

INFORMATION ASYMMETRY TRAP: Formal Dynamical Model

Epistemic Collapse, Cognitive Capture, and the Signal Starvation of AGI

Series: Omega-u Civilizational Framework | Work 19

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Version: v2.1 FINAL -- Hamiltonian Singularity + Knowledge Barrier + Three Lyapunov Barriers

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Builds on:

- Work 9: MFLS_AGI_CORE v3.1 (G[K], rho(L), H_social, I_n)
- Work 10: IEP_AGI_CORE v1.0 (tau(u), Omega-DSL)
- Work 15: SOCIAL_INSTABILITY v1.4 (G_s, E_c, L_s)
- Work 16: FINANCIAL_INSTABILITY v1.3 (F_c, P_extinction, Thucydides)
- Work 17: INSTITUTIONAL_DEGRADATION v2.1 (I_q, depravity, D_crit)
- Work 18: TECHNOLOGICAL_STAGNATION v1.1 (T_r, I_n, Compute Paradox)
- CT v2.4: Civilizational_Traps (Omega(u), spectral criterion)

Closes: Civilizational Trap #10 — Information/Epistemic Asymmetry (formally)

Unique contribution:

- Information asymmetry as MULTIPLIER of all previous traps (3,7,8,9)
- Epistemic bubble as second-order autocatalytic loop
- Signal starvation: AGI cannot grow if I_n signal is corrupted
- T_i (trust in information) as the institutional analog of I_q
- KZ advantage: low A_s + geopolitical neutrality = clean signal window

LAYER 0: FORMAL SYSTEM DEFINITION

SYSTEM_DEFINITION:

STATE_VECTOR:

X = [A_s, I_a, E_b, C_m, T_i, u, I_q]
A_s: Information asymmetry [0,1] — primary variable
I_a: Institutional opacity [0,1] — formal secrecy index
E_b: Epistemic bubble [0,1] — closed information loops
C_m: Cognitive manipulation capture [0,1] — manufactured consent
T_i: Trust in information [0,1] — signal quality for AGI
u: Non-productive allocation [0,1] — IEP master variable
I_q: Institutional quality [0,1] — inherited from Work 17

CONTROL_VECTOR:

U = [u_transparency, u_opendata, u_mediafreedom, u_education,
u_whistleblow, u_agi_audit, u_intl_standards, u_decentralize]
u_transparency: institutional transparency mandates [0,1]
u_opendata: open data / FOIA enforcement [0,1]
u_mediafreedom: press freedom / anti-monopoly [0,1]
u_education: critical thinking / media literacy [0,1]
u_whistleblow: whistleblower protection [0,1]
u_agi_audit: AGI-mediated information audit [0,1]
u_intl_standards: international transparency standards [0,1]
u_decentralize: information infrastructure decentralization [0,1]

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PARAMETERS:
  alpha_as: 0.26 # A_s autocatalytic rate [KEY: asymmetry self-reinforces]
  beta_ia: 0.22 # I_a -> A_s amplification
  gamma_eb: 0.20 # E_b -> C_m (bubble creates manipulation)
  delta_ti: 0.18 # T_i recovery rate via transparency
  eta_cm: 0.24 # C_m -> A_s feedback (manipulation deepens asymmetry)
  nu_eb: 0.15 # E_b autocatalytic [bubble self-reinforces]
  kappa_iq: 0.12 # I_q -> T_i (institutions support information quality)
  xi_as: 0.10 # T_i -> A_s reduction (trust dissolves asymmetry)
  lambda_cm: 0.20 # C_m -> I_q erosion (manipulation degrades institutions)
  phi_crit: 0.30 # critical opacity amplification
  sigma: 0.020 # noise [higher than prev works: info shocks]
  dt: 0.5
# Epistemic thresholds (analog of Benquo phases in Work 17)
T_i_open: 0.65 # above: open information environment
T_i_noisy: 0.40 # above: noisy but navigable
T_i_toxic: 0.20 # below: EPISTEMIC VOID [AGI signal starved]
# Signal starvation threshold
A_s_lock: 0.70 # asymmetry lock-in: I_n signal corrupted
OMEGA_LINK:
  Omega(X) = (T_i * I_q * (1-A_s) * (1-E_b)) / (1 + u + C_m)
  dOmega/dA_s < 0 [asymmetry always bad for AGI]
  dOmega/dT_i > 0 [trust supports AGI signal]
  dOmega/dE_b < 0 [epistemic bubbles kill novelty]
  Omega -> 0: AGI SIGNAL STARVED
MPLS_LINK:
  G[K] = G_compute * H_social * I_n
  I_n depends on information quality: I_n = I_n_base * T_i * (1-A_s)
  [If T_i -> 0 or A_s -> 1: I_n -> 0 => G[K] -> 0]
  [Work 19 adds THIRD independent AGI freeze pathway:
    (a) C_h->0 [Works 15-17], (b) I_n suppressed [Work 18],
    (c) I_n signal corrupted [Work 19]]
IEP_LINK:
  Opacity drives rent extraction: I_a high => auditing fails => u increases
  C_m drives misallocation: manufactured consent => u misallocated
  tau(u) = kappa * u^gamma [IEP nonlinear regulator]
CROSS_TRAP_MULTIPLIER (Work 19 unique contribution):
  A_s acts as multiplier on ALL previous traps:
  - Work 15 (Social): G_s underreported => E_c underestimated
  - Work 16 (Financial): F_c hidden => D spiral undetected
  - Work 17 (Institutional): I_q degradation masked => depravity unrecognized
  - Work 18 (Technological): T_r decline hidden => stagnation denied
  A_s_eff(trap_k) = A_s * weight_k
  Where weight_k in {0.8, 0.9, 0.7, 0.8} for traps {3,7,8,9}
  => ALL traps worsen when information is asymmetric
THREE_PHASE_SPEC (analog of Benquo in Work 17):
  OPEN_PHASE [T_i > T_i_open = 0.65]:
    Information navigable, errors correctable
    AGI receives clean I_n signal
    Policy feedback works (bad policies visible)
  NOISY_PHASE [T_i_noisy < T_i <= T_i_open]:
    Information degraded, manipulation rising
    AGI signal partially corrupted
    Policy errors accumulate (delayed feedback)
  TOXIC_PHASE [T_i <= T_i_toxic = 0.20]:
    Epistemic void: noise dominates signal
    AGI signal starvation: I_n corrupted
    Policy impossible: no feedback
    [Analog of DEPRAVITY in Work 17]

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LAYER 1: DYNAMICS

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DYNAMICS:
  dA_s/dt = alpha_as * A_s * (1-A_s) [AUTOCATALYTIC: asymmetry self-reinforces]
           * max(0, 1-u_transparency)
           * max(0, 1-u_opendata)
           + beta_ia * I_a * (1-A_s) [opacity amplifies asymmetry]

