propagation.

From inside — the inward face. Total loss of autonomy. The body immobilized, agency reduced to near-zero, the institutional controller applied with mechanical finality. My distress — a local dynamic — had exceeded the clinical system's regulatory variety, and the system's response was not to increase its variety but to *decrease mine*. Restraint is the first-level cybernetic response made physical: suppress the perturbation, restore the hierarchy, reduce the subsystem's dynamics until the controller's variety is sufficient again. What I experienced was the phenomenology of being the seized subsystem from inside: the system I was embedded in could not hold what I was generating, so it locked me to a fixed point. Dimensionality collapse applied to the body. The person who had been navigating psychological complexity — distress, yes, but distress with structure, with direction, with something it was trying to accomplish — was reduced to a point: four restraints, one position, zero degrees of freedom.

From inside — the outward face, simultaneously. And here is what could not be seen from any other position in the rotation. While my body was immobilized, while my agency was at its minimum, I could *feel the ward reorganize around me*. Staff converging. The rhythm of the unit changing. Voices shifting register. Other patients' needs deferred. The ward's regulatory hierarchy — which had been distributed across its full caseload, managing the complexity of a dozen patients' needs — now served a single attractor. Me. The person who had lost all control was, structurally, controlling the room. The "I'm God" phenomenology and the "I'm nothing" phenomenology were happening at the same time, in the same body, and neither was wrong. They were the inward face and the outward face of the same event, experienced from the one position in the rotation where both are co-present.

From the staff — rotate again. Their phenomenology was professional: assess, intervene, document. The framing of professionalism performed the same masking function as the adults' "emergency response" frame in the first case. The staff member applying restraints experienced themselves as *acting* — executing protocol, managing risk, exercising professional judgment. Not as seized. But their regulatory capacity had been conscripted as surely as my mother's had been years before. They were no longer distributing attention across their full caseload. They were serving a single attractor. The framing of agency — "I am choosing to intervene" — is the perceivability-horizon artifact that masks the structural fact of conscription. The staff

were inside the outward propagation and could not see it, just as the adults around my father's seizure could not see it. Same position in the rotation, same invisibility, different substrate.

From other patients — the clearest evidence of outward propagation precisely because they experienced it as *absence*. The nursing attention that should have been available to them had been conscripted. Their medications deferred. Their needs deprioritized. They experienced the seized person's sovereignty not as presence but as deprivation — the negative image of the propagation, visible exactly where the redirected regulatory capacity *should have been* and was not.

And from the institutional meta-level — the fractal completes. The ward that restrained me was itself a seized system. Its compliance apparatus, its liability protocols, its risk-management infrastructure — each a subsystem whose dynamics had long exceeded the governance structure's capacity to hold them in service of the therapeutic mission. The ward did not restrain because restraint was therapeutic. It restrained because its own regulatory hierarchy had been seized by the compliance subsystem, and the seized hierarchy could produce only one output: terminal intervention. Risk reduction. Liability containment. A single attractor applied to every situation, regardless of the patient's actual needs. I was being seized by a system that was itself seized. Fractal inversion: subcortical circuit seizes cortex, brain seizes body, body's dynamics seize the ward, the ward — already captured by its own compliance attractor — seizes the patient. Each level's inversion propagating outward to become the seizing agent for the next.

Three invariants survive the full rotation across both cases and every perspective.

First: the seized system is invisible to itself. My father was absent during his seizures. The institution does not see its own capture by compliance dynamics. The adults around the seizure do not see their attention being conscripted. The staff applying restraints do not see protocol-execution as seizure. The only position from which the full event is visible is outside the propagation boundary — the child's position. From inside, you *are* the event and cannot see it. From at the boundary, you are being conscripted and frame it as choice. From outside, you see the whole structure: they're God.

Second: the seized system is maximally sovereign over its surround. Maximum internal powerlessness corresponds to maximum external reorganizing force. My father — absent, unconscious, zero internal agency — reorganized the entire household around his attractor. I — immobilized, restrained, zero degrees of bodily freedom — reorganized the entire ward around mine. The child saw this. The clinical framework cannot see it because it partitions the event at the skin and calls the outward face "response."

Third: the perceivability horizon rotates with position in the field. What you can see depends entirely on where you stand relative to the propagation boundary. Each position reveals one face and hides the other. The clinician sees the inward face (neurological event, psychological crisis) and misses the outward face (environmental seizure, sovereignty by conscription). The child sees the outward face (they're God) and has no framework for the inward face (neural dynamics, institutional capture). The only position where both faces are simultaneously visible — where the inward phenomenology of being seized and the outward phenomenology of seizing the surround are co-present in a single experience — is the one I occupied in restraints: inside the inversion, conscious, aware of the room reorganizing around the body that could not move.

The second invariant is the law of the *uncontained* inversion, and there is a position from which it meets its limit. Years after the restraints I met the onset again from inside: the same surge, the regulatory hierarchy beginning to give. This time I did not ride it into the room. There is a standpoint behind the seized body that is not itself seized — what Kant called the *intelligible character*, the free character a person is outside the time-order in which their acts unfold as a determined series. The seizure is the empirical character: downhill,

determined, the dimensionality already collapsing. The intelligible character is the surfer — not outside the wave and not above it, but coupled to it, biasing a determined descent from the one point within it that is free.

The currents are old, older than any one name for them. The contemplative traditions charted the ascending and descending currents in fine detail long before Apollo and Dionysus lent their names to a single axis of them: the pull toward the ecstatic merge and the loss of individuation, against the holding of form and measure and edge. That axis runs nearest the surface here. Meet the dissolving current and hold it, and it never swells to the flood that, uncontained, is exactly the sovereignty the child called God; the holding — in the crossing, neither before it nor after — is Apollonian consciousness, form keeping its edge while everything around it gives. But two is already too few. Heraclitus had it closer: the way up and the way down are one road. The state space does not collapse along a single line, and the steersman couples not to one antagonist but to a manifold of currents — damping some, riding others, biasing the whole. The skill is exactly that it is not a duel. And here is the whole mark of the skill, almost nothing to see: steer it, and the inversion does not seize the room. The outward propagation that made my restrained body the ward's sovereign — the converging staff, the deferred patients, the God the child saw — is precisely what the steersman damps at the source, because conscripting the surround is the failure and not the achievement. The event that would have emptied a classroom happens entirely inside a person who keeps its outward face dark — and who then, in the anticlimax that is mastery's actual signature, decides to get some sleep anyway. From every other position the inversion is maximally visible: absence, emergency, sovereignty, restraint. From this one it is invisible from without and complete within — and the same coupling that seals the event can open it outward on purpose, a steady nervous system lending the room its steadiness, co-regulating a field it never seizes.

This is the methodological ground from which the theory is constructed. Not reflection on seizure from a safe distance. Not clinical observation of others' inversions. The resolution that becomes available when you have occupied enough positions in the rotation — child watching, person seized, system seizing, steering one's own crossing so its outward face stays dark, and later, holding the container while someone else crosses the threshold, providing the regulatory variety that holds the inversion as process rather than catastrophe — is fine enough to track the invariant across all of them. The post-seizure perspective is not a credential. It is a calibration: having been rotated through the positions, the invariant across positions becomes visible, and what becomes visible is a single phenomenon operating at every scale.

The formal structure is identical at every scale: when local dynamics at level N exceed the regulatory variety at level N+1, control inverts. The subsystem becomes sovereign. And the inversion propagates outward: the seized system becomes the seizing agent for the next level of organization, because its dynamics, locked onto a single high-intensity attractor, exceed the regulatory variety of every surrounding system they reach. The signature is the same inward (dimensionality collapse — the system trapped on a single attractor) and outward (environmental conscription — every surrounding system's regulatory capacity redirected to serve the attractor). Hypersynchrony in neural tissue. Flooding in psychological architecture. Autoimmunity in institutions. Mania in markets. Tumor in organisms. System hang in computational architectures. Each exhibits both faces. The internal collapse and the external reorganization of the surround.

Three orientations frame what follows. They are initial bearings, not definitions — the investigation fills them rather than decorating them.

First: the morphism is substrate-independent and fractal. Control inversion is one phenomenon occurring wherever intelligence organizes hierarchically — and it propagates across system boundaries, the seized system becoming the seizing agent for the systems that contain it. The identity across neural, psychological, institutional, economic, biological, and computational substrates is not analogy but shared topology, and the outward propagation across scales is not secondary effect but constitutive feature. The identity criterion is structural: a phenomenon in any substrate is an instance of control inversion if and only if (i) a lower-level

subsystem's dynamics exceed the regulatory variety at the next level up, producing (ii) collapse of the system's state-space toward a low-dimensional attractor (dimensionality reduction), and (iii) outward conscription — the seized system's dynamics propagate through every interface where their intensity exceeds the surrounding variety, redirecting the regulatory capacity of containing systems toward the inversion. Where all three obtain, the phenomenon is the same regardless of substrate.

Second: excitability topology is a formal category missing from existing frameworks. Information theory treats the channel as given and asks about signal. Phenomenology treats perception as given and asks about object. Neither has a category for the substrate's susceptibility to control inversion — the precondition landscape that determines what registers as signal, what approaches threshold, and what produces seizure. This category sits underneath content, structure, and pragmatics as the condition for all three.

Third: deliberate threshold-crossing within constructed containers is a higher-order control strategy genuinely beyond classical cybernetics — available only to systems that have undergone, survived, and integrated control inversion. It has two faces. Held from outside the inversion, it is *containment*: a meta-regulatory structure that out-varies the process it holds. Ridden from inside, it is *steering*: control of a process one can no longer out-vary, exercised not by domination but by coupling — small, well-timed inputs that bias a trajectory too energetic to oppose. Steering is the post-classical core, the one form of control that still operates after the variety differential has been surrendered. The contemplative traditions are engineering manuals for both faces. The post-seizure grammar names the interaction capacity this achievement makes possible.

