

Entropy Flows and Collapse Signatures: Coordination-State Patterns in Germany 1910–1930, Late Rome 380–450 CE, a United Kingdom Control, and Projections for 2025–2026

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Abstract

Complex adaptive societies are far-from-equilibrium dissipative structures that export entropy through fast-loop nodes (Shield, Craft, Flow, Hands) while slow-loop nodes (Helm, Lore, Archive, Stewards) generate and store negentropy. This paper examines three candidate collapse signatures — pre-collapse Helm lag, Stewards Bond Strength floor breach, and Library Attractor (\mathcal{L}) depression — across three polities: Germany 1910–1930 and Late Western Rome 380–450 CE as crisis cases, and the United Kingdom 1880–2026 as a non-collapse control subjected to the same exogenous shocks (the two World Wars). The control is decisive: the UK records an \mathcal{L} collapse gradient statistically indistinguishable from Germany’s, yet recovers fully — so gradient magnitude is shock-response, not a collapse diagnostic. No single signature is satisfied by both crisis cases and absent in the control except one: the Stewards Bond Strength floor breach. Helm lag is present in Germany but inverted in Rome; non-recovering \mathcal{L} depression is observed only in Rome. The legitimacy node thus emerges as the central early-warning indicator, with the qualification that a floor breach marks acute crisis rather than a deterministic terminal outcome — Germany breached it and recovered, Rome breached it and did not. The comparison falsifies purely exogenous accounts of civilisational failure: identical shocks produced divergent outcomes governed by internal coordination state.

1 Introduction

Complex adaptive societies must continuously export entropy to sustain internal negentropy and coordination. The Complex Adaptive Model of Societies (CAMS) formalises this through an eight-node grammar in a high-dimensional phase space. Slow-loop nodes (Helm, Lore, Archive, Stewards) generate and store negentropy over longer timescales; fast-loop nodes (Shield, Craft, Flow, Hands) handle real-time execution. Rate-separation between the loops, bridged by Kuramoto-type synchronisation, produces durable macroscopic order. Candidate collapse signatures appear as progressive decoupling: declining bond strengths, slow-loop suppression, fast-loop hyper-reactivity, and Stress–Capacity correlation breakdown.

This paper analyses four windows:

1. Germany 1910–1930 — primary quantitative case.
2. Late Western Rome 380–450 CE — deep-historical case.
3. United Kingdom 1880–2026 — non-collapse control (same exogenous shocks, divergent outcome).

4. 2025–2026 projections for contemporary actors.

Data provenance. Germany and the UK are five-agent CAMNATIONS5 ensembles with companion envelope files. Rome is a single-scorer recalculation (no uncertainty envelope). Rome and the CAMNATIONS5 ensembles use different Bond Strength normalisations. Cross-polity comparisons involving Rome are therefore qualitative until a matched-normalisation Roman ensemble exists (Section 10).

2 Theoretical Framing

Societies maintain coherence by exporting entropy through fast loops while slow loops generate negentropy. The Library Attractor $\mathcal{L} = (B_{\text{Lore}} \times B_{\text{Archive}})/S_{\text{Hands}}$ quantifies slow-loop coupling strength. The candidate failure markers examined here are Helm lag, Stewards Bond Strength floor breach, and \mathcal{L} depression. The Kuramoto Bridge frames crises as non-agentic desynchronisation. Stress–Capacity anti-correlation ($\rho \approx -0.66$ to -0.70) is the working baseline; its breakdown is a candidate stress indicator.

3 Germany 1910–1930: Quantitative Case

Data: `germany_cams5_ensemble_mean.csv` + envelope.

Signature 1 — Pre-collapse Helm lag. In the ensemble mean, Helm Node Value sits below 10 (8.8–9.9) while Shield and Craft remain above 14 across 1908–1911 and 1913 — a clean four-year run. The robust feature is the separation: Helm runs roughly five to six points below Shield and Craft. The strict “below 10” threshold is less robust — every Helm reading in 1908–1913 has an envelope band crossing 10 — so the signature is stated as a sustained Helm-to-fast-loop separation rather than a hard threshold crossing.

Signature 2 — Stewards Bond Strength floor. Stewards Bond Strength falls to 2.6 in 1923, well below the nominal ~ 7 threshold at which the legitimacy node ceases to be a net negentropy generator. This is the sharpest single marker in the German series.