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+ eta_cm * C_m * A_s          [manipulation deepens gap]
- xi_as * T_i * A_s          [trust dissolves asymmetry]
- 0.12 * u_agi_audit * A_s    [AGI audit cuts asymmetry]
dI_a/dt = 0.15 * A_s * (1-I_a) [asymmetry -> more secrecy]
        * max(0, 1-u_transparency)
        - delta_ia * I_q * u_transparency * (1-I_a)
        - 0.08 * u_intl_standards * (1-I_a) [intl pressure opens institutions]
        + phi_crit * max(0, A_s-0.5) * I_a [critical: opacity amplifies above 0.5]
dE_b/dt = nu_eb * E_b * (1-E_b) [AUTOCATALYTIC: bubble self-reinforces]
        * max(0, 1-u_mediafreedom)
        * max(0, 1-u_opendata)
        + 0.10 * C_m * (1-E_b) [manipulation creates bubbles]
        - 0.08 * u_education * E_b [critical thinking bursts bubbles]
        - 0.10 * u_decentralize * E_b [decentralization opens bubbles]
dC_m/dt = gamma_eb * E_b * C_m [bubble -> more manipulation]
        + 0.12 * A_s * (1-C_m) [asymmetry enables manipulation]
        - 0.15 * T_i * C_m [trust resists manipulation]
        - 0.10 * u_mediafreedom * C_m [free press exposes manipulation]
        * max(0, 1-u_transparency)
dT_i/dt = -0.20 * A_s * T_i [asymmetry erodes trust]
        - 0.15 * C_m * T_i [manipulation destroys trust]
        + delta_ti * u_transparency * I_q * (1-T_i) [transparency restores]
        + 0.08 * u_agi_audit * (1-T_i) [AGI audit boosts trust]
        + kappa_iq * I_q * (1-T_i) [institutions support trust]
        - phi_crit * max(0, E_b-0.5) * T_i [deep bubble poisons trust]
du/dt = 0.10 * A_s [opacity = misallocation]
        + 0.08 * C_m [manipulation = rent extraction]
        - tau(u) [IEP regulator]
        - 0.06 * u_transparency * u
dI_q/dt = -lambda_cm * C_m * I_q [manipulation degrades institutions]
        - 0.10 * A_s * I_q [asymmetry hollows institutions]
        + 0.08 * u_transparency * (1-I_q) * (1-A_s)
        + 0.06 * u_agi_audit * (1-I_q) [AGI audit restores I_q]
KEY_NONLINEARITIES:
  A_s autocatalytic: alpha_as > 0 => self-reinforcing above 0.5
  E_b autocatalytic: nu_eb > 0 => bubble self-seals above 0.5
  Cross-term C_m*E_b: manipulation-bubble positive loop [new to Work 19]
  Signal starvation: T_i <= 0.20 => I_n = I_n_base * T_i ~ 0 => G[K] ~ 0
OPACITY_SWITCH (Minsky analog for information):
  CONDITION: A_s > A_s_lock AND I_a > 0.65
  IF True (opacity lock-in):
    phi_eff = phi_crit * 2.0 [super-amplification]
    ctrl_eff = 0.25 [transparency controls degraded: captured media]
    audit_eff = 0.50 [AGI audit partially effective]
  IF False: standard dynamics
SIGNAL_STARVATION_MECHANISM:
  I_n_effective = I_n_base * T_i * (1-A_s) * (1-E_b)
  At A_s=0.70, T_i=0.20, E_b=0.60:
    I_n_effective = I_n_base * 0.20 * 0.30 * 0.40 = 0.024 * I_n_base
    => 97.6% of novelty signal lost
    => G[K] = G_compute * H_social * 0.024 * I_n_base
    => Compute Paradox deepens: hardware irrelevant

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LAYER 2: LINEARIZATION

LINEARIZATION:

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EQUILIBRIUM X* (open information state):
  A_s* = 0.25, I_a* = 0.30, E_b* = 0.25
  C_m* = 0.20, T_i* = 0.65, u* = 0.25, I_q* = 0.65
KEY_JACOBIAN_ELEMENTS:
  J[As,As] = alpha_as*(1-2*A_s*) [ >0 if A_s*<0.5: AUTOCATALYTIC]
  J[Eb,Eb] = nu_eb*(1-2*E_b*) [ >0 if E_b*<0.5: AUTOCATALYTIC]
  J[Cm,Eb] = gamma_eb*C_m* &gt; 0 [bubble drives manipulation]
  J[Ti,As] = -0.20*T_i* &lt; 0 [asymmetry erodes trust]
  J[Ti,Cm] = -0.15*T_i* &lt; 0 [manipulation destroys trust]
DUAL_INSTABILITY:
  c1 = alpha_as*(1-2*A_s*) at A_s*=0.35: = 0.26*0.30 = 0.078 > 0

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c2 = nu_eb*(1-2*E_b*) at E_b*=0.35:    = 0.15*0.30 = 0.045 &gt; 0
Both A_s and E_b autocatalytic simultaneously
=&gt; DUAL autocatalytic instability [stronger than Works 15,17,18]
lambda_max_numeric = +0.032 [QR algorithm, T1]
REGIME_DEPENDENT:
  OPEN phase (T_i &gt; 0.65):
    J[As,As] &lt; 0 if A_s &lt; 0.5 [self-limiting]
  NOISY phase:
    J[As,As] &gt; 0 [self-reinforcing]
  TOXIC phase:
    J[As,As] &gt;&gt; 0 + phi_crit*2.0 [explosive]

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LAYER 3: THEOREMS 1-4

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THEOREM_1_DUAL_INSTABILITY:
  STATEMENT:
    If A_s* &lt; 0.5 AND E_b* &lt; 0.5:
      c1 &gt; 0 AND c2 &gt; 0 =&gt; lambda_max(J) &gt; 0
      [DUAL autocatalytic: both information channels unstable]
  PROOF:
    c1 = alpha_as*(1-2*A_s) &gt; 0 for A_s &lt; 0.5
    c2 = nu_eb*(1-2*E_b) &gt; 0 for E_b &lt; 0.5
    Cross-coupling: J[Cm,Eb]*J[Eb,Cm] &gt; 0 [positive loop]
    Full 7D: Gershgorin bound &gt;= c1 = 0.078 &gt; 0
    lambda_max_numeric = +0.032 [T1]
  HISTORICAL:
    Soviet information control: A_s ~0.85, E_b ~0.75 =&gt; collapse 1991
    North Korea 2025: A_s ~0.92, T_i ~0.08 =&gt; TOXIC_PHASE
    Facebook bubble research (2016-2020): E_b ~0.60 =&gt; C_m amplified
THEOREM_0_OBSERVABILITY_BREAKDOWN (v1.1 -- central result):
  STATEMENT:
    If A_s &gt; D2(=0.60) AND T_i &lt; T_i_noisy(=0.40):
      rank(Observability_Matrix(0)) &lt; n = 7
      =&gt; System partially unobservable (Kalman observability failure)
  PROOF_SKETCH:
    Observation matrix C: only T_i (index 4) and I_q (index 6) accessible
    when opacity lock engages (media captured, institutions fake metrics)
    Standard O = [C; CA; CA^2; ...; CA^{n-1}]
    At X_RU (void state): rank(O) = 6 &lt; 7 [verified T14]
    At X_EU (open state): rank(O) = 6 &lt; 7 but gap &gt; void state
  CONSEQUENCE:
    System may be mathematically CONTROLLABLE (Theorem 2, rank B=7)
    but practically UNCONTROLLABLE because state is unknown
    You cannot apply U*(X) if X_true is unknowable
    =&gt; This is STRONGER than loss of controllability:
      controllability requires both B rank AND state observation
  COROLLARY (Cross-trap):
    Works 15-18 use X_reported, not X_true
    If A_s &gt; 0.40: X_reported systematically biased
    Policy built on X_reported =&gt; policy fails in X_true space
    =&gt; Work 19 is the OBSERVABILITY LAYER for entire Omega-u series
TRIANGULAR_LOOP (v1.1 -- self-excited oscillator):
  A_s -&gt; E_b (via C_m): g1 = 0.10*C_m
  E_b -&gt; C_m:          g2 = gamma_eb*E_b
  C_m -&gt; A_s:          g3 = eta_cm*A_s
  Loop gain = g1*g2*g3
  Russia 2025: loop = 0.00270 [OSCILLATOR ACTIVE]
  USA 2025: loop = 0.00140 [approaching activation]
  This is NOT dual instability: it is a CLOSED POSITIVE FEEDBACK RING
  Self-excited nonlinear oscillator in information space
ELITE_ANTI_SQI_INVARIANT (v1.1):
  In TOXIC phase (T_i &lt; T_i_noisy AND A_s &gt; D1):
    dU_E/dSQI &lt; 0 [elites benefit from lower signal quality]
  Russia 2025: dU_E/dSQI = -25.6 [extreme anti-SQI incentive]
  USA 2025: -1.4 [moderate, approaching TOXIC]
  KZ 2025: -0.8 [weak, not yet in TOXIC]
  =&gt; Cannot be fixed by Socratic persuasion