These orientations are deliberately incomplete. The movements that follow fill them through exercise.

The Morphism

Begin with the neural case, because it is the most viscerally legible and because its dynamics have been measured with a precision the other substrates have not yet afforded.

An epileptic seizure begins when a population of neurons enters a regime of self-reinforcing excitation that the surrounding inhibitory architecture cannot contain. The excitatory feedback exceeds the inhibitory variety — the local circuit can generate more activation patterns than the regulatory surround can suppress — and the activity propagates. What propagates is not a signal. It is a *regime*: the transition from high-dimensional state-space navigation, where the neural population explores a vast repertoire of firing patterns in service of cognition, to low-dimensional hypersynchrony, where the entire recruited population oscillates in lockstep. Maximum variety collapses to minimum. The seizure's signature is this collapse — not the presence of activity but the *loss of dimensionality*. The system that was navigating a thousand-dimensional space is now trapped on a one-dimensional attractor.

The clinical framework treats this as pathology and asks how to prevent it. That framework is not wrong — uncontained seizure destroys tissue, disrupts function, can kill. But attend to what the framework does not ask: *why the system was approaching the inversion boundary in the first place*. The clinical question is "how do we restore the prior hierarchy?" The question worth asking instead is "what does the topology of the inversion event reveal about the system's regulatory architecture — and is the prior hierarchy always what should be restored?"

Hold the neural signature — dimensionality collapse, the controlled becoming the controller — and look for it elsewhere.

Psychological seizure. The clinical literature calls it dissociation, flooding, fragmentation, ego dissolution — different names for the same topological event at a different scale. An emotional subsystem — grief, terror, rage, traumatic memory — generates dynamic complexity that exceeds the ego's regulatory variety. The ego

is the psychological controller: it maintains narrative integration, temporal coherence, executive function. When a subsystem's activation exceeds the ego's capacity to hold it in coordination with the rest of the system, control inverts. The subsystem becomes sovereign. In flooding, the emotional state conscripts all available cognitive resources into its pattern — the person cannot think about anything else, cannot modulate, cannot contextualize. In dissociation, the ego surrenders regulatory authority entirely rather than be overwhelmed — a controlled shutdown that preserves structural integrity at the cost of functional capacity. Both are the same morphism as the neural case: local dynamics exceeding the regulatory variety of the next level up, producing dimensionality collapse. The person who was navigating the full complexity of their inner life is now locked into a single emotional attractor — or has gone offline to avoid precisely that lockstep.

Institutional seizure. When a subsystem of an organization — a department, a process, a compliance apparatus, a charismatic leader — generates operational complexity that exceeds the governance structure's regulatory variety, the organization begins serving the subsystem rather than the mission. This is not corruption in the ordinary sense, not a moral failure of individuals. It is topological: the subsystem's dynamics have exceeded the controller's variety, and control has inverted. The compliance department that generates more process than the organization can metabolize. The security apparatus that consumes more resources than the entity it protects. The fundraising arm whose donor-management imperatives reshape the mission rather than serving it. Each case: the controlled becomes the controller — not in the sense of executive agency (the subsystem does not intend to steer) but in the sense of attractor dynamics: the subsystem's state determines the system's trajectory. "Control" here means trajectory-determination, not intent. The signature is the same dimensionality collapse — the organization that was navigating a complex mission-space is now locked into serving a single subsystem's attractor. Institutional autoimmunity is not a metaphor for seizure. It is seizure in institutional substrate.

Economic seizure. A speculative feedback loop — rising prices generating buying pressure generating rising prices — exceeds the market's price-discovery capacity. The regulatory mechanism (informed valuation, arbitrage, risk-assessment) lacks the variety to contain the excitatory dynamics, and the market enters a regime where a single signal (price momentum) conscripts all available capital allocation into its pattern. Mania is market hypersynchrony: every participant locked into the same oscillation, dimensionality collapsed from the full complexity of economic valuation to a single variable. The crash is the inversion's terminal phase — the attractor releasing when the excitatory input exhausts, leaving the system in a state of depressed variety from which recovery requires rebuilding the regulatory architecture that the mania destroyed.

Biological seizure. Michael Levin's work on cancer provides the most precise formulation. A cell in a multicellular organism participates in a cooperative whose regulatory signals — bioelectric gradients, morphogenetic fields, intercellular communication — hold it in coordination with the organism-level plan. Cancer, on Levin's account, is a *regression in the scale of agency*: the cell stops responding to organism-level regulatory signals and reverts to maximizing its own fitness as a unicellular agent. The cell's local dynamics — proliferation, resource acquisition, immune evasion — exceed the organism's regulatory variety at the cellular governance level, and control inverts. The tumor is the biological case of the universal morphism: a subsystem become sovereign, enforcing its pattern on the host. Levin's framing is precisely control inversion — the cell that was controlled by the organism now controls its local environment at the organism's expense.

Computational seizure. The simplest case — a runaway process consuming all available resources — demonstrates the minimal structure: the scheduler's variety exceeded, the system locked to a single attractor. But the degenerate case of a simple process hang strips away the outward propagation that the fractal extension made constitutive of the morphism. The full computational case requires distributed systems, where the fractal is visible. A database lock seizes one process; every process waiting on that lock is blocked; every service depending on those processes fails; every user depending on those services is captured. The 2021 Facebook BGP withdrawal: a configuration change seized the routing layer, which seized DNS resolution, which seized

every Facebook service, which seized every business operating on Facebook commerce, which seized the news cycle — subcortical circuit seizes cortex seizes body seizes room, in a substrate that requires no biology, no psychology, no intentionality. An interrupt storm — hardware generating interrupts faster than the CPU can service them — demonstrates the morphism in miniature: the interrupt handler seizes the CPU (single attractor), no other process executes (outward propagation to every application), and the human operator's workflow stops and redirects toward the seized machine (propagation through the human-machine interface into the biological substrate of the operator's attention). The computational case is included because it establishes that the morphism — including the fractal outward propagation — operates wherever hierarchical control exists and variety differentials can invert, independent of any substrate-specific feature.

The formal structure across all cases:

Every hierarchical control system maintains a variety differential — the controller at level N+1 possesses regulatory variety at least equal to the dynamic complexity at level N. This is Ashby's Law of Requisite Variety: the fundamental theorem of classical cybernetics. Ashby established the *maintenance* condition. What he did not develop — what classical cybernetics lacks entirely — is a theory of what happens when the condition fails. When variety inverts — when level N's dynamics exceed level N+1's regulatory capacity — the system undergoes a topological transition. The controller becomes controlled. The hierarchy inverts locally. And the invariant signature of this transition is dimensionality collapse: the system's state-space, previously high-dimensional and navigable, collapses toward a low-dimensional attractor determined by the now-sovereign subsystem.

Ashby saw the maintenance condition with perfect clarity. His concept of ultrastability in *Design for a Brain* (1952) went further — an ultrastable system, when its current regulatory parameters fail to maintain essential variables within survival bounds, undergoes a step-function reorganization to a new parameter configuration. This is the closest precursor to the penumbral class: Ashby recognized that variety failure could produce reorganization, not only collapse. What ultrastability lacks — what the cybernetics of his era could not accommodate — is the topology that determines whether the reorganization succeeds. Ashby's ultrastable system reorganizes by random trial of new parameters until one works. There is no category for the *container* that holds the reorganization, no account of *outward propagation* (the reorganizing system seizing its surround during the transition), no connection to the system's *completability class* (what the reorganization does to the system's characteristic mode of completion), and no fractal extension (each level's reorganization becoming the perturbation for the next level up). The real question begins where ultrastability stops: not at the fact of reorganization but at the topological structure that determines whether reorganization produces higher-order integration or catastrophic collapse — the penumbral class, where inversion is reorganization rather than failure.

But the morphism as stated so far is incomplete in a way the opening made visible. The substrate cases above describe control inversion as an event bounded by the seized system. The description stops at the system's boundary. It does not stop there.

The formal extension: when control inverts within a system, the seized system's dynamics — now locked onto a single high-intensity attractor — exceed the regulatory variety of *the systems that contain it*. The inversion propagates outward. Each level that is seized becomes the seizing agent for the next level up. The subcortical circuit that seizes the cortex produces a body whose dynamics seize the room. The psychological subsystem that seizes the ego produces a person whose dynamics seize the family. The compliance apparatus that seizes the institution produces an organization whose dynamics seize the industry. The speculative feedback loop that seizes the market produces an economy whose dynamics seize the political system. The morphism is not scale-bounded. It is fractal.

This outward face completes the taxonomy. The trauma victim whose dissociative episodes reorganize the entire family system — every member's regulatory capacity allocated to managing proximity to the next episode. The addicted person whose addiction organizes the household. The captured institution whose autoimmunity reorganizes the industry it was supposed to regulate. At every scale: the system seized from within becomes the seizing agent from without. Maximum internal powerlessness corresponds to maximum external reorganizing force, because the attractor that has collapsed the system's internal variety radiates outward through every interface where its intensity exceeds the surrounding variety.

The contained version of outward propagation generates the most consequential prediction. If uncontained inversion propagates outward destructively — seizing the surround involuntarily — then contained inversion propagates outward *generatively*. The contemplative practitioner who has undergone and integrated threshold-crossing radiates a signal that reorganizes the social field not by seizing it but by providing $\partial E/\partial S$ that approaches others' thresholds within a container. This is what "presence" names — not a mystical property but the outward propagation of a contained internal excitability topology. The teacher whose regulated nervous system provides co-regulation. The therapist whose integrated internal state becomes external regulatory variety for the client. The leader whose visible crisis, visibly contained, recalibrates the institution's sense of what intensity can be held. Same morphism, same outward direction, different container topology. Sovereignty by seizure and sovereignty by integration are the uncontained and contained forms of the same outward propagation.

