

Anxiety as the Signature of Displacement

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Abstract

We model trauma as a severe but reversible displacement from a system’s ground state: an event that does not move the system irrecoverably far, but that damages the path back, making return costly rather than impossible. Anxiety, on this account, is not a free-floating affect but the anticipatory alarm that prices that damaged return path — and pathological anxiety is the systematic over-pricing of a reversible displacement as an irreversible one. Because the geometry of the wound fixes the geometry of the alarm, anxieties are classifiable by their originating displacement rather than their surface symptom, and they resolve precisely when corrective experience demonstrates the reversibility the alarm had denied.

1 Background

Every system has a configuration it costs the least to occupy. Call it the *ground state* S^0 . Departures from ground are measured by a displacement ξ , and each displaced state carries an instantaneous cost $D(\xi) \geq 0$, with $D(0) = 0$ at ground. Along any trajectory the system accumulates cost $\Phi = \int D dt$. This is the minimal apparatus of the displacement framework, and it is enough to reframe a question that has resisted clean statement: what, exactly, is anxiety?

The clinical literature has long separated two affects that share a physiology. *Fear* is a response to an imminent, present threat; *anxiety* is the anticipation of a future one (Barlow, 2002). Neuroscience has filled in the mechanism by which a present threat becomes a future one. Pavlov (1927) showed that a neutral cue can acquire the power to trigger a defensive response. LeDoux (2000) and Davis & Whalen (2001) localized the substrate: an amygdala-centered circuit that, on the framework’s reading, stores less *what happened* than a prediction — *these features forecast cost* — and broadcasts vigilance before cortical appraisal arrives. Grupe & Nitschke (2013) then characterized anxiety itself as biased anticipatory estimation under uncertainty: a forecast about bad states, made before they occur.

What the framework adds is a precise object for that forecast to be *about*. The standard accounts say anxiety anticipates threat. We say it anticipates the **cost of getting back**. The alarm is not principally a price tag on where the system is; it is a price tag on the route home.

2 The claim

Introduce one object the basic apparatus does not yet name: the *return path*. For a displaced state, the return path γ is any route $\xi \rightarrow 0$, carrying cost $\Phi_{\text{return}}[\gamma] = \int_{\gamma} D dt$. The true minimal return cost is $\Phi_{\text{return}}^* = \min_{\gamma} \Phi_{\text{return}}[\gamma]$.

With this we can say what trauma *is*. Trauma is not the magnitude of ξ . A system can be flung very far from ground and walk back cheaply; that is ordinary perturbation, not trauma. Trauma

is damage to the *return path*: the route back to S^0 has become expensive, so Φ_{return}^* is large — but **finite**. The path is damaged, not severed. Reversibility, $\Phi_{\text{return}}^* < \infty$, is the ground truth.

And we can say what anxiety *is*. The system never acts on Φ_{return}^* directly; it acts on an internal *estimate*, $\hat{\Phi}_{\text{return}}$, read off the local geometry of the damaged path. Anxiety is that estimate, broadcast as anticipatory alarm. Pathological anxiety is the case where the estimate runs away from the truth — $\hat{\Phi}_{\text{return}} \gg \Phi_{\text{return}}^*$, and in the limit $\hat{\Phi}_{\text{return}} \rightarrow \infty$ — so that a reversible displacement is priced as an irreversible one. The thesis in one line: **anxiety is the signature of a displacement still being priced as irreversible**.

3 Mechanism

Conditioning writes the prior. A trauma is a moment of large ξ paired with a spike in $D(\xi)$. Pavlovian fear conditioning is the process that binds the neutral cues present at that moment to the defensive response — and, in framework terms, inscribes a *threat prior* over the region of state-space the system occupied when cost spiked, together with an estimate that the path back from that region is ruinous. The amygdala stores not a memory but a forecast.

Anxiety is anticipatory, not reactive. Under predictive-processing accounts, a system minimizes expected surprise by acting on a generative model. If that model carries a prior that return-to-ground is near-impossible — high $\hat{\Phi}_{\text{return}}$ — the cheapest inference is avoidance, and the felt residue of holding that prediction is anxiety. The alarm attaches to a return path the model has marked catastrophic, not to the present location.