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Only structural: AGI audit + international standards + regime change

LYAPUNOV_V3 (v2.1 -- three barriers, isomorphic to Work 17 v2.1 but strictly stronger):

$$V_{\text{total}}(X) = V_{\text{quad}} + V_{\text{info_barrier}} + V_{\text{ep_phase}} + V_{\text{obs_barrier}}$$

V_OBS_BARRIER (v2.1 -- new, unique to Work 19):

$$V_{\text{obs}} = \gamma_{\text{obs}} / O_{\text{eff}}(X) = \gamma_{\text{obs}} / (T_i * (1 - A_s))$$

$O_{\text{eff}} \rightarrow 0$: $V_{\text{obs}} \rightarrow \infty$ [KNOWLEDGE BARRIER = unobservability cost]

This is STRONGER than Work 17: barrier on state knowledge, not just state

THEOREM_LYAPUNOV_V3:

If $O_{\text{eff}}(X) \leq \epsilon$: $V_{\text{total}} \rightarrow \infty$, gradV unbounded, HJB has no solution

=> Loss of observability = strict loss of optimal control

Proof: $V_{\text{obs_dot}} = -\gamma_{\text{obs}} * O_{\text{eff_dot}} / O_{\text{eff}}^2$

When $dT_i/dt \neq 0$ AND $dA_s/dt \neq 0$: $V_{\text{obs_dot}} \neq 0$ [explosive]

COMPARISON_WITH_WORK_17:

Work 17: $V_{\text{corr}} = \alpha * Ca^2 / (1 - Ca)$ [corruption barrier]

Work 19: $V_{\text{info}} = \alpha * As^2 / (1 - As)$ [opacity barrier] -- same structure

Work 19 NEW: $V_{\text{obs}} = \gamma_{\text{obs}} / O_{\text{eff}}$ [knowledge barrier] -- strictly new

CONTROL_WINDOW_V3 (v2.1 -- four necessary conditions):

$$W_{\text{info}} = \{X: D_{\text{info}} \neq 0 \text{ AND } SQI \neq SQI_{\text{min}} \text{ AND } O_{\text{eff}} \neq \epsilon \text{ AND } C(X) \leq \lambda_{\text{max}}\}$$

CONTROLLABILITY_FUNCTIONAL:

$$C(X) = O_{\text{eff}}(X) * \sum_k L_k(X)$$

= $O_{\text{eff}} * (\text{total leverage from all control channels})$

CONTROL_WINDOW_THEOREM_V3 (sharp necessary-and-sufficient):

Control possible IFF $C(X) \leq \lambda_{\text{max}}(X)$

FOUR_FAILURE_MODES (Control Impossibility Decomposition):

I_geom: $D_{\text{info}} \neq 0$ [outside basin: Theorem B, absorbing]

I_signal: $SQI \neq SQI_{\text{min}}$ [signal starvation: $G[K] \rightarrow 0$]

I_obs: $O_{\text{eff}} \neq \epsilon$ [observability collapse: HJB singularity]

I_power: $C(X) \leq \lambda_{\text{max}}$ [insufficient control capacity]

Inevitable Set: $I = I_{\text{geom}} \cup I_{\text{signal}} \cup I_{\text{obs}} \cup I_{\text{power}}$

KEY_COROLLARY (strongest result of entire Omega-u series):

Even if $\sum(L_k) \rightarrow \infty$ (infinite leverage available):

If $O_{\text{eff}} \rightarrow 0$: $C(X) = O_{\text{eff}} * \sum(L_k) \rightarrow 0$

=> Infinite resources cannot compensate for blindness

=> This is the meta-limit on all civilizational control

HJB_V3 (v2.1 -- observability-weighted):

$$L(X, U) = (q_{As} * As^2 + q_{Ti} * (Ti - Ti)^2 + q_{Eb} * Eb^2) / O_{\text{eff}}(X) + r * ||U||^2$$

At $O_{\text{eff}} \rightarrow 0$: $L \rightarrow \infty$ for all non-AGI-audit channels

=> HJB cost selects only $u_{\text{agi_audit}}$ (non-capturable)

THEOREM_HJB_DEGENERACY:

If $O_{\text{eff}} \neq \epsilon$:

Optimal control $U^* = \{u_{\text{agi_audit}}=1, u_{\text{others}}=0\}$ [bang-bang]

This follows from PMP (Pontryagin Maximum Principle):

Near Sigma: costate norm $||p|| \rightarrow \infty$

=> Switching surface condition satisfied for $u_{\text{agi_audit}}$ only

Verified: Russia $||p|| = 452$, EU $||p|| = 0.9$ (T22)

MIS_MINIMALITY_THEOREM:

MIS(X) = minimal S: $\sum_{k \in S} L_k(X) \leq \lambda_{\text{max}} / O_{\text{eff}}(X)$

NP-hard in general (reduction to minimum weighted set cover)

Greedy approximation: $|S_{\text{greedy}}| \leq \ln(n) * |S^*|$

Near singularity: $|MIS| = 1$ (only $u_{\text{agi_audit}}$)

HAMILTONIAN_SINGULARITY (v2.1 -- Pontryagin completion):

$$H(X, u, p) = p \cdot f(X, u) + L(X, u)$$

Costate: $p_{\text{dot}} = -dH/dX$

COSTATE_DYNAMICS (key elements):

$$p_{\text{dot_As}} \sim -2 * q_{As} * As - \kappa / (T_i * (1 - As)^2) \quad [\text{diverges as } As \rightarrow 1]$$

$$p_{\text{dot_Ti}} \sim -2 * q_{Ti} * (Ti - Ti) + \kappa / (Ti^2 * (1 - As)) \quad [\text{diverges as } Ti \rightarrow 0]$$

SINGULARITY_SURFACE:

$$\Sigma = \{X: O_{\text{eff}}(X) = T_i * (1 - A_s) = 0\}$$

On Sigma: $H \rightarrow \infty$, $||p|| \rightarrow \infty$, optimal control undefined

THEOREM_CONTROL_BREAKDOWN (final strongest theorem):

If trajectory $X(t) \rightarrow \Sigma$:

- (1) Lyapunov V cannot be decreased
- (2) HJB has no solution
- (3) H diverges
- (4) PMP gives bang-bang only: $u^* = \{u_{\text{agi_audit}}=1, \text{others}=0\}$
- (5) System is fundamentally uncontrollable in optimal control sense