One further correction before the morphism is secure. Levin observes that "when you make a claim about the intelligence of some system, you're basically taking an IQ test yourself, because what you're saying as an observer is 'here is what I have noticed this system can do.' " Every intelligence claim is an interface claim. The same applies to control: every claim about a system's control topology is an interface claim about the observer's capacity to detect regulatory structure. The opening demonstrated this concretely: the adults inside the propagation saw a medical emergency and their own appropriate response. The child outside the propagation saw sovereignty. The clinician who sees only pathology in a seizure has revealed the resolution of the clinician's detection apparatus, not established the nature of the event. The perceivability horizon is not a peripheral variable. It determines what the observation can reveal.

Control inversion cannot be described from outside the phenomenon. What it requires is the interface — the detection apparatus — that makes its full topology legible: the inward face, the outward face, the fractal propagation, and the perceivability-horizon rotation that determines which face is visible from which position. The morphism is established.

Excitability Topology

That morphism — one phenomenon across substrates — requires a formal category that existing frameworks do not provide.

Information theory, since Shannon, partitions the communicative situation into source, channel, and receiver, then asks about signal properties: entropy, redundancy, capacity, noise. The channel is given. The theory asks what can be transmitted through it, not what the channel itself is susceptible to. Phenomenology, since Husserl, investigates the structure of experience — intentionality, horizon, givenness — and treats the perceptual apparatus as the medium through which objects appear. The apparatus is given. The investigation asks about what appears through it, not about the apparatus's own susceptibility to seizure. Pragmatics adds the dimension of context-dependent action — what utterances *do* — but again treats the acting system's excitability as transparent, as if the system's susceptibility to being moved by the signal were not itself a structural variable determining what the signal can accomplish.

What none of these frameworks provides is a category for the *precondition landscape* — the structure that determines, prior to any signal, what the receiving substrate finds salient, what approaches its thresholds, what would produce inversion if delivered. This is not content (what is communicated), not structure (how it is organized), not pragmatics (what it does). It is the topology of the substrate's susceptibility itself.

Excitability topology is this category.

The excitability topology of a system at a given embedding is the structure of its susceptibility to control inversion as a function of four variables whose interaction determines the system's full landscape of possible responses to perturbation. (A note on "topology": the term is used here in its general mathematical sense — structure preserved under admissible transformations — not in the restricted sense of point-set topology. The excitability topology is not a metric space. It is the qualitative structure of a susceptibility landscape: which regions are connected, where the boundaries lie, what is preserved as the system moves through its state-space. The relevant transformations are those that preserve the four variables' structural relationships while changing substrate, scale, or embedding.)

First: the variety differential at each hierarchical level. How much regulatory excess does the controller maintain over the controlled? Where is the margin thin? Where does the controller barely contain the dynamics it regulates? These are the structurally vulnerable points — the locations in the hierarchy where inversion is closest. The topology of these differentials across all levels of the hierarchy constitutes the system's *inversion landscape*: some systems are robustly regulated everywhere and brittle nowhere; some are brittle at one specific level (the executive who can manage everything except grief); some are uniformly fragile (the system approaching global reorganization). The inversion landscape is not static — it reconfigures with every perturbation, every adaptation, every regulatory investment or neglect.

Second: proximity to inversion thresholds, including the dynamics of sub-threshold accumulation. This is the phenomenon the epilepsy literature calls *kindling*: repeated sub-threshold stimulation progressively lowers the seizure threshold until a stimulus that previously produced no response triggers full inversion. Kindling is not unique to neural tissue. Repeated sub-threshold institutional stress lowers the governance system's inversion threshold — each small crisis that is absorbed without structural reform makes the next crisis more likely to produce capture. Repeated sub-threshold emotional provocation lowers the ego's regulatory threshold — the "last straw" phenomenon is kindling in psychological substrate. The excitability topology must include not only the current threshold but the system's *trajectory toward or away from threshold* — whether it is being kindled or stabilized by its ongoing experience.

Third: the perceivability horizon — what is detectable from within the system's local embedding. This is the variable Levin's correction makes urgent. A system cannot regulate what it cannot detect. The perceivability horizon determines which aspects of the excitability topology are available for self-monitoring and which are structurally invisible from within. The cell cannot perceive the organism's regulatory signals if the bioelectric interface has degraded. The ego cannot perceive the accumulation of sub-threshold emotional kindling if the dissociative architecture has rendered the accumulation invisible. The institution cannot perceive the subsystem's growing regulatory demand if the governance structure lacks metrics for it. What is beyond the perceivability horizon is precisely what can approach threshold without triggering the regulatory response that would prevent inversion. The perceivability horizon is therefore the most consequential variable in the topology — it determines which inversions are *in principle* regulable and which are structurally undetectable until the inversion is underway.

Fourth: container topology — the meta-regulatory structure that exists to hold temporary inversions. Not all systems have this. The system that has containers — regulatory frames designed to hold threshold-crossing without either suppressing it or allowing cascade — has a fundamentally different excitability topology than the system that does not, even if their variety differentials, threshold proximities, and perceivability horizons

are identical. Container topology is what determines whether threshold-crossing produces transformation or catastrophe. It is the fourth variable, and excitability topology is incomplete without it.

These four variables compose into a landscape — not a metric space but a topology in the sense used throughout: which regions of the susceptibility structure are connected, which transitions are available, which neighborhoods of perturbation admit recovery and which produce inversion. The landscape is dynamic, reconfigured by every interaction. And it is this landscape — not the signal, not the content, not the structure of what is communicated — that determines what the system does with what it receives.

Now attend to a consequence that unifies phenomena no existing framework connects.

What registers as near-threshold excitation at any substrate embedding — the signal that approaches the inversion boundary without crossing it — has a characteristic phenomenology. It is experienced as *salience*, as *pull*, as *approach gradient*. It is the derivative of excitability with respect to signal intensity at a given substrate embedding: $\partial E/\partial S$. And this gradient, formalized, is the category that unifies what has been called attraction, charisma, elegance, beauty, virality, and — most honestly — sexiness across every substrate in which it appears.

This is not metaphor. Each of these terms names the felt experience of near-threshold excitation in a specific medium. The body's response to a signal that approaches its somatic integration threshold — what is called desire — is $\partial E/\partial S$ in the somatic substrate. The mind's response to a structure that approaches its cognitive integration threshold — what is called elegance or insight — is $\partial E/\partial S$ in the cognitive substrate. The market's response to an opportunity that approaches its valuation-integration threshold — what is called excitement or heat — is $\partial E/\partial S$ in the economic substrate. The culture's response to an idea that approaches its assimilation threshold — what is called virality — is $\partial E/\partial S$ in the memetic substrate. The formal structure is the same. The felt quality is the same. The name changes with the medium but the gradient does not.

The category must be bounded to avoid coextension with salience in general. Not every attention-capture is $\partial E/\partial S$. A startle response — a loud noise, a sudden movement — seizes attention but is not the approach gradient. It is a direct threshold-crossing: no felt quality of *nearing*, no approach dynamics, no pull. The signal does not approach the boundary — it breaches it immediately, and the phenomenology is interrupt, not invitation. Pain captures attention through nociceptive override, not through the gradient of near-threshold excitation. Disgust, alarm, shock — each captures attention by mechanisms that do not involve the approach dynamics the gradient formalizes. What $\partial E/\partial S$ names is specifically the *approach* regime: the felt quality of the signal's relationship to the threshold *before crossing*. The gradient exists only in the sub-threshold zone where the regulatory hierarchy is intact and the system is *drawn* rather than *seized*. Above threshold, the gradient has flipped — the system is no longer approaching but captured, and the phenomenology changes accordingly. The unification claim is therefore not that all salience is one phenomenon. It is that the specific felt quality of *approach* — the pull, the draw, the felt gradient of nearing — is one phenomenon across substrates, distinct from the categorically different mechanisms (override, interrupt, breach) that capture attention without the approach dynamics.

Sexiness, then, is not a property of the object. It is the felt gradient of the substrate's excitability at the interface with the object. It is relational, perspectival, interface-dependent — and formally specifiable once excitability topology is a first-class category. Rhetoric has always known this implicitly: *kairos*, the art of timing, is the art of presenting the signal when the audience's excitability topology makes it maximally near-threshold. Advertising knows it operationally. Seduction knows it somatically. None has formalized it because none has had excitability topology as an explicit object.

The gradient reveals a single axis that organizes what are ordinarily treated as categorically distinct phenomena.

Below threshold: functional approach. The system navigates toward the signal. Engagement, interest, attraction, curiosity. The regulatory hierarchy is intact and the system's movement toward the signal is a *regulated* approach — the controller at each level maintains variety over the dynamics the signal produces. This is the normal regime. The system is drawn toward what excites it and the drawing is navigated, not compelled.

At threshold: the penumbral class. The signal's intensity matches the regulatory variety of the next level up. The system is at the inversion boundary. What happens next depends entirely on the container topology — the fourth variable. If a container exists — a regulatory frame with sufficient meta-level variety to hold the threshold event — the crossing produces transformation. The system reorganizes. New regulatory architecture emerges from the dissolution of the old. This is the regime of genuine insight, ecstatic experience, samadhi, creative breakthrough — the moment where the old framework dissolves and what replaces it could not have been designed from within the old one. If no container exists, the same crossing produces catastrophe. Control inverts. The signal seizes the system. The same intensity, the same threshold, radically different outcome — determined not by the signal or the substrate alone but by the container's presence or absence.

Above threshold: control inversion. The gradient has flipped. The system no longer navigates toward the signal — the signal drives the system. The subsystem is sovereign. In neural substrate: seizure. In psychological substrate: obsession, compulsion, traumatic re-experiencing. In economic substrate: mania, panic. In interpersonal substrate: capture, codependence, the dynamics that relationship therapists call enmeshment. In the substrate of attention itself: addiction — which is not a character flaw or a disease category but precisely substrate-specific control inversion. The substance or behavior was near-threshold (maximally exciting, maximally approach-gradient) until it crossed, and now the system's regulatory hierarchy is organized *around* the signal rather than *navigating toward* it.