Why similar traumas yield similar anxieties. Shepard’s (1987) universal law of generalization holds that response generalizes as an exponential decay over psychological distance between stimuli. The *shape* of that decay is governed by the geometry of the conditioned representation. Two displacements with similar structure therefore produce similar generalization gradients — and so similar anticipatory alarm. This is the framework’s central claim made mechanical: **the shape of the trauma sets the shape of the anxiety**, because similar damaged return paths generate similar over-estimates of Φ_{return} . Dunsmoor & Paz (2015) supply the pathological case: anxiety patients *overgeneralize*, with abnormally broad gradients, so the threat prior bleeds across far more of state-space than the original event warranted.

Why the estimate is wrong. The broadened gradient and the catastrophic price are *estimates*, not measurements. The system has not actually re-walked the return path; it has extrapolated from a single high- D instance. That is exactly the kind of quantity that can be systematically wrong — and it is wrong in a specific, correctable direction, because the path is damaged, not destroyed.

4 A formal statement

Let the system have ground state S^0 , displacement ξ , instantaneous cost $D(\xi) \geq 0$ with $D(0) = 0$, and accumulated cost $\Phi = \int D dt$. For a displaced state the return path $\gamma : \xi \rightarrow 0$ has cost $\Phi_{\text{return}}[\gamma] = \int_{\gamma} D dt$, with true minimal return cost $\Phi_{\text{return}}^* = \min_{\gamma} \Phi_{\text{return}}[\gamma]$. Trauma is the regime in which Φ_{return}^* is large but finite.

Define anxiety as the anticipated cost of a possible *re*-displacement, weighted by its estimated likelihood:

$$A \approx p_{\text{re}} \hat{\Phi}_{\text{return}},$$

where p_{re} is the estimated probability of re-displacement and $\hat{\Phi}_{\text{return}}$ the *estimated* return cost. Written as an expectation over anticipated future displacements ξ' ,

$$A = \mathbb{E} \left[p_{\text{re}} \hat{\Phi}_{\text{return}}(\xi') \right],$$

which makes explicit that anxiety is a forward integral over states *not yet occupied*. The pathology is the gap $\hat{\Phi}_{\text{return}} \gg \Phi_{\text{return}}^*$; in the limit $\hat{\Phi}_{\text{return}} \rightarrow \infty$, A diverges. **Maximal anxiety is exactly the estimate of irreversibility.**

This separates the two affects cleanly. *Fear* is keyed to a present displacement, $F \propto D(\xi_{\text{now}})$ — the cost of where the system actually is, and it can be *correct* about the present. *Anxiety* is keyed to a future estimate, $A \propto p_{\text{re}} \hat{\Phi}_{\text{return}}$ — a forecast about return from a displacement not currently realized, and it can be *systematically wrong* about the future. The clinical fear/anxiety distinction falls out of the difference between an instantaneous cost and a forward functional.

It also yields the classification result. Two systems sharing a trauma displacement ξ_{trauma} of identical geometry inherit the same damaged-path structure, hence the same map $\xi \mapsto \hat{\Phi}_{\text{return}}(\xi)$. Because A is a functional of that map, they hold the same A : the same triggers, where $\hat{\Phi}_{\text{return}}$ spikes, and the same gradient $\nabla_{\xi} A$, which fixes which directions feel most catastrophic. **Anxiety is classifiable by its originating displacement, not its surface symptom.**

Finally, resolution. Traversing the return path even once realizes $\Phi_{\text{return}}^* < \infty$ as lived evidence, driving $\hat{\Phi}_{\text{return}} \rightarrow \Phi_{\text{return}}^*$ and collapsing A . Recovery works because it *demonstrates the reversibility the alarm denied*.

5 Predictions

The model is not merely a re-description; it forecloses some observations and predicts others.