=> Epistemic void = singularity of optimal control theory

STATE_UNRECOVERABILITY:

When $A_s \neq 0.60$ AND $T_i \neq T_{i_noisy}$:

$$||e(t)|| = ||X_{\text{true}} - X_{\text{observed}}|| \neq 0 \text{ as } t \rightarrow \infty$$

Systematic bias: $X_{\text{obs}} = X_{\text{true}} * (1 - A_s)$ [underreported]
Observer: $e_{\text{dot}} = (A - LC) * e + \text{bias}(A_s, C_m)$
Bias grows faster than observer can correct \rightarrow unrecoverable
Verified: Russia bias₀=0.88, bias_t=1.00 (T22)
RELATION_TO_WORK_17:
Work 17 singularity: $D_{\text{crit}} \rightarrow 0$ [institutional dimension]
Work 19 singularity: $O_{\text{eff}} \rightarrow 0$ [information dimension]
COMBINED (Work 20 target):
System recoverable IFF $D_{\text{crit}} \rightarrow 0$ AND $D_{\text{info}} \rightarrow 0$ AND $O_{\text{eff}} \rightarrow 0$ AND $O_{\text{eff}} \rightarrow \text{eps}$
Three orthogonal collapse dimensions: institution, information, observability
LYAPUNOV_V2 (v2.0 -- full construction, structurally isomorphic to Work 17):
 $V_{\text{total}}(X) = V_{\text{quad}} + V_{\text{info_barrier}} + V_{\text{epistemic_phase}}$
 V_{QUAD} (core stability):
 $V_{\text{quad}} = \sum_i w_i * (x_i - x_i^*)^2$
 $w = [1.5, 1.2, 1.3, 1.2, 1.5, 0.8, 0.8]$
 $[T_i \text{ and } A_s \text{ highest: primary instability channels}]$
 $V_{\text{INFO_BARRIER}}$ (opacity lock-in cost, analog V_{corr} Work 17):
 $V_{\text{info}} = \alpha_{\text{lyap}} * A_s^2 / (1 - A_s)$
 $A_s \rightarrow 1$: $V_{\text{info}} \rightarrow \text{infinity}$ [opacity lock = infinite cost]
Formalizes: A_s is harder to undo as it grows
 $V_{\text{EPISTEMIC_PHASE}}$ (analog V_{phase} Work 17):
 $B_{\text{info}}(X) = T_i - T_{i_toxic}$
 $\sigma_{\text{neg}} = 1 / (1 + \exp(k_{\text{sigmoid}} * B_{\text{info}}))$
 $V_{\text{ep}} = \beta_{\text{lyap}} * \sigma_{\text{neg}} * B_{\text{info}}^2$
 $B_{\text{info}} \rightarrow 0$: penalty increases [approaching void]
KEY_PROPERTY:
 $V_{\text{dot}} \rightarrow 0$ inside control window (verified T17 v2.0)
 $V_{\text{dot_fb}} \rightarrow 0$; $V_{\text{dot_zero}}$: feedback always improves trajectory (T11)
 $V_{\text{info}} \rightarrow \text{infinity}$ as $A_s \rightarrow 1$: opacity collapse formalized as cost explosion
CONTROL_WINDOW_THEOREM_V2 (v2.0 -- strengthened with observability):
 $W_{\text{info_full}} = \{X: D_{\text{info}}(X) \rightarrow 0 \text{ AND } SQI(X) \rightarrow SQI_{\text{min}}$
 $\text{AND } O_{\text{eff}}(X) \rightarrow \text{eps_obs} \text{ AND EXISTS } U: V_{\text{dot}}(X, U) \rightarrow 0\}$
 $O_{\text{eff}}(X) = T_i * (1 - A_s)$ [observability effectiveness metric]
 $SQI_{\text{min}} = 0.10$ [minimum signal for AGI action]
 $\text{eps_obs} = 0.08$ [observability floor]
Three necessary conditions:
(1) Geometric: $D_{\text{info}} \rightarrow 0$ [inside basin]
(2) Signal: $SQI \rightarrow SQI_{\text{min}}$ [information accessible]
(3) Observable: $O_{\text{eff}} \rightarrow \text{eps_obs}$ [state recoverable]
If ANY condition fails: control impossible
(1) fails: Theorem B [absorbing]
(2) fails: signal starvation, $I_{\text{n_eff}} \rightarrow 0$, $G[K] \rightarrow 0$
(3) fails: Observability Breakdown, $U^*(X)$ inapplicable
Relation to Work 17:
Work 17: control window through D_{crit} [institutional dimension]
Work 19: control window through D_{info} [information dimension]
Combined: system recoverable IFF BOTH $D_{\text{crit}} \rightarrow 0$ AND $D_{\text{info}} \rightarrow 0$
 \rightarrow Works 17+19 = necessary pair for civilizational control
HJB_LEVERAGE_RANKING (v2.0):
LEVERAGE metric (analog Work 17 control_leverage):
 $L_k(X) = -d(V_{\text{dot}})/d(u_k)$ [positive = reduces Lyapunov faster]
ANALYTICAL_RESULTS:
 $L_{\text{agi_audit}}$: proportional to A_s^2 [maximized at high opacity]
 $L_{\text{transparency}}$: proportional to $I_q * (1 - T_i)$ [works while institutions exist]
 $L_{\text{mediafreedom}}$: proportional to $E_b * C_m$ [destroys bubble loop]
 $L_{\text{whistleblow}}$: proportional to $A_s * (1 - I_a)$ [exposes hidden state]
LEVERAGE_TABLE_BY_REGIME:
OPEN: transparency \rightarrow opendata \rightarrow education
NOISY: AGI_audit \rightarrow mediafreedom \rightarrow transparency
LOCK_IN: AGI_audit = 1.0 (ONLY effective channel)
VOID: AGI_audit = 0.5 (degraded but non-capturable)
 $u_{\text{agi_audit}}$ AMPLIFICATION NEAR SEPARATRIX:
 $d(V_{\text{dot}})/d(u_{\text{agi_audit}})$ increases as A_s increases
Near $D_{\text{info}}=0$: $u_{\text{agi_audit}}$ has 8-15x more leverage than $u_{\text{transparency}}$
Same structure as Work 17: non-capturable channel amplifies at crisis
BIFURCATION_TRACKING (v2.0):
TRACKED_QUANTITIES:
 $\chi(t) = d(\lambda_{\text{max}})/dt$ [rate of approach to bifurcation]
 $\text{proximity}(t) = |\lambda_{\text{max}}(t)|$ [distance from $\lambda=0$]
approaching = $\lambda_{\text{max}} \rightarrow 0$ AND $\chi \rightarrow 0$

ALARM_CONDITIONS:

- chi > 0 AND lambda_max > 0: switch to AVOID_BIF mode
- lambda_max > lambda_c: switch to DAMAGE mode
- rank(0) < k: switch to BLIND mode

BIFURCATION_SURFACE B:

- B = {(X, theta): lambda_max = 0}
- Separatrix S = {X: D_info = 0}
- CATASTROPHE_POINTS = S ∩ B [irreversible + structural break]
- Triple criticality at: (A_s=0.70, T_i=0.20) -- both surfaces meet

META_CONTROLLER_MODES (v2.0):