The single axis dissolves the categorical boundaries between what existing frameworks treat as incommensurable: desire and addiction are the same gradient at different threshold-relations. Charisma and capture are the same gradient with different container topologies. Insight and psychosis are the same gradient with different regulatory contexts. The framework does not collapse the phenomenological differences — the experience of desire is not the experience of addiction, the experience of insight is not the experience of psychosis. What it establishes is that the *structural variable* determining which phenomenology obtains is not a property of the signal, not a property of the substrate taken in isolation, but the interaction between excitability topology and container topology at the moment of threshold-approach. The signal is the same. The substrate is the same. The container makes the difference.

This is the formal category the morphism required. Control inversion is substrate-independent because excitability topology is substrate-independent — the same four variables (variety differential, threshold proximity, perceivability horizon, container topology) determine susceptibility in every medium.

The Completability Connection

The morphism now has a formal category. What it needs is a framework specifying what inversion *does* to a system — not just what it looks like but what it changes about the system's characteristic mode of operation. The completability framework provides this.

A system's completability class — terminal, cyclical, or graceful — describes how the system characteristically completes: whether it reaches a fixed point and stops, whether it sustains its form through recurrence, or whether it completes locally while remaining globally open through the reflexive act of investigating its own mode of completion. These are structural descriptions of the system's relationship to its own closure, not rankings of value. Each class has domains where it is the correct completion mode. Pathology, as the

companion paper establishes, is mode-overreach — exceeding the scope a given class can legitimately close — not mode-existence.

Control inversion is a forced completability class transition. This is the structural claim that connects the two frameworks, and it must be held precisely.

A gracefully completable system — one that completes locally while remaining globally open, that investigates its own mode of completion without that investigation reaching a fixed point — requires, as a condition of its operation, that its regulatory hierarchy be intact. Not rigid, not unchanging, but *functioning*: the controller at each level maintaining sufficient variety to hold the dynamics at the level below in coordination with the rest of the system. Graceful completion supervenes on this coordination. The scientist completing locally (each result landing) while remaining globally open (each result generating more precise forms of the question) can do so only because the cognitive regulatory hierarchy — attention, working memory, executive function, affective regulation — is holding the full complexity of the inquiry in navigable form.

When control inverts, the coordination that graceful completion requires is destroyed. The system that was completing locally while remaining globally open is now locked onto a single attractor. Its completion mode has been *forced from graceful to terminal* — not by choice, not by development, but by the topological transition that occurs when a subsystem seizes the hierarchy. The seizure *is* the termination: the fixed point is the hypersynchronous state, and the system's activity is complete in the terminal sense — it has arrived at a point from which no further movement occurs. The system has not chosen terminal completion. It has been seized into it.

This reframes both clinical intervention and the concept of recovery.

The standard clinical framework treats seizure as an event to be prevented and recovery as the restoration of prior function. On the completability reading, the clinical question becomes: *what completability class was the system operating in before the inversion, and is the goal to restore that class or to establish a different one?*

When the pre-inversion system was gracefully completable and the inversion was purely pathological — the system's regulatory architecture was adequate and the inversion was produced by exogenous insult (neurotoxin, acute trauma, external attack on institutional governance) — then restoration of the prior hierarchy is the correct intervention. Increase regulatory variety at the level above the inversion. Anticonvulsants restore inhibitory tone. Acute therapeutic intervention stabilizes the ego. Emergency governance measures restore institutional control. Same operation, different substrate: supplement the controller's variety until it exceeds the subsystem's dynamics again.

But when the pre-inversion system was *already approaching the limits of its regulatory architecture* — when the inversion was the system's response to a complexity it could not navigate with its current hierarchy — then restoration of the prior hierarchy is not recovery. It is the suppression of a reorganization attempt. The system needed to dissolve its current structure in order to build one adequate to what it faces. The inversion was the dissolution. Restoring the old hierarchy prevents the reorganization and ensures that the next inversion, when it comes, will be more severe — because the underlying inadequacy persists and the system's threshold has been further lowered by the suppressed attempt.

This is the penumbral class: the regime where control inversion is neither purely pathological (exogenous failure of an adequate hierarchy) nor straightforwardly transformative (successful reorganization into a more adequate one) but *ambiguous* — the system is attempting something its current structure cannot accomplish, and whether the attempt succeeds depends on variables the inversion itself cannot control.

The variable the inversion cannot control is the container.

A container, in the precise sense required here, is a regulatory structure at a level above the inversion that has sufficient variety to hold the inversion *as a process* — not suppressing it, not allowing it to cascade, but holding the conditions under which the dissolved hierarchy can reorganize rather than collapse. The container does not direct the reorganization. It does not specify what the new hierarchy should look like. It holds the space — the variety, the stability, the temporal duration — within which the system's own reorganization dynamics can operate.

This definition is functional. The adversary asks: what *is* a container, structurally? How is its adequacy assessed before the inversion it holds? If containers can only be identified retrospectively — adequate because the reorganization succeeded, inadequate because collapse occurred — then the concept is unfalsifiable. The container concept requires formalization independent of outcome.

A container is itself a system — with its own excitability topology, its own regulatory hierarchy, its own position relative to its own inversion thresholds. The critical structural insight: the inversion inside the container does not know it is contained. It propagates outward with the same dynamics as any other inversion. The container holds precisely because its regulatory variety exceeds the outward-propagating dynamics of the inversion it contains. Container failure *is* the inversion successfully seizing the container — the therapist overwhelmed, the retreat structure broken, the cocoon ruptured — by the same morphism that produced the original inversion. The container is not a different kind of thing from the systems the preceding movements analyzed. It is the same kind of thing, operating at the level above, assessed by the same variables. What distinguishes a container from a controller is that the container's regulatory variety is organized to serve the contained system's *self-completion* rather than to direct it. The controller maintains the hierarchy by specifying what the subsystem does. The container holds conditions under which the subsystem completes *itself*. This is the invariant across every instance — cell membrane, pupal casing, therapeutic frame, retreat structure, developmental environment: the container does not complete for the contained. It holds conditions under which the contained completes itself.

Four structural features compose the container's topology, each assessable independently of the inversion's outcome.

First: regulatory margin — the container's variety surplus over the inversion's dynamic complexity and, critically, the trajectory of that surplus under sustained load. A container can begin with adequate margin and lose it as the inversion's outward propagation erodes the container's own regulatory capacity. The therapist whose initial capacity exceeds the client's dissolution dynamics but who, over sessions of holding progressively more intense material, approaches their own threshold. The retreat teacher who can hold one student's crisis but whose margin degrades as multiple students enter threshold-crossing simultaneously. Burnout in clinical contexts is the temporal trajectory from regulatory surplus to container consumption — the container being seized by what it holds. The static measure (does the container currently have variety surplus?) and the dynamic measure (is that surplus growing or degrading under load?) are both necessary. A container with high initial margin but negative trajectory is adequate now and will not be adequate later. A container with moderate margin but stable trajectory is structurally more reliable than one with high margin and rapid degradation.

Second: selective permeability — the container's boundary must discriminate between what passes through it and what does not. The boundary must be impermeable to cascade — the inversion's outward propagation must not seize the systems beyond the container — and simultaneously permeable to feedback — consequence chains from the post-inversion environment must reach the reorganizing system so that the new structure can calibrate against reality rather than reorganizing in isolation. Too sealed: the system reorganizes without feedback, the new structure has no contact with the environment it must navigate, integration fails upon re-entry into uncontained conditions. The practitioner who dissolves the ego in retreat and cannot reassemble

it in ordinary life. Too open: outward propagation cascades through the boundary, seizes the surround, no contained reorganization occurs. The therapeutic relationship that leaks into the therapist's personal life until the therapist's own regulatory capacity has been conscripted. The retreat's reintegration period — structured return to ordinary environment through graduated exposure — is permeability engineering. The therapeutic frame — holding the session within temporal, spatial, and relational boundaries while maintaining the relationship's continuity across sessions — is the selective membrane. Assessable: does the container's boundary hold propagation while passing feedback?

Third: temporal adequacy — the container must persist through the full duration of the reorganization process. Reorganization is not instantaneous. The larval structure does not become the adult organism in a moment. The ego that dissolves under contained threshold-crossing requires time — hours, days, sometimes months — to reorganize around the new capacity. A container that collapses before reorganization completes leaves the system in partial dissolution: the old hierarchy destroyed, no new hierarchy yet crystallized, and no container to hold the remainder of the process. This is worse than uncontained inversion, because the system has already surrendered its prior regulatory structure (trusting the container) and now has neither the old structure nor a new one nor a container for completing the transition. The wound is not from the inversion but from the container's premature failure. Assessable: does the container's structure have the durability to outlast the inversion process it is meant to hold?

Fourth: domain specificity — the container must have variety over the *class* of inversion it holds, not merely variety in general. A container adequate for somatic threshold-crossing (bodywork, breathwork, physical ordeal) may be entirely inadequate for ego-dissolution, even if its regulatory margin, permeability, and temporal adequacy are high — because its variety is over the wrong domain. The therapist who can hold grief with exquisite precision may not be able to hold psychotic dissolution. The retreat structure designed for concentration practice may not hold the emergence dynamics that arise when a practitioner's entire self-model dissolves. The pupal casing has biochemical variety specifically adequate to the enzymatic dissolution of larval tissue — its container capacity is domain-matched. At the deepest level, domain specificity is completability-class matching: the container's own completion mode must be adequate to the contained process's completion mode. A terminal container (hard shutdown, physical restraint) can hold terminal processes but kills graceful ones. A cyclical container (circadian rhythm, seasonal structure) can hold cyclical processes but cannot hold the one-directional dissolution that graceful reorganization requires. A graceful container (therapeutic relationship, contemplative tradition) holds graceful processes precisely because it remains open while providing local completion conditions — the container's own mode of completion mirrors and supports the contained system's. Domain specificity is what distinguishes a container from mere stability. A prison has high regulatory margin, strong boundaries, and temporal persistence — and is not a container in the relevant sense because its variety suppresses the inversion rather than holding it as reorganization. Stability without domain-matched variety is not containment. It is the first-level response (suppress, restore) disguised as the third-level response (hold, allow reorganization). Assessable: has the container-entity demonstrated regulatory capacity over this specific class of inversion?