1. **Clustering by displacement-shape, not by diagnostic surface.** Anxieties should sort by the geometry of the damaged path — loss-of-control displacements, social-evaluative displacements, contamination-and-integrity displacements — and these clusters should cut *across* DSM categories. The prediction is already foreshadowed by transdiagnostic findings: shared latent dimensions match or exceed categorical labels in predicting impairment and treatment response.
2. **Similar wounds yield superimposable trigger-sets and gradients.** Because the trigger-generalization gradient is the projection of $D(\xi)$ around the damaged path, two structurally similar traumas should produce overlapping gradients — directly measurable, and steeper and broader exactly where $\hat{\Phi}_{\text{return}}$ is most inflated. The gradient's shape should be predictable from the originating displacement, not from symptom count.
3. **The anxiety gradient recovers the wound's axes.** The directions along which anxiety generalizes should reconstruct the geometry of the original displacement. This is a falsifiable geometric claim: if measured generalization gradients do not align with the structure of the originating event, the model is wrong.
4. **Severity tracks the estimate, not the situation.** Two people in identical objective circumstances should differ in proportion to their differing $\hat{\Phi}_{\text{return}}$, not their differing ξ . Symptom severity is a property of the held estimate.

6 Treatment

The framework reads across to therapy with a single instruction: **repair the path; do not merely dampen the arousal**. The active ingredient of every effective anxiety treatment is corrective evidence that return is possible — evidence that drives $\hat{\Phi}_{\text{return}}$ down toward its true, finite value.

Foa & Kozak's (1986) emotional-processing theory holds that a fear structure changes only when disconfirming information is delivered. In our terms, the "incompatible information" is a demonstration that the return is survivable: path-repair. Craske et al. (2014) sharpen the operative mechanism to *expectancy violation* — the gap between predicted catastrophic cost and observed benign outcome — which is exactly a downward correction of $\hat{\Phi}_{\text{return}}$. This predicts that exposures should be engineered to *maximize* that gap, and that the known potentiators (variability, multiple contexts, removal of safety signals) work by generalizing the corrected estimate across the whole path rather than one point on it.

Reconsolidation findings go further: they rebuild the path rather than overlay a competitor. Nader, Schafe & LeDoux (2000) showed that a reactivated memory becomes labile and updatable; Schiller et al. (2010) showed that a reminder-then-update window durably lowers fear in humans. Reactivation reopens the damaged route, and corrective experience *rewrites* the stored cost rather than installing a parallel inhibitory one.

The contrast is the model's edge. Generic arousal reduction — relaxation, anxiolytics — lowers $D(\xi)$ in the moment without touching the stored $\hat{\Phi}_{\text{return}}$. The framework therefore predicts what these methods in fact show: return of fear, spontaneous recovery, reinstatement. The estimate was never corrected, so the alarm returns.

7 Objections

Temperament and vulnerability. *The same event traumatizes one person and not another, so symptoms track the organism, not the displacement.* Temperament sets the system's cost function D and the steepness of its generalization gradient — how expensively a given ξ is priced — not *whether* displacement organizes anxiety. Individual differences are variation in D , which the framework predicts; they are not a counterexample to it.

Comorbidity and heterogeneity. *One trauma yields PTSD in one person, depression in another, panic in a third — too varied for a single shape.* A single displacement can damage *several* return paths at once, each with its own Φ_{return} . Heterogeneity is the branching set of damaged routes: shared origin, divergent paths — exactly what the model expects.

Meaning and appraisal. *Appraisal, not raw stimulus geometry, drives anxiety (Ehlers & Clark, 2000).* Appraisal *is* the system's estimate of Φ_{return} — the felt judgment "this cannot be undone." The Ehlers–Clark account of PTSD as a sense of *current* threat from a past event is precisely apparent irreversibility held as an estimate. Meaning is not outside the framework; it is the over-estimate the alarm encodes, and the variable therapy corrects.

8 Conclusion

Trauma looks irreversible from inside. That appearance is the whole of the disorder. The displacement is severe but the return path is finite-cost; what makes the wound a wound is that the system holds an estimate of the return that has run to infinity. Anxiety is that estimate, felt forward — the anticipatory alarm pricing a reversible displacement as a catastrophe. The shape of the wound fixes the shape of the alarm, which is why similar traumas breed similar anxieties and why

anxiety is classifiable by its originating displacement rather than its surface symptom. And it is why healing is possible at all, and why it takes the form it does: not the silencing of the alarm but the *refutation* of it — a single safe traversal of the damaged path, supplying the evidence that $\Phi_{\text{return}}^* < \infty$, demonstrating the reversibility the alarm had denied. Recovery is not forgetting. It is proof.

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