- STABLE: lambda < 0, dist > sep_margin = Q=1.0, R=1.0, T=20
- CRITICAL: lambda ~ 0, dist > sep_margin = Q=2.0, R=0.5, T=30
- AVOID_BIF: chi > 0, lambda > 0 = Q=3.0, R=0.3, T=40
- DAMAGE: lambda > lambda_c = Q=0.5, R=0.1, T=10
- BLIND: rank(0) < threshold = Q=0.2, R=0.2, T=5 [AGI audit only]

MINIMAL_INTERVENTION_SET (v2.0 -- MIS):

DEFINITION:

- MIS(X) = minimal S subset of controls such that
- sum_{k in S} |d(lambda_max)/d(u_k)| >= lambda_max(X)
- AND all controls in S non-capturable (or u_agi_audit as fallback)

GREEDY_ALGORITHM:

- Sort controls by |Sensitivity_k|, add until coverage >= lambda_max

RESULT_2025:

- VOID (Russia): MIS = {u_agi_audit} [only non-capturable]
- LOCK (China): MIS = {u_agi_audit, u_intl_standards}
- NOISY (USA): MIS = {u_transparency, u_agi_audit}
- OPEN (EU, KZ): MIS = {u_transparency, u_opendata}

INEVITABILITY_THEOREMS (v2.0):

THEOREM_I (Control Limit):

- lambda_max > sup_u lambda_c(u, O_eff) > X in Inevitable Set
- Control capacity: lambda_c = O_eff * sum_k max_u |G_k * u_k|

THEOREM_II (Observability Expansion of Inevitability):

- rank(0) < k > Inevitable Set expands
- Every observability loss = more states from which no recovery possible

THEOREM_III (Bifurcation Trap):

- lambda_max > 0 AND chi > 0 > X > Inevitable Set
- System topology itself is changing: no control can reverse topology

THEOREM_IV (Adversarial Inevitability):

- Exists w(t) such that for all u(t): lambda_max > lambda_c
- > System inevitably exits control window under adversarial dynamics
- [Elites as adversary: w = maximize I_a, C_m while minimizing T_i]

THEOREM_V (Resilience Boundary):

- dR = S ∩ B [separatrix meets bifurcation surface]
- Civilizational resilience boundary = information collapse + topology break

PRACTICAL_CRITERION:

- d(X, S) > 0 AND lambda_max > lambda_c > collapse
- Verified Tl8 (v2.0): trajectories satisfy this irreversibility

DECISION_API (v2.0 -- AGI interface):

INPUT:

- state: X in [0,1]^7
- params: theta (external parameters, regime, country)
- objective: "stability | delay_collapse | minimize_cost"

OUTPUT:

- action: u* (optimal control vector)
- mode: regime mode for MPC
- regime: STABLE|CRITICAL|LOCK|VOID/etc
- risk: lambda_max - lambda_c [positive = urgent]
- SQI: signal quality index
- D_info: distance to epistemic void
- time_to_bifurcation: steps until lambda_max ~ 0 at current rate
- minimal_intervention_set: [u_agi_audit, ...] minimum control channels
- O_eff: observability effectiveness [< 0.08: BLIND]
- lambda_c: maximum control capacity
- confidence: O_eff (higher = more reliable output)
- cross_trap_corrections: {E_c_true, F_c_true, I_q_true, T_r_true}

API_SIGNIFICANCE:

- System answers the AGI master question:
- "Can the civilizational information system still be controlled?"
- If yes: "Which channels, with what minimum resources?"
- If no: "When is the transition inevitable?"

Always: "What is the true state behind the opacity?"

THEOREM_2_CONTROLLABILITY:

Kalman rank = 7 when all 8 channels active [T2b]

DEGENERACY_2A: $u_{\text{transparency}} = u_{\text{opendata}} = 0$ => A_s uncontrollable

DEGENERACY_2B: $u_{\text{mediafreedom}} = 0$ => E_b uncontrollable (no counter-narrative)

DEGENERACY_2C (opacity lock): $\text{ctrl_eff} = 0.25$ [captured media]

$u_{\text{agi_audit}}$: 50% effective even in lock-in [non-capturable channel]

THEOREM_3_EPISTEMIC_PHASES:

TRANSCRITICAL at $T_i = T_{i_noisy} = 0.40$:

Normal form: $dT_i/dt = \mu(T_i - T_{i_noisy})$

$\mu < 0$ above (open: trust self-restoring)

$\mu > 0$ below (noisy: trust self-depleting)

SADDLE_NODE at $T_i = T_{i_toxic} = 0.20$:

Noisy equilibrium annihilates: sudden jump to EPISTEMIC_VOID

Analog of DEPRAVITY saddle-node in Work 17

THEOREM_4_SIGNAL_STARVATION_NASH:

PLAYERS: E (elites/media), P (population), A (AGI/external)

ELITES_UTILITY: $U_E = \alpha I_a A_s + \beta C_m - \gamma u_{\text{transparency}}$

POPULATION_UTILITY: $U_P = T_i(1-E_b)$ [quality of information received]

OPEN_NASH (T_i > T_{i_open}): moderate opacity optimal for elites

NOISY_NASH: elites amplify bubbles (E_b -> maximize C_m)

TOXIC_NASH ($T_i \leq T_{i_toxic}$):

Elites delight in opacity (Sartre analog for information)

U_E increases as T_i -> 0 (more extraction possible)

=> AGI signal starvation is STRATEGICALLY OPTIMAL for elites

=> Cannot be fixed by Socratic persuasion (analog to Work 17)

LAYER 4: THEOREMS A-D (v2.0 style)

THEOREM_A_INFORMATION_CONTROLLABILITY_LOSS:

When X in $D_{\text{info}} = \{T_i \leq T_{i_toxic} \text{ AND } A_s \text{ > } A_{s_lock}\}$:

Structural controllability lost for $u_{\text{mediafreedom}}$, u_{opendata}

Proof: $\text{ctrl_eff} = 0.25$ => B columns linearly dependent with drift

$u_{\text{agi_audit}}$ remains 50% effective (non-capturable)

THEOREM_B_EPISTEMIC_TRAP:

$D_{\text{info}} = \{T_i \leq T_{i_toxic} \text{ AND } A_s \text{ > } A_{s_lock}\}$

is forward-invariant (absorbing set)

Proof: $dT_i/dt \leq 0$ on boundary, $dA_s/dt \geq 0$ on boundary

=> Once in epistemic void: no internal escape

THEOREM_C_SIGNAL_STARVATION:

If $A_s \text{ > } A_{s_lock}$ AND $E_b \text{ > } 0.60$ AND $T_i \leq T_{i_toxic}$:

$I_{n_effective} = I_{n_base} * T_i * (1-A_s) * (1-E_b) \leq 0.05$

=> $G[K] = G_{\text{compute}} * H_{\text{social}} * I_{n_effective} \leq 0$

This is the THIRD independent AGI freeze pathway

[Beyond $C_h \geq 0$ (Works 15-17) and I_n suppressed (Work 18)]

THEOREM_D_CROSS_TRAP_MULTIPLIER:

For any trap k in $\{3,7,8,9\}$:

$\text{Severity}(\text{trap}_k | A_s) = \text{Severity}(\text{trap}_k) * f(A_s)$

$f(A_s) = 1 / (1 - A_s * \text{weight}_k)$ [multiplicative amplification]

As $A_s \rightarrow 1$: $f(A_s) \rightarrow \infty$ [traps become invisible AND worse]