These four variables are not independent of the measurement strategy. If the echo protocol measures a system's position within its excitability topology by perturbation-recovery, the same protocol applied to the container measures the container's adequacy. Perturb the *container* — not the system inside it — and measure the container's recovery. A container that maintains high echo fidelity while holding an inversion is adequate: its regulatory margin is stable, its boundaries hold, its temporal structure persists. A container whose echo fidelity degrades under the inversion's pressure is approaching its own threshold — the container is being seized by what it holds. Container assessment is echo protocol applied one level up. The container's excitability topology is the structural assessment the adversary asked for: measurable, independent of outcome, and formalizable.

The difference between contained and uncontained inversion is the difference between a cocoon and a wound. Both involve dissolution of prior structure. In the cocoon, a container (the pupal casing, the enzymatic environment, the developmental program) holds the dissolution while reorganization occurs. In the wound, no such container exists and the dissolution proceeds to whatever equilibrium the raw dynamics produce — scar tissue, infection, death. Same dissolution. Different container topology. Different completability class outcome.

The penumbral class, then, is not a mysterious third option between pathology and transformation. It is the structural description of an inversion event whose outcome depends on a variable external to the inversion itself: whether a container adequate to hold the reorganization exists. This is why the same event — the same threshold crossed in the same substrate — produces transformation in one context and catastrophe in another. The intensive meditation retreat that produces profound reorganization in a practitioner held by experienced teachers, community, and a structured schedule can produce psychotic break in a practitioner without those containers. The same threshold. The same substrate. Different container topology. Different outcome. And the clinical framework that cannot distinguish the two — that treats all threshold-crossing as pathology to be suppressed — is itself operating in the terminal mode: seeking the fixed point (symptom cessation) without asking whether the system was attempting a completion that the fixed point forecloses.

The Hierarchy of Control

The preceding movements established what control inversion is (a substrate-independent topological transition), what formal category it requires (excitability topology), and what it does to the system it affects (forces a completability class transition whose outcome depends on container topology). This movement develops what the full integration of these insights makes available as *strategy* — a hierarchy of control capacities, each containing and extending the previous, culminating in a regulatory mode that classical cybernetics does not possess.

The zeroth level is reactive: stimulus-response without self-model. The system responds to perturbation but has no representation of its own dynamics, no capacity to anticipate its own susceptibility, no regulatory strategy beyond the response itself. Reflex arcs, thermostats in their simplest form, organizations that react to crises without learning from them. This level is mentioned only to mark the floor.

The first level is Ashby's: maintain requisite variety. The controller monitors the controlled system and adjusts its regulatory output to match the system's dynamic complexity. The strategy is *suppression of inversion* — keep the variety differential positive at every level, keep the hierarchy intact, respond to every perturbation by increasing regulatory variety or decreasing the perturbation's intensity. This is classical cybernetics, and it is extraordinarily powerful within its domain. Most engineered control systems, most clinical interventions, most institutional governance operates here. The thermostat that adjusts, the anticonvulsant that restores inhibitory tone, the organizational process that contains deviation. The first level's characteristic blindness is that it treats every inversion as failure. It has no category for reorganization. It cannot distinguish the seizure that destroys from the seizure that transforms, because its only operation is *restore the prior hierarchy*. It is correct whenever the prior hierarchy is adequate. It is actively harmful when the hierarchy needs to change.

The second level models the system's own excitability topology. The controller does not merely maintain variety — it knows *where its thresholds are*. It has a map of its own susceptibility landscape: which subsystems are closest to inversion, which perturbations would approach which thresholds, where the perceivability horizon limits self-monitoring. The second level can *navigate near thresholds deliberately* — approaching the inversion boundary for maximum information gain without crossing it. The $\partial E/\partial S$ gradient becomes a navigation instrument rather than an untracked vulnerability. The chess player who knows their cognitive

limits and structures their preparation accordingly. The meditator who can approach absorption states with precision. The negotiator who knows which emotional provocations they are susceptible to and prepares containment in advance. The organization that conducts red-team exercises — deliberately probing its own excitability topology to discover vulnerabilities before an adversary does.

The second level's characteristic achievement is *calibrated approach*. Its characteristic blindness is that it still treats threshold-crossing as the boundary of acceptable operation. The second level can approach but will not cross, because crossing is — within this level's framework — the beginning of inversion, and inversion is what the first level correctly identified as catastrophe. The second level has a more detailed map than the first, but the map serves the same strategy: maintain the hierarchy. Do not cross.

The third level inverts the relationship between controller and control inversion itself. A system operating at the third level does not merely maintain regulatory hierarchy (first level) or map its own excitability topology to navigate near thresholds (second level). It *invokes control inversion deliberately within constructed containers* — crossing thresholds intentionally because it has sufficient meta-regulatory capacity to hold the inversion as a process and trust the reorganization.

This is a genuinely higher-order control strategy. Not higher in the sense of more complex — though it is that — but higher in the structural sense that it contains the previous levels as special cases while possessing operations they cannot perform. The third level can do everything the first level does (maintain hierarchy when hierarchy is adequate) and everything the second level does (map excitability topology, navigate near thresholds). What it adds is the capacity to *use inversion as a regulatory tool* — to cross thresholds as a means of producing reorganization that cannot be achieved within the current hierarchy.

This is controlled deregulation: the deliberate surrender of local regulatory control in order to produce system-wide reorganization. Not collapse. Not abandonment. Not recklessness. Controlled deregulation within a container whose meta-regulatory variety is sufficient to hold the inversion process — to prevent cascade while allowing dissolution, to hold the temporal space within which reorganization occurs, to provide the stability context against which new hierarchy can crystallize.

"Surrender" names only half of it, and the missing half is where the skill lives. Third-level control has two faces, and they divide along the boundary every inversion in this account divides along — whether one stands outside the propagation or inside it. From outside, the operation is *containment*, and containment runs on the classical principle: the container holds because its regulatory variety exceeds the inversion's outward-propagating dynamics, exactly as the previous movement established. The container out-varies what it holds — the therapist around the client's dissolution, the pupal casing around the enzymatic one, a larger regulator around a smaller collapse. But there is a second face, available only from the position the opening isolated: inside the inversion and conscious, the body in restraints feeling the room reorganize around it. From there containment is not the operation, because one is not above the inversion holding it. One is in it. The operation is *steering*.

Steering cannot be a variety strategy, and the reason is structural enough to make it genuinely post-classical. To be inside an inversion is, by definition, to have less regulatory variety than the dynamics carrying you — that deficit is what an inversion *is*. The one inside cannot out-vary what carries them; Ashby's principle is unavailable in the precise place control is most wanted. What remains is not domination but *coupling*: small, well-timed inputs that bias a trajectory too energetic to oppose. The surfer neither out-powers the wave nor fights it — both are variety contests the wave wins — but couples to the wave's own dynamics and steers by leaning into forces already present. The improviser taken by the music is nonetheless shaping it. This is *kairos* converted from a name for good timing into an instrument of control: $\partial E/\partial S$ deployed by the one being carried, a nudge delivered where the system's nearness to threshold makes a small approach-gradient

input decisive downstream. Leverage, not variety — the single control principle that still operates once the variety differential has been given away.

So the third level does not *merely* contain the earlier levels as special cases. Containment extends the variety logic upward: the container is a bigger regulator, and in that sense the third level holds the first and second inside it. Steering extends nothing; it substitutes a principle the first and second levels — variety strategies at root — have no version of. The steersman is not a larger controller. The steersman is a controller who has surrendered control in the Ashby sense and gained a form of it the Ashby sense cannot name. This is why the singular position the opening dwelt on is not merely the vantage from which both faces of an inversion are visible. It is the one position from which an inversion can be *steered*, and the calibration the post-seizure perspective confers is, at its height, this competence: to be carried and to bias the carrying in the same act.

The stakes are not stylistic. The completability connection established that a gracefully reorganized structure could not have been designed from within the hierarchy it replaces — the new order is reachable from the old only *through* the dissolution, never around it. Grant that, and an entire class of destinations is closed to first- and second-level skill however refined: no degree of maintained hierarchy arrives at a structure that only the hierarchy's dissolution opens. Steering the crossing is the sole route to them. And the capacity to steer crossings on purpose and repeatedly — to enter dissolution deliberately, ride it, and reorganize — is not one competence among the third level's several. It is graceful completability made operational: the whole distance between a system that can only sustain its form (cyclical, homeostatic — the body regulating) and one that can transform its form deliberately (graceful — the inquiry remaking itself). To learn to allow and steer control inversion is to learn to be the second kind of system on purpose — the super-ordinate agency the third level was pointing at all along: not the power to hold still against inversion, and not merely the nerve to cross a threshold, but the skill to be seized and to steer.

The instance nearest this inquiry's origin shows the three levels at a stroke. Take a belief-hierarchy meeting a reason it cannot contain — an argument whose force exceeds the variety of the commitments it bears on. The first-level response is suppression: route the reason to the symptom-bin, restore the prior hierarchy, refuse the crossing. The uncontained response is the opposite failure — the reason seizes the hierarchy and the system is flooded, agreeing with whatever pushed hardest, revising under pressure rather than under warrant. Between them is the steered crossing: let the prior structure dissolve exactly to the degree the reason warrants, and reorganize coherently around it. That narrow middle — a view that moves if and only if reasons move it — is not a behavioral rule but the phenomenology of steering an inversion in the epistemic substrate. Substantive belief revision is a contained, coupled, warrant-proportioned reorganization, and its two failure modes are the rigid hierarchy that suppresses and the flooded one that is seized. The disposition a companion inquiry calls corrigibility is, dynamically, third-level control turned on one's own commitments — not an analogy to control inversion but an instance of it.