Signature 3 — Library Attractor depression. \mathcal{L} falls steeply across 1914–1918, at approximately -37 units/year (1913→1918). It reaches a floor of 1.6% of the 1913 baseline in 1923, then recovers — to 72% of baseline by 1925 and 87% by 1928 — tracking the Weimar stabilisation. The earlier characterisation of German \mathcal{L} as “non-recovering” is withdrawn: German \mathcal{L} depression is deep and prolonged but it is not terminal.

4 Late Roman Empire 380–450 CE: Partial Signature Match

Data: `rome_claude_recalculated.csv` (single-scorer; separate BS normalisation).

Signature 1 — Helm lag: absent, and inverted. From 380–410 CE Helm Node Value exceeds Shield and Craft throughout (Helm 11.0 → 3.0 against Shield 4.5 → 1.0). The German pattern — central direction lagging reactive execution — does not appear; in Rome the fast loop (Shield) degrades first.

Signature 2 — Stewards Bond Strength floor: present. Stewards Bond Strength falls below 1.0 on its own scale by approximately 410 CE (0.94 at 410, 0.79 at 430), with Stewards Node Value turning negative across 420–450.

Signature 3 — \mathcal{L} depression: present and non-recovering. On its own scale Roman \mathcal{L} declines monotonically from a ~ 390 CE peak (0.62) to 0.10 at 450 CE, with no recovery. This is genuine terminal depression.

Result for Rome: two of three signatures present (Stewards floor breach, non-recovering \mathcal{L}); Signature 1 absent and inverted.

5 United Kingdom 1880–2026: A Non-Collapse Control

Data: UK_CAMNATIONS5_ensemble_mean.csv + envelope.

Scale compatibility. UK Bond Strength ranges 8.95–40.14 against Germany’s 1.24–44.33 — the same CAMNATIONS5 normalisation. UK and Germany may be compared in raw units.

Helm lag — absent at both wars. UK Helm never falls below 10 in either pre-war window (11.5–15.5 across 1908–1913; 11.5–13.5 across 1936–1939). A one-year dip to 9.5 in 1917 recovers immediately. The only sharp Helm lag anywhere in the UK series is recent and isolated — 2018–2019 (Helm 3.1–3.3) — flagged for Section 6.

Stewards Bond Strength floor — never breached. UK Stewards Bond Strength has a series minimum of 16.9 (2009); its WWI and WWII troughs are ~ 24 and ~ 25 . It never approaches Germany’s 2.6 or the ~ 7 threshold.

\mathcal{L} — **the discriminating case.** The UK records a WWI \mathcal{L} gradient of approximately -33 units/year (1913→1918), within ten per cent of Germany’s -37 . By gradient magnitude alone the UK in 1914–1918 would be misclassified as collapsing. It was not: UK \mathcal{L} bottoms at 23% of its 1913 baseline (1917), recovers to 64% by 1924, and exceeds the baseline by 1950. The WWII net gradient is essentially flat (-0.2 /year). A steep \mathcal{L} gradient is therefore a shock-response, not a collapse diagnostic.

5.1 Comparative Table

Signature	Germany 1910–1930	Western 380–450 CE	Rome	United Kingdom 1880–2026
Helm lag	Present — Helm 5–6 pts below Shield/Craft, 1908–1911	Absent — inverted; Helm leads Shield/Craft 380–410		Absent at WWI and WWII (Helm stays >10)
Stewards BS floor breach	Yes — 2.6 (1923)	Yes — <1.0 by ~ 410 CE (own scale)		Never — series minimum 16.9 (2009)
\mathcal{L} behaviour	Deep collapse (floor 1.6% of baseline) then recovery to 87% by 1928	Monotone decline, no recovery (terminal)		Moderate collapse (floor 23%), full recovery + overshoot
Within-window outcome	Regime change + Weimar recovery	Terminal collapse		Survived both shocks

Table 1: Comparative table. The Stewards floor breach is the only signature common to both crisis cases and absent in the control.

5.2 Interpretation

Germany and the UK received the same exogenous shock in 1914–1918, and only Germany shows Helm lag and a Stewards floor breach. Identical shock, divergent internal response: this falsifies a purely exogenous account of civilisational failure.

The three-case comparison does not support a unified “three-signature set satisfied by all collapse cases.” It supports a narrower and more defensible claim:

- The **Stewards Bond Strength floor breach** is the one signature present in both crisis cases (Germany, Rome) and absent in the control (UK). It is the strongest single early-warning indicator the data support.
- Helm lag discriminates Germany from the UK but is absent — indeed inverted — in Rome. It may be specific to modern bureaucratic states.