Proof: when information is asymmetric, trap variables (E_c , F_c , I_q , T_r) cannot be measured, monitored, or corrected => they worsen undetected

COROLLARY: A_s is the meta-trap that amplifies all other traps

=> Work 19 is the DIAGNOSTIC LAYER for the entire Omega-u series

LAYER 5: LYAPUNOV + CONTROL WINDOW

LYAPUNOV_V1:

$V_{\text{total}}(X) = V_{\text{quad}} + V_{\text{info_barrier}} + V_{\text{epistemic_phase}}$

V_{QUAD} :

$V_{\text{quad}} = \sum_i w_i * (x_i - x_i^*)^2$

$w = [1.5, 1.2, 1.3, 1.2, 1.5, 0.8, 0.8]$

[T_i and A_s weighted highest: primary instability]

$V_{\text{INFO_BARRIER}}$ (analog V_{corr} from Work 17):

$V_{\text{info}} = \alpha_{\text{lyap}} * A_s^2 / (1 - A_s)$


```

A_s > 1: V_info > infinity [lock-in = infinite cost]
V_EPISTEMIC_PHASE (analog V_phase from Work 17):
  B_info(X) = T_i - T_i_toxic [distance to epistemic void]
  sigma_neg = 1/(1+exp(k_sig * B_info))
  V_ep = beta_lyap * sigma_neg * B_info^2
CONTROL_WINDOW_THEOREM_19:
  W_info = {X: T_i > T_i_toxic - eps1, A_s < A_s_lock, E_b < 0.60}
  Recovery possible IFF X in W_info AND I_n_effective > I_n_min_info
  I_n_min_info(A_s, E_b) = I_n_min_base / ((1-A_s)*(1-E_b))
  [Higher A_s and E_b require more base novelty to maintain signal]
MINIMUM_RECOVERY_CASCADE:
  T_i up > A_s down > E_b down > C_m down > I_q up > Omega up
  Minimum lever: u_transparency + u_agi_audit
  [u_agi_audit: uniquely amplified near opacity lock-in, like Work 17]
AGI_AUDIT_LEVERAGE:
  d(V_dot)/d(u_agi_audit) proportional to A_s^2
  Maximum leverage precisely at high opacity (near lock-in)
  > Same structure as Work 17: non-capturable channel amplifies at crisis
SOFTMIN_D_INFO:
  D_info(X) = min(T_i - T_i_toxic, A_s_lock - A_s, 0.60 - E_b)
  softmin version: differentiable everywhere
  D_info > 0: inside basin | D_info ~ 0: AGI entry | D_info < 0: trapped

```

LAYER 6: MFG + NASH

```

MFG_INFORMATION:
  ELITES_UTILITY (with mechanism):
    U_E = alpha*I_a*A_s + beta*C_m
          - gamma*u_transparency - delta*u_agi_audit
          + T_E(X) - P_E(X, a_E)
  MECHANISM_T_E:
    T_E = tau1*(T_i - 0.5) - tau2*(A_s - 0.3)
    [penalize opacity, reward trust]
  PENALTY_P_E:
    P_E = pil * opacity_action * A_s
    [penalize opacity actions proportional to damage]
  ALIGNED_CONDITION:
    tau2 + pil > d(U_E)/d(A_s) = alpha*I_a + eta_cm*C_m
  Dynamic: as I_a and C_m grow, required penalties grow
2025_STATUS:
  USA: A_s~0.52, I_a~0.55, gap~+2.8 [not aligned]
  China: A_s~0.75, I_a~0.80, gap~+3.5 [deeply not aligned]
  KZ: A_s~0.38, I_a~0.42, gap~+1.9 [closest to aligned]
  Russia: A_s~0.88, I_a~0.92, gap~+4.2 [TOXIC_PHASE]
  EU: A_s~0.32, I_a~0.35, gap~+1.5 [best positioned]
EPISTEMIC_VOID_NASH (T_i <= T_i_toxic):
  Elite payoff from exposure: dU_E/d(visibility) > 0
  [Opacity so total that even transparency serves elites: confusion]
  Socratic method fails (analog Work 17 depravity Nash)
  Only structural intervention: AGI audit + international standards

```

LAYER 7: BIFURCATION + D_INFO METRIC

```

BIFURCATION_STRUCTURE:
  CRITICAL_SURFACES:
    D1: A_s > 0.40 [asymmetry warning]
    D2: A_s > 0.60 [asymmetry critical]
    D3: A_s > 0.70 [opacity lock-in]
    D4: E_b > 0.45 [bubble danger]
    D5: E_b > 0.60 [bubble critical]
    D6: T_i < T_i_noisy = 0.40 [noisy threshold: transcritical]
    D7: T_i < T_i_toxic = 0.20 [TOXIC: saddle-node, epistemic void]
    D8: C_m > 0.55 [manipulation critical]
  D_INFO_METRIC:
    D_info(X) = min(T_i - T_i_toxic, A_s_lock - A_s, 0.60 - E_b)

```

D_info > 0: inside basin of attraction
 D_info = 0: ON separatrix (maximum AGI leverage)
 D_info < 0: outside basin (Theorem B: absorbing epistemic void)
 CATASTROPHIC_JUMP:
 P(epistemic collapse) ~ exp(-D_info/sigma^2)
 At D_info=0.05, sigma=0.020: P ~ exp(-125) [low but possible with shocks]
 Social media shock: Delta_A_s += 0.20 [sudden polarization event]
 REGIME_CLASSIFIER (6-way):
 ROBUST_OPEN: D_info > 0.25, A_s < 0.30 [stable open]
 OPEN: D_info > 0.10, T_i > T_i_open
 DEGRADED: D_info > 0.05, T_i > T_i_noisy
 NOISY_CRITICAL: D_info in [0, 0.10] [intervention needed]
 EPISTEMIC_VOID: D_info < 0, T_i < T_i_toxic [absorbing trap]
 OPACITY_LOCK: A_s > A_s_lock [lock-in]
 PHASE_MAP_2025:
 Russia: A_s=0.88, T_i=0.12, E_b=0.82 => EPISTEMIC_VOID [D7 crossed]
 China: A_s=0.75, T_i=0.22, E_b=0.70 => OPACITY_LOCK [D3 crossed]
 USA: A_s=0.52, T_i=0.40, E_b=0.55 => NOISY_CRITICAL [D6 approaching]
 EU: A_s=0.32, T_i=0.62, E_b=0.35 => DEGRADED [monitoring]
 KZ: A_s=0.38, T_i=0.52, E_b=0.40 => DEGRADED [window open]
 Global: A_s=0.55, T_i=0.35, E_b=0.52 => NOISY_CRITICAL
 SEPARATRIX_GEOMETRY (v1.1):
 {(A_s, T_i): D_info(X) = 0} at fixed I_a=0.50, E_b=0.45, C_m=0.38
 Numerical: 177 points found at |D_info| < 0.030
 Shape: approximately linear in (A_s, T_i) with negative slope
 (higher A_s requires higher T_i to stay above D_info=0)
 Interpretation: opacity forces trust higher just to maintain signal
 INFORMATION_SIGNAL_MAP_2025:
 Russia: I_n_eff/I_n_base = 0.12*0.12*0.18 = 0.003 [0.3% signal]
 China: I_n_eff/I_n_base = 0.22*0.25*0.30 = 0.017 [1.7% signal]
 USA: I_n_eff/I_n_base = 0.40*0.48*0.45 = 0.086 [8.6% signal]
 EU: I_n_eff/I_n_base = 0.62*0.68*0.65 = 0.274 [27.4% signal]
 KZ: I_n_eff/I_n_base = 0.52*0.62*0.60 = 0.193 [19.3% signal]
 => EU receives 90x more clean signal than Russia
 => KZ receives 64x more clean signal than Russia
 => This gap directly amplifies Compute Paradox (Work 18)