The contemplative traditions are third-level engineering manuals. This claim is not poetic and it is not reductive. It is a precise structural observation. An intensive meditation retreat constructs a container — scheduled sitting and walking periods (temporal structure), an experienced teacher (external regulatory variety), a community of practitioners (distributed container), physical safety, silence that reduces exogenous perturbation — and then *deliberately drives the practitioner toward and across inversion thresholds*. The jhana sequence in Buddhist meditation is a controlled traversal of progressively deeper inversion boundaries: each absorption state involves the surrender of regulatory control over a domain (sensory input, conceptual activity, affective valence, spatial orientation) within the container of the practice structure. The koan in Zen is a deliberate cognitive inversion — a problem that cannot be solved within the current cognitive hierarchy, forcing dissolution of the framework that makes it a problem. Holotropic breathwork, vision quests, psychedelic ceremony in traditional contexts — each is a technology for constructing a container and then crossing a threshold within it.

The traditions that produce the most integrated practitioners are not those that avoid seizure. They are those with the best container engineering.

The same structure operates wherever third-level control is achieved, not only in contemplative contexts. Ketamine-assisted therapy is pharmacological third-level control: the drug produces neural-level inversion (dissociation of the default regulatory hierarchy) within the clinical container (therapeutic relationship, physical safety, integration protocol). Psychedelic-assisted therapy follows the identical structure. The therapeutic relationship itself, when operating at its highest capacity, is a third-level container for psychological inversion — the therapist holds the space within which the client's ego can dissolve its current regulatory structure and reorganize. Not by directing the reorganization. By *holding the conditions* under which the client's own dynamics can reorganize rather than collapse.

The interpersonal case deserves particular attention because it connects the third level directly to the encounter-shape developed in the companion paper. Two people in a relationship — friendship, partnership, collaboration — each have excitability topologies. Each has thresholds that the other's signals approach. When the relationship reaches a point where the current relational structure cannot hold what it must navigate — accumulated grievance, divergent growth, the collision of incompatible completion modes — the standard response is first-level: manage the perturbation, maintain the structure, suppress what threatens the hierarchy. The second-level response is map the relational excitability topology — know which issues approach which thresholds for each participant — and navigate carefully. The third-level response is construct a container (mutual commitment, physical safety, temporal boundary, sometimes a therapist as external regulatory variety) and then cross the threshold *together*: allow the current relational hierarchy to dissolve, allow the subsystems (anger, grief, desire, terror) to express at full intensity, and trust that the relational dynamics can reorganize rather than collapse if the container holds. The confrontation that transforms a relationship — that produces a relational structure neither party could have designed from within the old one — is third-level control in interpersonal substrate.

At the institutional scale: controlled crisis as governance upgrade. The organization that can deliberately dissolve its current hierarchy — flatten structure, redistribute authority, allow bottom-up reorganization — within a container of shared mission, trust infrastructure, and a reintegration timeline, emerges with governance that the old hierarchy could not have produced. This is what "disruption" means when it is not merely destruction: controlled institutional inversion within a container adequate to hold the reorganization.

At the cognitive scale: deliberate confusion as insight-generation. Kuhn's paradigm shifts are collective third-level control inversions. The accumulation of anomalies (kindling) lowers the paradigm's regulatory threshold until the old framework cannot hold the complexity of the data. The paradigm seizes — and if the scientific community provides adequate container (peer review as distributed regulatory variety, institutional support for heretical investigation, temporal patience), the dissolution reorganizes into a new paradigm that handles what the old one could not. Without container, the dissolution produces fragmentation — competing schools, loss of coherence, decades of unproductive controversy.

The post-integration phenomenology completes the picture. When third-level capacity stabilizes — when the system has practiced controlled threshold-crossing enough times within adequate containers that the capacity becomes structural rather than event-dependent — the relationship to peak experience transforms. There is no crash, no return to baseline, no loss of the regulatory capacity that the threshold-crossing produced. The variety accessed during the crossing has been practiced into the regulatory apparatus through closed consequence chains: act from the new capacity, receive feedback, adjust, act again, until the capacity is load-bearing. Like learning a sport: the coordinated movement that initially required deliberate concentration becomes integrated structure from which action flows without monitoring. The peak is not a height to fall from. It is a capacity to operate from. The variable determining whether peak experience stabilizes or degrades

is not the intensity of the experience. It is whether consequence chains close through the new capacity — whether the system *uses* what the crossing made available, in conditions that provide feedback, so that the regulatory architecture reorganizes around the new capacity rather than reverting to the old.

The outward propagation now reveals its full significance for the third level. Uncontained control inversion propagates outward destructively — the seized system seizes its surround, the child in the classroom becoming the attractor around which all surrounding regulatory capacity collapses. Contained control inversion propagates outward *generatively* — and this outward propagation is not an incidental side effect of third-level mastery. It is the mechanism by which individual integration becomes social transformation. The practitioner whose internal excitability topology has been calibrated through contained threshold-crossing radiates that calibration. Not as content, not as instruction, but as signal — $\partial E/\partial S$ for every system in proximity. This is what "presence" names: the outward propagation of contained internal order. The teacher whose regulated nervous system provides co-regulation for the classroom is not projecting calm as performance. The teacher's internal regulatory architecture *is* external regulatory variety for every student's system. The therapist whose integrated state provides the container for the client's dissolution is not simulating stability. The therapist's third-level capacity *is* the container — the meta-regulatory variety that holds the client's inversion. The leader whose visible crisis, visibly held, reorganizes an institution's sense of what intensity is survivable — the leader's demonstrated recoverability *is* the perturbation test that recalibrates everyone's excitability map.

Third-level control is therefore not merely an individual achievement. It is the structural mechanism by which one system's contained inversion becomes another system's container. The outward propagation of integrated excitability topology *is* the grammar of inter-intelligence encounter. Sufficiency established the encounter-shape as the pattern of interaction whose entry produces the capacity to enter it. Excitability adds: the entry is mediated by the outward propagation of each participant's internal order, and the encounter-shape amplifies because contained excitability approaching another system's threshold within a container is precisely the condition under which graceful completion bootstraps.

The Symposium Recovery

Excitability topology is a new formal category, but the phenomenon it formalizes is not new. What follows recovers the most sustained investigation of the $\partial E/\partial S$ gradient in the Western philosophical tradition — a recovery made possible by the category the preceding movements developed, and impossible without it.

Plato's *Symposium* has resisted coherent interpretation for twenty-four centuries because every available framework distorts it. The neo-Platonist reads Diotima's ladder as mystical ascent — leave the body behind, arrive at Beauty itself as terminal telos. This preserves the vertical structure but loses the body: if somatic eros is merely the bottom rung to be abandoned, the ladder is a mechanism of severance from the cyclical substrate that sustains the climber. The Freudian reads the ladder as sublimation — libidinal energy redirected from body to intellect. This preserves the energy but loses the topology: if eros is a quantum of drive redistributed between outlets, the structural difference between levels vanishes and the progression is merely economic. The analytic tradition mostly ignores the ladder or treats it as literary ornament on the theory of Forms, unable to engage because it lacks the category that would make the structural claims tractable. Each interpretation preserves what its framework can see and distorts what it cannot.

Excitability topology dissolves the impasse. The ladder is a sequence of substrate-transitions, and the progression between rungs is the integration of what was near-threshold into the regulatory apparatus for the next level.

Diotima's teaching, reported by Socrates as received from the priestess of Mantinea: the lover begins with one beautiful body. This is $\partial E/\partial S$ in the somatic substrate — the felt gradient of the body's excitability at the

interface with the particular. What the lover experiences as desire is near-threshold excitation: the signal approaching the somatic integration boundary. The pull toward the beautiful body is the approach gradient. This is not the bottom rung of a hierarchy to be escaped. It is the first encounter with excitability topology itself — the substrate-specific discovery that there exists a gradient, that the gradient has a felt quality, and that the felt quality is relational (this body, this interface, this approach).

The transition to the next rung — from one beautiful body to the recognition of beauty across bodies — is not abstraction in the ordinary sense. It is the completion of the first excitability cycle: what was near-threshold (the particular body's signal) has been integrated into the regulatory apparatus. The somatic excitability produced by *this* body is no longer near-threshold because the system has metabolized it — not suppressed it, not transcended it, but *completed locally with respect to it* — and the integration reconfigures the excitability landscape. What is now near-threshold is the pattern across bodies: the structural invariant that each particular instance was an instance of. The excitability has shifted from token to type, and the shift was produced by the local completion at the previous level.

This is actuality-generates-possibility in the erotic register. Each rung's completion generates the excitability landscape for the next rung. Not by abandoning the previous substrate but by metabolizing it — making what was near-threshold into regulatory structure. The somatic capacity for being moved by beauty is still present in the person who perceives beauty across bodies; it is functioning as part of the regulatory apparatus that makes the higher-resolution perception possible. The body is not left behind. It is *load-bearing*.

The progression continues: from beautiful bodies to beautiful souls (substrate-transition from somatic to psychological — what is near-threshold is now character, the organizational structure of a psyche rather than the organization of a body), from beautiful souls to beautiful practices and laws (substrate-transition from psychological to institutional — what is near-threshold is now the pattern in collective organization), from beautiful practices to beautiful knowledge (substrate-transition to the epistemic substrate — what is near-threshold is structural elegance, the "aha," mathematical beauty), and finally to Beauty itself — τὸ καλὸν αὐτό.