- \mathcal{L} behaviour is a continuum. The gradient is shock-response (the UK proves this). Strict non-recovery is observed only in Rome. Germany’s \mathcal{L} collapses far deeper than the UK’s but recovers.

A floor breach signals acute crisis, not a foregone terminal outcome — the Germany–Rome divergence after breach remains an open problem.

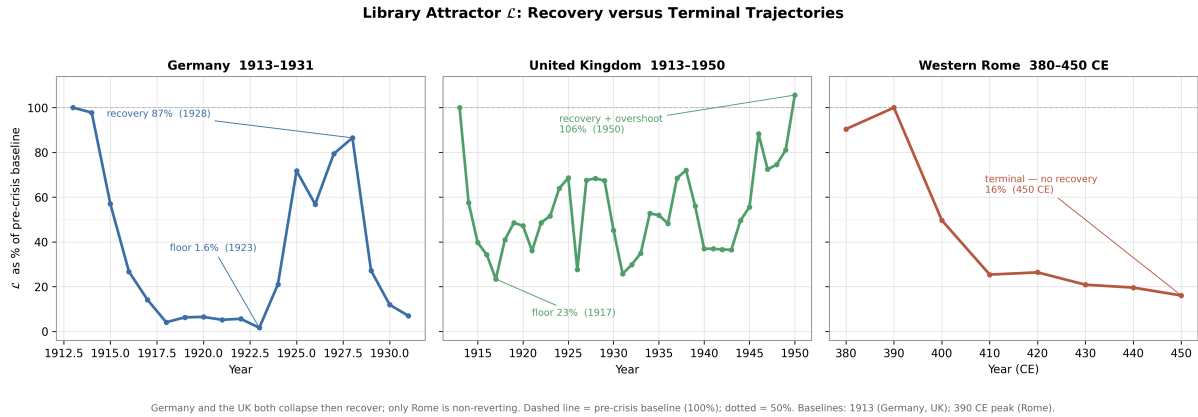


Figure 1: Library Attractor (\mathcal{L}) recovery trajectories. Germany shows deep but recoverable collapse (floor 1.6% of baseline, rebound to 87% by 1928). The UK shows moderate collapse (floor 23%) with full recovery and overshoot. Rome exhibits terminal monotonic decline (no recovery).

6 Contemporary Projections: 2025–2026 Risk Surface

United States. On the available ensemble, Helm Node Value falls from 11.9 (2015) to 6.3 (2018) to 0.4 (2026) — this is not a Helm lag but a Helm collapse. Archive declines to 6.0 (2026); Craft falls to 4.2 (2026). There is no Scissors Effect — the pattern is broad activation collapse (Helm, Craft and Archive all suppressed together), consistent with a Type II (“cortical ablation”) profile. Stewards Bond Strength is 8.78 (2026), below the ~ 12 monitoring line since ~ 2020 and approaching the ~ 7 floor (normalisation check pending). \mathcal{L} stands at roughly 3% of its post-1990 peak and is still declining. The USA shows Stewards approaching breach and a sustained, as-yet non-recovering \mathcal{L} decline — via a different mechanism from the early-German scissors.