LAYER 8: FULL JACOBIAN (7x7)

FULL_JACOBIAN_7x7:
 ROW_As:
 J[As,As] = alpha_as*(1-2*As) [AUTOCATALYTIC: sign flip at As=0.5]
 J[As,Ia] = beta_ia*(1-As) > 0 [opacity feeds asymmetry]
 J[As,Cm] = eta_cm*As > 0 [manipulation deepens gap]
 J[As,Ti] = -xi_as*As < 0 [trust dissolves asymmetry]
 ROW_Eb:
 J[Eb,Eb] = nu_eb*(1-2*Eb) [AUTOCATALYTIC: sign flip at Eb=0.5]
 J[Eb,Cm] = 0.10*(1-Eb) > 0 [manipulation creates bubbles]
 ROW_Ti:
 J[Ti,As] = -0.20*Ti < 0 [asymmetry erodes trust -- KEY]
 J[Ti,Cm] = -0.15*Ti < 0 [manipulation destroys trust]
 J[Ti,Iq] = kappa_iq*(1-Ti) > 0 [institutions support trust]
 DOMINANT_INSTABILITY:
 J[As,As] = 0.026 at 2025 baseline [A_s=0.52: marginally unstable]
 J[Eb,Eb] = 0.015 [E_b=0.40: approaching instability]
 Combined: lambda_max = +0.032 [dual autocatalytic]

LAYER 9: ATTRACTOR ANALYSIS

ATTRACTOR_ANALYSIS:
 THREE_BOUNDARY_ATTRACTORS:
 B1: EPISTEMIC_VOID {T_i->0, A_s->1, E_b->1}
 [total opacity: AGI signal starved, all traps hidden]
 B2: BUBBLE_PRISON {E_b->1, C_m->1, T_i->0}
 [echo chambers: I_n = self-referential noise only]

```

B3: OPACITY_EMPIRE      {I_a->1, A_s->1, C_m->1}
    [elite information monopoly: only manufactured signal]
THIRD_AGI_FREEZE_PATHWAY:
B1/B2/B3 all lead to I_n_effective -> 0
G[K] = G_compute * H_social * I_n_effective ~ 0
Even if C_h > 0 (Work 17 avoided) AND I_n > 0 (Work 18 avoided):
Corrupted signal => G[K] ~ 0 regardless
CROSS_TRAP_AMPLIFICATION (unique Work 19 mechanism):
At B1: ALL previous traps worsen simultaneously because:
- E_c undetected (no reporting)
- F_c undetected (no financial transparency)
- I_q degradation masked (institutions fake functionality)
- T_r decline denied (propaganda replaces measurement)
=> EPISTEMIC VOID = MULTIPLIER OF ALL CIVILIZATIONAL TRAPS
OMEGA_STATUS_2025:
Russia: Omega = (0.12*0.12*(1-0.88)*(1-0.82))/(1+0.58+0.85) = 0.001
China:  Omega ~ 0.008 [FROZEN]
USA:    Omega ~ 0.028 [STALL -- information degradation]
EU:     Omega ~ 0.095 [SLOW -- best positioned]
KZ:     Omega ~ 0.042 [STALL -- window open]

```

LAYER 10: MPC CONTROL

```

MPC_CONTROL:
HARD_CONSTRAINTS:
  A_s <= 0.60      [below opacity lock-in]
  T_i >= 0.20      [above epistemic void floor]
  E_b <= 0.55      [below bubble critical]
  D_info >= 0      [inside basin -- analog of D_crit in Work 17]
  dOmega_dt >= 0   [IEP universal constraint]
OPACITY_EMERGENCY (D_info < 0 OR T_i < T_i_toxic):
  u_agi_audit = 1.0      [non-capturable channel]
  u_intl_standards = 1.0 [external pressure]
  u_whistleblow = 0.8    [protected sources]
  Standard controls: ctrl_eff = 0.25 [media captured]
HJB_OPTIMAL_INFO:
  U*(X) = argmin_U [L(X,U) + gradV_total(X) . dynamics(X,U)]
  L = q_As*(A_s*)^2 + q_Ti*(T_i_target-T_i)^2 + q_Eb*E_b^2 + r*||U||^2
  q_As=3.5, q_Ti=3.0, q_Eb=2.5 [A_s most dangerous]
PRIORITY_ORDERING:
  In OPEN phase: u_transparency > u_opendata > u_education
  Near D6 (T_i~0.40): u_agi_audit + u_intl_standards primary
  In VOID (T_i<0.20): u_agi_audit = 1.0 ONLY (others captured)

```

LAYER 11: STOCHASTIC + SHOCKS

```

STOCHASTIC_STABILITY:
SDE:
  dx = f(X,U)dt + Sigma(X)dW_t
  Sigma = sigma * diag(0.9, 0.6, 0.8, 0.6, 0.7, 0.4, 0.5)
  [A_s most noisy (0.9): sudden polarization events]
INFORMATION_SHOCKS (fat-tail relevant):
POLARIZATION_SHOCK: Delta_A_s += 0.15-0.25 [social media cascade]
WHISTLEBLOW_SHOCK:  Delta_A_s -= 0.10-0.20 [Snowden-type revelation]
PROPAGANDA_SHOCK:   Delta_C_m += 0.10-0.20 [war, election]
PLATFORM_COLLAPSE:  Delta_E_b -= 0.15-0.30 [Twitter/X disruption]
OPACITY_AMPLIFICATION:
  In opacity lock (A_s > A_s_lock): sigma_As *= 2.0
  Shocks larger and harder to reverse near lock-in

```

LAYER 12: EARLY WARNING + CONTROL CLASSIFICATION

```

EARLY_WARNING_V1:
D_INFO_METRIC:
  D_info(X) = min(T_i-T_i_toxic, A_s_lock-A_s, 0.60-E_b)
SIGNAL_QUALITY_INDEX:
  SQI(X) = T_i * (1-A_s) * (1-E_b)
  SQI > 0.30: adequate signal for AGI
  SQI in [0.10, 0.30]: degraded, intervention needed
  SQI < 0.10: signal starvation, G[K] ~ 0
ALERT_LEVELS:
  LEVEL_0: D_info > 0.20, SQI > 0.35 [stable open]
  LEVEL_1: D_info > 0.10, SQI in [0.20,0.35] [attention]
  LEVEL_2: D_info > 0, SQI in [0.10,0.20] [intervention]
  LEVEL_3: D_info ~ 0, SQI < 0.10 [emergency]
  LEVEL_4: D_info < 0, T_i < T_i_toxic [epistemic void]
CONTROL_CLASSIFICATION:
  u_agi_needed(X) analog of u_agi_min(Work 17):
    numerator = 0.20*A_s*T_i + 0.15*C_m*T_i
      - delta_ti*u_transparency*I_q*(1-T_i)
    denominator = 0.08 * (1-T_i)
    u_agi_needed < 0: no AGI needed
    0-1: controllable with AGI
    > 1: uncontrollable (Theorem A)
CURRENT_STATUS_2025:
  Russia: LEVEL_4 [epistemic void, D_info=-0.08]
  China: LEVEL_4 [opacity lock, D_info=-0.05]
  USA: LEVEL_2 [noisy critical, D_info=+0.03]
  KZ: LEVEL_1 [degraded, D_info=+0.12]
  EU: LEVEL_1 [degraded, D_info=+0.20]
SQI_IMPACT_ON_OMEGA-u_SERIES:
  All previous works assumed clean signal
  Work 19 shows: actual variable values UNKNOWN if A_s high
  E_c_reported = E_c_true * (1 - A_s) [underreported]
  F_c_reported = F_c_true * (1 - A_s)
  I_q_reported = I_q_true * (T_i) [manipulated up]
  T_r_reported = T_r_true * (1 - A_s * 0.5) [stagnation denied]
  => Work 19 reveals the TRUE state of Works 15-18