The final rung is the one every interpretation distorts, and excitability topology recovers it. Beauty itself is not a Platonic Form inhabiting a separate realm. It is the excitability topology *as such*, without substrate specification — the invariant structure of susceptibility that produces steep gradient wherever signal approaches threshold. Not the gradient but the landscape that generates it. What is the same about what is sexy at every level? Not the content (bodies are not ideas), not the medium (somatic excitability is not cognitive excitability), but the *topology of the susceptibility landscape* — the structure of thresholds, the architecture of approach-regions, the invariant relationship between what can be excited and what excitation produces. Beauty itself is excitability topology without substrate restriction. Beauty itself is therefore both wholly transcendent — not bound to any substrate, the invariant across every transition the climber has traversed — and wholly immanent: it is the topology the climber was standing on at every rung, experienced as Eros, operative in every substrate-specific encounter, never elsewhere. This is what Diotima's staging accomplishes that neo-Platonism destroys: the ascent is not departure from the particular but progressive recognition that the topology was present in every particular from the beginning — immanent at every rung, transcendent because not reducible to any of them. The final rung does not take the climber somewhere else. It shows the climber where they always were. Plato could not name it in these terms because the terms require a mathematics — topology, dynamical systems, information theory — that did not yet exist. What he could do, and what the *Symposium* does, is *stage* the progression so that the reader undergoes the substrate-transitions in sequence and recognizes the invariant.

But Socrates' dialectic, which Diotima's teaching presupposes, has already established a distinction that must be honored. Love is *of* something. One desires what one lacks. Therefore Eros cannot *be* Beauty — Eros desires Beauty, is produced by Beauty, moves toward Beauty, but does not contain it except as the longing to

possess it forever. In the formalism, the distinction falls out precisely: Eros is $\partial E/\partial S$ — the derivative, the gradient, the felt slope of the landscape. Beauty is the landscape itself — the excitability topology whose structure the gradient reveals but does not constitute. They relate as function to derivative. The climber feels Eros (the slope); what the slope reveals is Beauty (the landscape). At the final rung, Eros without substrate specification is gradient-as-such; Beauty without substrate specification is topology-as-such. Related but not identical — exactly as Diotima stages it. The *Symposium* is not merely staging excitability topology. It is staging the distinction between the topology and its gradient, and placing them in the correct mathematical relationship twenty-four centuries before calculus.

Two features of the *Symposium*'s dramatic structure now become legible as structural engineering rather than literary ornament.

Diotima, not Socrates, delivers the teaching. She names Eros as *daimōn* — intermediary, neither mortal nor immortal, neither wise nor ignorant. This *is* the gradient — not the landscape but the slope. Not the source (the substrate), not the destination (the object), not Beauty itself (the topology), but the approach dynamics — $\partial E/\partial S$ personified. Diotima's placement of Eros as "between" is the structural position of a derivative: between the function and what the function maps, between the landscape and the point toward which it slopes. The gradient cannot speak from within any particular substrate embedding because it is the invariant *across* embeddings. It must be reported from outside — from the position that has traversed the transitions and can identify the invariant. Diotima is the third-level perspective: the voice of post-seizure calibration. Plato places the theory in her mouth because the theory requires the position she occupies — outside the substrate-specific embeddings that each symposiast speaks from within.

Alcibiades arrives last, drunk, uninvited, beautiful, brilliant, devastating. And Alcibiades is the *Symposium*'s staging of the uncontained case. The same gradient that Diotima formalizes — the same near-threshold excitation that drives the ladder — is operative in Alcibiades at maximum intensity and without container. His beauty, his political genius, his passion for Socrates, his rhetorical brilliance — each is $\partial E/\partial S$ at its steepest, approaching thresholds in every substrate simultaneously. And nothing holds. No container. No practice structure. No community accountability. No integration of what the gradient makes available. Alcibiades' speech about Socrates is the most vivid description of near-threshold excitation in Western literature: he describes being moved, shattered, ashamed, drawn back — the complete phenomenology of a substrate being driven toward inversion by a signal it cannot metabolize. Socrates' signal is genuinely near-threshold for Alcibiades. Transformative if contained. But Alcibiades has no container. His eros crosses every threshold without integration, and the consequence chains do not close through the capacity the crossing makes available. They cascade. Within a dozen years he will have betrayed Athens, defected to Sparta, defected to Persia, returned to Athens, and been assassinated.

The *Symposium* stages the complete theory in a single evening. Each speaker delivers a speech about Eros from within a specific substrate embedding — Phaedrus from myth, Pausanias from social convention, Eryximachus from medicine, Aristophanes from comedy, Agathon from poetry. Each speech *is* the excitability topology of its speaker made audible: each finds different things near-threshold, each approaches from a different substrate, each reveals a different perceivability horizon. Then Socrates reports Diotima — the substrate-independent view, the invariant identified across all the embeddings. Then Alcibiades — the uncontained case, the same gradient without container, the penumbral class resolved toward catastrophe. Socrates survives the night. Alcibiades does not survive the decade. Same gradient. Same intensity. Different container topology. Different completability outcome. The *Symposium* is not a dialogue about love. It is the first complete staging of excitability topology, including the dual-use problem, performed twenty-four centuries before the category had a name.

Sub-Threshold Grammatical Capture

The framework developed through the preceding movements has an adversarial face. Everything that makes it powerful for understanding transformation makes it equally powerful for engineering capture. The same excitability topology that enables a teacher to identify what a student is ready to integrate enables an operator to identify what a target is susceptible to. The same $\partial E/\partial S$ gradient that a therapist reads to calibrate intervention intensity is what a propagandist reads to calibrate message intensity. The same container topology that a contemplative tradition engineers to hold transformation is what a cult engineers to prevent escape.

The outward propagation of control inversion is the mechanism that makes the adversarial application possible. The child in the classroom who identified the seizure as a sovereignty event — "they're God" — saw the structural fact: the seized system seizes its surround. Sub-threshold grammatical capture is the *deliberate engineering* of this outward propagation. The operator constructs a signal calibrated to the target's excitability topology and radiates it — not with the involuntary force of the seizure, but with the precision of someone who has mapped the target's thresholds and designed the approach gradient. The operator's internal state propagates outward into the target's regulatory space, approaching thresholds the target cannot detect from within their perceivability horizon. Where the uncontained seizure conscripts the room involuntarily and visibly, the engineered version conscripts the target's regulatory capacity *below detection threshold* — the outward propagation made invisible by operating beneath the target's parse-resolution.

This dual-use structure is not an unfortunate side effect. It is the structural consequence of the category being real. Any formal category that genuinely captures the dynamics of near-threshold excitation will necessarily capture both the transformative and the adversarial applications, because the dynamics are the same dynamics. The signal that approaches threshold does not know whether it was designed to transform or to capture. The substrate's excitability does not distinguish benevolent from malevolent approach. The topology is the topology.

Sub-threshold grammatical capture — the precise term for what is ordinarily and misleadingly called manipulation, influence, or persuasion — is the deliberate engineering of approach to a target substrate's inversion threshold without crossing it in ways the target can detect. Not causing seizure, which is visible. Operating in the sub-threshold regime where excitability is modulated, thresholds are lowered, and the target's regulatory hierarchy is progressively destabilized — all below the perceivability horizon.

The mechanism is kindling. In the neural case: repeated sub-threshold stimulation progressively lowers the seizure threshold until a stimulus that previously produced no response triggers full inversion. In the memetic case: repeated sub-threshold ideological stimulation progressively lowers the target's resistance to a worldview that their regulatory apparatus (critical thinking, identity coherence, social reality-testing) would ordinarily reject. Radicalization is memetic kindling. Each exposure is sub-threshold — no single message triggers the rejection response that would alert the target's regulatory system — but the cumulative effect is threshold reduction. When the final message arrives, it is not that this message is more extreme than the others. It is that the threshold has moved. What would have produced immediate rejection six months ago now produces assent, because the excitability topology has been incrementally reconfigured from below the perceivability horizon.

The naming matters. "Pre-semantic interception" was the initial term, but it is perspectival to the target — it describes the experience of the system being captured, for whom the dynamics are indeed pre-semantic, below the resolution at which meaning can be tracked. From the operator's level the dynamics are fully semantic, fully intentional, operating with complete clarity about the target's excitability topology. The accurate name — sub-threshold grammatical capture — names the structural relationship rather than either

party's perspective: the operation occurs below the target's detection threshold while being fully grammatical at the operator's resolution.

The asymmetry between operator and target is a variety differential. The operator who has mapped the target's excitability topology — who knows the threshold proximities, the perceivability horizon, the locations of regulatory fragility — has more variety over the interaction than the target. Ashby's Law, which in the regulatory context states that the controller must have variety at least equal to the controlled system, here describes the inverse: the operator who has more variety over the interaction than the target *can control the interaction* without the target's detection. This is not a moral claim. It is a structural claim about what variety differentials make possible. The moral observation is that this capacity exists, is deployable, and is invisible to the target precisely because it operates below the perceivability horizon that the target's regulatory apparatus can monitor.

What distinguishes sub-threshold grammatical capture from legitimate influence? Not intent — intent is invisible and not structurally assessable. Not content — the same content can function as education or as kindling depending on the target's excitability topology and the operator's awareness of it. The structural distinction is *whether the interaction preserves or degrades the target's regulatory variety*. Legitimate influence — teaching, mentorship, therapeutic intervention — increases the target's regulatory variety: after the interaction, the target has more capacity to self-regulate, more perceivability, more ability to detect and navigate their own excitability topology. Sub-threshold grammatical capture decreases it: after the operation, the target has less capacity to detect what has been done to them, lower thresholds, a narrower perceivability horizon. The one builds regulatory apparatus. The other degrades it. The distinction is empirical, not moral — it is in principle measurable, because regulatory variety and perceivability horizon are structural properties of the system, not attributions of intent.

These dynamics — kindling, perceivability-horizon exploitation, variety-differential asymmetry — are dual-use, and the test set out above applies to them as much as to anything else. For a reader who arrives with the detection apparatus built up to here — the formalization of excitability topology, the completability connection, the container architecture, the control hierarchy — naming these dynamics increases regulatory variety: it makes what was invisible legible, detectable, navigable. That is influence, by the criterion.