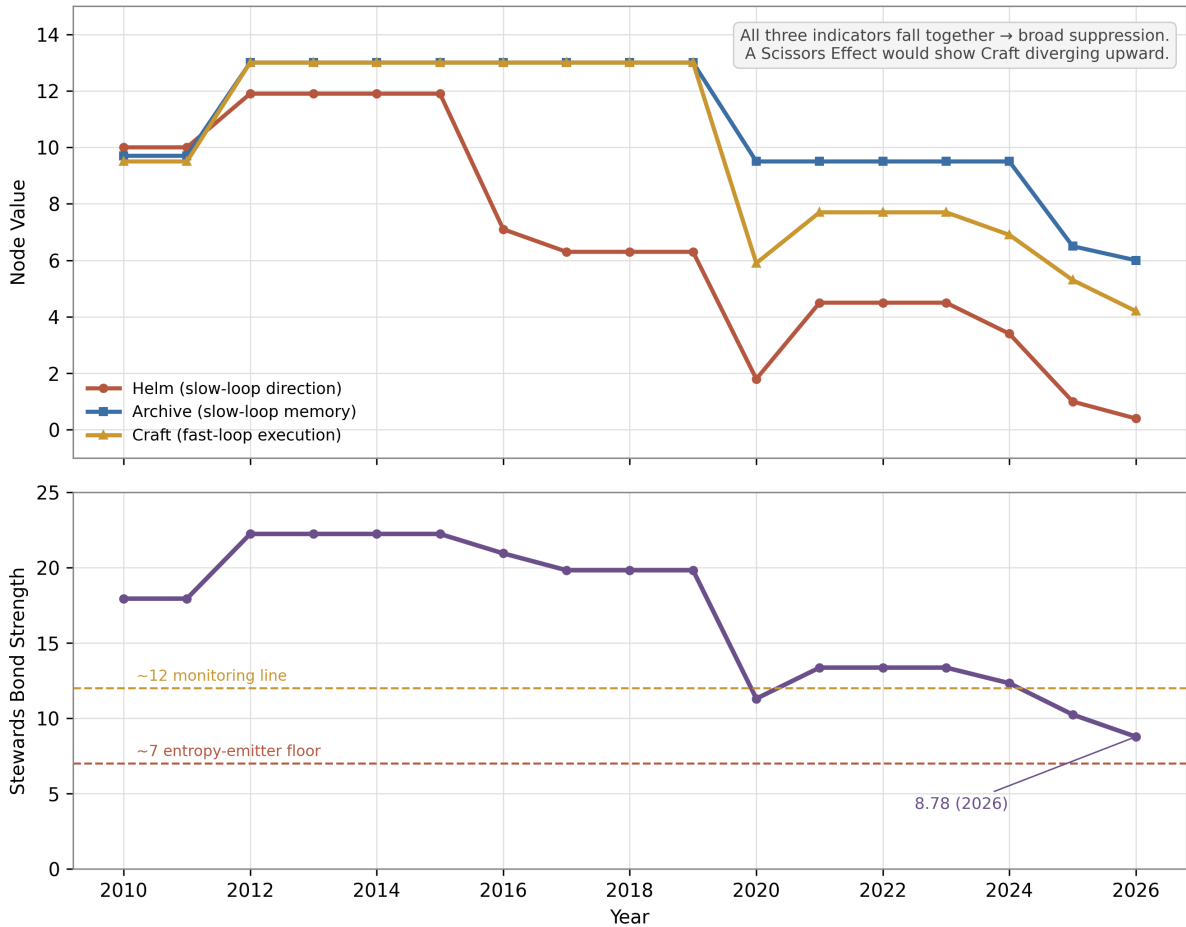
Australia. Strong slow-loop Node Values (Archive ~ 20 , Helm ~ 11 , Craft ~ 17). Qualitative picture — slow-loop strength, no scissors — is supportable, but the file uses the low (Rome-type) BS normalisation, so its \mathcal{L} and Stewards Bond Strength cannot be cross-compared with the USA/Germany/UK figures.

Risk assessment. The USA exhibits Helm collapse, Stewards approaching the floor, and non-recovering \mathcal{L} decline on the available data — pending normalisation confirmation and source-file reconciliation.

7 Discussion and Falsifiability

The three-polity comparison with matched exogenous shocks falsifies purely exogenous accounts of collapse: the outcome divergence is internal. The Stewards floor breach is the most robust single marker. Rome’s inverted Helm ordering is a substantive divergence from the rate-separation expectation and is presented as an open finding.

USA 2010-2026: Broad Activation Collapse



Data: MARKERCAMS5_USA ensemble. Bond-Strength normalisation versus the CAMNATIONS5 thresholds is pending confirmation (see Paper 4 §4.9).

Figure 2: USA 2010–2026. Helm, Archive and Craft node values fall together — broad activation collapse with no Scissors Effect (a Scissors Effect would instead show Craft diverging upward while Helm falls). Stewards Bond Strength crosses the ~ 12 monitoring line around 2020 and approaches the ~ 7 entropy-emitter floor. Source: MARKERCAMS5_USA ensemble; normalisation against the CAMNATIONS5 thresholds is pending confirmation (Section 10).

8 Stress Transfer Between Nations in Wartime — Hypothesis

Hypothesis (reframed from claim). Wartime entropy export — a polity’s elevated Shield/Craft activity under stress — may couple through inter-polity synchronisation to depress neighbouring systems’ \mathcal{L} . Observation: German and UK \mathcal{L} both fall steeply in 1914–1918, the UK at $-33/\text{year}$ against Germany’s -37 . Competing explanations: (a) directional transfer from Germany to the UK; (b) shared exogenous shock, each polity absorbing the same war independently. Discriminating test (pending): cross-national lag analysis. Until that test is run, transfer remains unproven.

What the data do support is the **recipient-state filter**: the UK’s \mathcal{L} depression, whatever its source, was survivable because UK Stewards Bond Strength stayed above 24 and Helm above 9.5. Recipient internal state, not the shock alone, governed the outcome.

Stress-Transfer Hypothesis (1914–1918) and the Recipient-State Filter

A hypothesis, not a result — see competing explanation below.

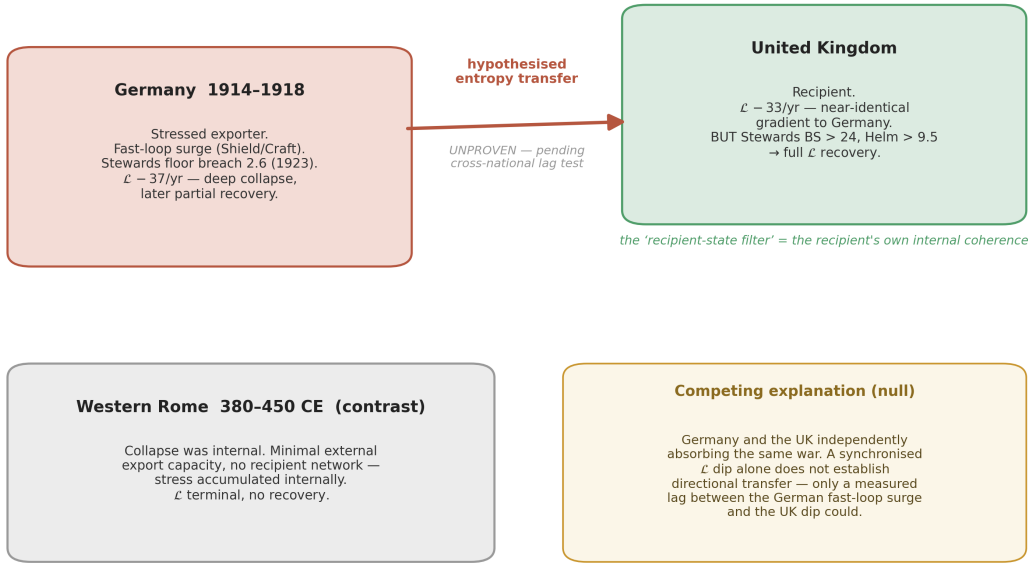


Figure 3: Stress-transfer hypothesis (1914–1918). Germany’s fast-loop entropy export is *hypothesised* to depress UK \mathcal{L} ; the synchronised \mathcal{L} dip is equally consistent with both polities independently absorbing the same war, and directional transfer is unproven pending cross-national lag analysis. Whichever the source, the UK’s recipient-state filter (Stewards BS >24, Helm >9.5) enabled full recovery, whereas Rome — lacking an external export network after 410 CE — shows terminal decline.

9 Conclusion and Policy Implications

Internal coordination state, not exogenous shock, governs whether a society absorbs or succumbs to crisis. Among the candidate signatures, the Stewards Bond Strength floor breach is the one marker common to both crisis cases and absent in the control, making the legitimacy node the central early-warning indicator. Helm lag is a secondary, possibly modern-specific marker; \mathcal{L} non-recovery is a terminal marker that isolates Rome in this corpus. A Stewards floor breach signals acute crisis, not a foregone terminal outcome.

Policy implication (preliminary). A polity showing legitimacy-node decline or broad slow-loop suppression has reason to prioritise slow-loop restoration — Archive (institutional memory), Stewards (legitimacy), Helm (strategic coherence) — over fast-loop reactivity. The UK 1914–1918 case indicates that intact slow-loop coupling can convert an identical shock into survivable compression.

10 Outstanding Dependencies

1. Matched-normalisation CAMNATIONS5 ensemble for Rome 360–460 CE.
2. Cross-national wartime \mathcal{L} lag analysis (1914–1918, 1939–1945).
3. Section 6 source-file reconciliation and MARKER-vs-CAMNATIONS5 normalisation confirmation.

4. Author decision on signature framing (see Section 5.2).
5. Version confirmation — v3.2-R-ESCH.

Status: Corrected final internal draft. All figures verified against source CSVs as of 16 May 2026.