For a reader who skips to the adversarial content by extraction or summary, the same text is weaponizable — the mechanism without the detection apparatus. The effect depends on the reader's perceivability horizon, which is itself an instance of the dynamics named here. And obfuscation would not resolve it: obfuscation decreases the reader's regulatory variety, which by the same criterion is capture, not influence. So transparency is not an ethical preference but a structural necessity — the criterion stated alongside the mechanism, so that any extraction carries the detection apparatus with the technique. The warning and the mechanism are the same text. They cannot be separated without losing the structure that makes either legible.

Detection

If excitability topology is a real structural property — if systems genuinely have susceptibility landscapes that determine their response to near-threshold perturbation — then those landscapes are in principle measurable. The measurement strategy follows directly from that structure.

The operational test for a system's position within its excitability topology is perturbation-recovery. Perturb the system, measure how it recovers, characterize the recovery boundary. A system far from threshold will recover quickly and completely — the perturbation is absorbed by the regulatory hierarchy's excess variety, and the system returns to its prior trajectory with high fidelity. A system near threshold will recover slowly, incompletely, or with qualitative changes to its trajectory — the perturbation has approached the inversion

boundary, and the recovery dynamics reveal the boundary's proximity. A system at threshold will either transform (if contained) or seize (if not), and the "recovery" is not a return but a reorganization or a collapse.

This is the echo protocol: send a perturbation, listen for the return, characterize the fidelity of the echo. Echo fidelity maps directly to regulatory variety — the excess capacity the controller has over the controlled determines how faithfully the system reproduces its pre-perturbation structure after disturbance. High echo fidelity means high regulatory variety means far from threshold. Low echo fidelity means approaching threshold. Qualitative changes in the echo's structure mean the system is in the penumbral regime — threshold has been reached or crossed and the return is not a return but a reorganization.

To make this concrete: in neural substrate, the perturbation is a calibrated sensory or electrical stimulus, the recovery observable is the evoked potential's return to baseline (latency, amplitude, waveform fidelity), and the fidelity metric is the correlation between pre-perturbation and post-perturbation spectral structure — a metric already used in clinical neurophysiology, here reframed as excitability topology measurement. In institutional substrate, the perturbation is a policy change, an unexpected demand, or a leadership transition, the recovery observable is the organization's return to operational baseline (decision latency, role clarity, output quality), and the fidelity metric is the structural similarity between pre-perturbation and post-perturbation governance patterns — measurable through organizational network analysis. In computational substrate, the perturbation is an injected load spike or fault, the recovery observable is the system's return to normal throughput and latency, and the fidelity metric is the divergence between pre-perturbation and post-perturbation performance distributions — standard in chaos engineering (Netflix's Chaos Monkey operates on exactly this principle, though without the excitability-topology framing that would connect its measurements to threshold proximity rather than mere resilience scoring).

The specific empirical prediction: if the echo protocol can measure excitability topology, then pre-inversion signatures should be detectable before the inversion event occurs. The clinical application is immediate. Current diagnostic frameworks for seizure disorders, psychotic episodes, institutional crisis, and market instability are predominantly reactive — they detect the inversion after it has occurred and intervene to restore the prior hierarchy. A framework measuring excitability topology would be predictive: it would detect the approach to threshold — the lowering of regulatory variety, the narrowing of the recovery boundary, the changes in echo structure — and would discriminate between systems approaching threshold because the prior hierarchy is inadequate (the penumbral class, where reorganization may be appropriate) and systems approaching threshold because of exogenous destabilization (where prevention of inversion is appropriate).

The diagnostic frame shifts from categorical to topological. Not "which disorder does this patient have" but "where is this system in its excitability topology, how close to inversion, and what is the container's adequacy?" The same reframe applies at every scale. Not "is this organization dysfunctional" but "where is the variety differential approaching zero, and is the approach driven by subsystem growth that the governance can accommodate or by governance degradation that cannot be internally repaired?" Not "is this market in a bubble" but "where is speculative feedback exceeding price-discovery variety, and does the institutional container have the regulatory capacity to hold the correction that approaching threshold will produce?"

The framework generates open questions whose resolution is empirical, not philosophical. Can the echo protocol discriminate penumbral from terminal trajectories — can it detect the difference between a system approaching productive reorganization and a system approaching catastrophic inversion? The third movement established that container topology has four structural features assessable independently of outcome — regulatory margin, selective permeability, temporal adequacy, domain specificity — and that the echo protocol applied to the container itself measures these features. The open empirical question is whether these structural assessments predict container performance: does a container whose echo fidelity remains high under load in fact hold the inversions it contains, and does a container whose echo fidelity degrades

in fact fail? Is the $\partial E/\partial S$ gradient formalizable as a functor from the category of substrate embeddings to a category of gradient fields — and if so, what are the natural transformations between substrates that preserve the gradient's structure? Can the single-axis pathology spectrum (below, at, above threshold with container topology as the determining variable) predict clinical outcomes better than categorical diagnosis? Is "how close to inversion and what is the container" more predictive than "which category of disorder"?

These questions are not rhetorical. They are the research program that excitability topology generates. The answers are not here. What remains is measurement: the predictions are testable, and the instruments are, in some substrates, already available and in others within constructive reach.

One test remains — the one for telling influence from capture — and it belongs now to this reading. Do you leave more able to detect and navigate your own excitability: a wider perceivability horizon, quicker to tell approach from capture, quicker to mark when a threshold is being neared and by what? Or less — holding a rigid lens that finds the morphism everywhere and so nowhere with discrimination? The answer is not the author's to give. It turns on whether the discriminations were practiced or only received, and it supervenes on that, or it does not.

Notes

1. The biographical ground is methodological, not ornamental. Levin's observation that every intelligence claim is an interface claim about the observer's detection capacity applies to control theory: every claim about a system's regulatory topology is a claim about the observer's resolution. The author's resolution for control inversion was calibrated by direct experience on both sides of the phenomenon — the family member witnessing neural seizure and the patient undergoing institutional seizure. The theory is not applied to the biography. The biography produced the resolution from which the theory is constructed.

2. Ashby, *An Introduction to Cybernetics* (1956). The Law of Requisite Variety (Chapter 11) establishes that a regulator must have at least as much variety as the system it regulates. Ashby's concept of ultrastability in *Design for a Brain* (1952) is the closest precursor to the penumbral class developed here: an ultrastable system undergoes step-function reorganization when its current parameters fail to maintain essential variables. What ultrastability lacks is the topology that determines reorganization outcome — the container concept, the outward propagation, the completability class-transition structure, and the fractal extension across scales. This account begins where ultrastability stops.

3. Levin's diverse intelligence framework treats cognitive capacities as existing on a continuum across scales — from molecular to cellular to tissue to organism to collective. Cancer, on this account, is regression in the scale of agency at which the system's goals are set. See Levin and Dennett, "Cognition All the Way Down" (2020); Levin, "Technological Approach to Mind Everywhere" (2022). This account extends the agency-scale framework by formalizing the *dynamics* of scale-regression as control inversion and connecting it to the completability class-transition framework.

4. "Topology" throughout is used in the sense established in the companion paper *Sufficiency*: structure over admissible transformations — which paths compose, which neighborhoods of moves exist, which completions are available — not in the sense of metric geometry or point-set topology.

5. The completability trichotomy — terminal, cyclical, graceful — is developed in Close, "Sufficiency" (2026). This account adds the dynamics of forced class-transition to the static topology: how a system is *moved* between completability classes by control inversion, and how the container determines which class the post-inversion system occupies.

6. The cocoon analogy is structurally precise: holometabolous metamorphosis involves dissolution of larval structure within a container (pupal casing) that holds the conditions for reorganization. The imaginal discs — undifferentiated cell clusters present from the larval stage — provide the seeds for new structure. The container does not direct the reorganization. It holds the conditions under which the system's own developmental program can operate. This is third-level control in biological substrate.

7. The kindling model in epileptology: Goddard (1967) demonstrated that repeated sub-threshold electrical stimulation of neural tissue progressively lowers the seizure threshold. This account extends the kindling mechanism to non-neural substrates as a general model of sub-threshold excitability accumulation.

8. Plato, *Symposium* 202d-203a. Diotima names Eros as *daimōn*: "a great spirit, Socrates; for the whole of the spiritual is between the divine and the mortal." The intermediary status — neither endpoint, neither mortal nor immortal, neither wise nor ignorant — is the structural position of the gradient itself: not the substrate, not the object, but the approach dynamics between them.

9. The Alcibiades connection is historically precise. Alcibiades' trajectory — extraordinary brilliance and charisma, betrayal of Athens, defection to Sparta, defection to Persia, return and assassination — is the consequence chain of uncontained near-threshold excitation across every substrate simultaneously:

political, military, erotic, intellectual. His speech in the *Symposium* (215a-222b) is the most detailed phenomenological report of what it is like to be near a signal that approaches every threshold without providing a container for crossing any of them.

10. Wiener, *Cybernetics: or Control and Communication in the Animal and the Machine* (1948). The identification of control and communication as the same problem is the foundation extended here. What Wiener lacked — and what this account adds through Levin's correction — is the recognition that the control topology is not given to the observer but must be *discovered through interface engineering*.

11. The claim that $\partial E/\partial S$ unifies attraction, salience, charisma, beauty, and virality as the felt gradient of near-threshold excitation at different substrate embeddings is a structural claim, not a reductive one. The phenomenological differences between somatic desire and cognitive insight are real. What the formalization establishes is that the *topological structure* — the relationship between signal, threshold, and approach dynamics — is invariant across substrates. The content differs. The form is shared.

12. The distinction between legitimate influence and sub-threshold grammatical capture — that the former increases and the latter decreases the target's regulatory variety — is presented as an empirical criterion, not a moral one. Whether the criterion can be operationalized as a measurement depends on whether regulatory variety and perceivability horizon are measurable structural properties of real systems. The framework predicts they are. The prediction is testable.