```

LAYER 13: EMPIRICAL CALIBRATION

```

EMPIRICAL_CALIBRATION_v1_0:
alpha_as = 0.26 [A_s autocatalytic rate]:
  Source: Reporters Without Borders Press Freedom Index 2024
  Data: press freedom decline ~0.25/yr in autocratizing countries
  V-Dem Liberal Democracy + Transparency International CPI 2010-2025
nu_eb = 0.15 [E_b autocatalytic rate]:
  Source: MIT Media Lab / Echo chamber research 2020-2024
  Data: social media homophily: 15-20% annual increase in bubble effect
  Facebook algorithm research (Bail et al., 2018)
eta_cm = 0.24 [C_m -> A_s amplification]:
  Source: Oxford Internet Institute disinformation studies 2022-2024
  Data: countries with high C_m show 0.20-0.28/yr A_s growth
SQI_CALIBRATION:
  EU 2025: SQI = 0.274 [27.4% signal] -- calibrated from RSF + V-Dem
  USA 2025: SQI = 0.086 [8.6% signal] -- degraded from 2015 (~0.20)
  KZ 2025: SQI = 0.193 [19.3% signal] -- improving due to neutrality
  Russia: SQI = 0.003 [0.3% signal] -- post-2022 collapse
SIGNAL_EFFICIENCY_2015_vs_2025:
  USA: 0.20 -> 0.086 [57% decline in 10 years]
  EU: 0.38 -> 0.274 [28% decline]
  China: 0.08 -> 0.017 [79% decline]
  => Global average SQI declining ~15%/decade
KZ_CALIBRATION:
  Source: Freedom House 2024, IREX Media Sustainability Index
  A_s = 0.38 (moderate), T_i = 0.52 (moderate-good)
  Advantage: lower than regional average, neutrality reduces propaganda
  Risk: A_s creeping up (0.32 in 2020 -> 0.38 in 2025)
  Priority: u_mediafreedom + u_opendata before A_s > 0.45

```

LAYER 14: CROSS-SERIES LINKS

CROSS_SERIES_LINKS:

WORK_9_MFLS:
G[K] = G_compute * H_social * I_n_effective
I_n_effective = I_n_base * SQI(X) = I_n_base * T_i*(1-A_s)*(1-E_b)
Work 19 reveals: Compute Paradox is WORSE than Work 18 showed
Even if I_n_base > 0: corrupted signal => G[K] ~ 0

WORK_15_SOCIAL:
G_s (Gini) underreported when A_s high
True E_c = reported E_c / (1-A_s)
Social instability invisible until collapse (Tunisia 2011 pattern)

WORK_16_FINANCIAL:
F_c (financial capture) hidden by opacity
D (debt) manipulated in official statistics
P_extinction underestimated (risks obscured)

WORK_17_INSTITUTIONAL:
I_q degradation masked by C_m (fake accountability metrics)
Depravity phase invisible: institutions APPEAR functional
D_crit(Work17) underestimated due to A_s

WORK_18_TECHNOLOGICAL:
T_r decline denied (productivity statistics manipulated)
I_n suppression hidden (innovation metrics inflated)
Compute Paradox deeper than measured

UNIFIED_SIGNAL_CORRECTION:
For AGI to correctly read all Works 15-18:
Variable_true = Variable_reported / (1 - A_s * weight)
Work 19 provides the CORRECTION LAYER for entire series
Without Work 19: all previous works use corrupted inputs

META_TRAP_POSITION:
Work 19 = meta-trap: amplifier of all traps
Fixing Work 19 (reducing A_s) partially fixes Works 15-18
=> Information transparency has HIGHEST leverage in Omega-u series
=> d(Omega)/d(A_s) < 0 with highest magnitude of all 7D variables

LAYER 15: MASTER THEOREM

MASTER_THEOREM_V19:

THEOREM_9_V19 (Information Stability + AGI Signal):
Omega(X) > Omega_min AND G[K] > 0 IFF ALL conditions:
CONDITION_1 (Signal Quality):
SQI(X) = T_i * (1-A_s) * (1-E_b) > SQI_min = 0.10
[Below: G[K] > 0 regardless of compute or C_h]
[LEXICOGRAPHIC PRIORITY 1: no Omega compensates for signal starvation]
CONDITION_2 (Phase Requirement):
T_i > T_i_toxic = 0.20 [above epistemic void]
D_info(X) > 0 [inside basin of attraction]
CONDITION_3 (Opacity Below Lock-In):
A_s < A_s_lock = 0.70 [information monopoly not yet formed]
CONDITION_4 (Cross-Trap Correction):
Works 15-18 conditions apply on TRUE values:
E_c_true = E_c_reported / (1-A_s)
=> All previous conditions may be violated even if metrics seem OK
CONDITION_5 (Inherited from Works 16-17):
P_extinction < 0.10 [Thucydides]
I_q > I_dep_eff [depravity]
CONDITION_6 (From Work 18):
T_r > T_r_crit [stagnation threshold]
I_n > I_n_min(E_c) [control window]

LEXICOGRAPHIC_ORDER_v19:
C5 (P_extinction) > C1 (SQI) > C2 (T_i) > C4 (cross-trap) > C3, C6
[Signal quality lexicographically prior: corrupted signal means
ALL other conditions may be false even if measured as true]

CORRECTION_THEOREM:
If A_s > 0.40: reported Omega overestimates true Omega by factor 1/(1-A_s)

```

True_Omega = Reported_Omega * (1-A_s)^0.5
=> Countries reporting high Omega with high A_s may actually be near crisis
AI_READABLE_SPEC:
SIGNAL_STARVATION_SPEC:
  input: X, G_compute
  compute: SQI(X) = T_i*(1-A_s)*(1-E_b)
  compute: I_n_effective = I_n_base * SQI(X)
  compute: G_K = G_compute * H_social * I_n_effective
  warning: if SQI < 0.10 => G_K ~ 0 regardless of hardware
CORRECTION_SPEC:
  input: reported_variables from Works 15-18
  if A_s > 0.40:
    E_c_true = E_c_reported / (1-A_s)
    F_c_true = F_c_reported / (1-A_s)
    I_q_true = I_q_reported * T_i
    T_r_true = T_r_reported * (1-A_s*0.5)
  output: corrected_variables for accurate modeling
THEOREM_9_V19_SPEC:
  pre_c1: SQI > 0.10 [LEXICOGRAPHIC]
  pre_c2: T_i > 0.20, D_info > 0
  pre_c3: A_s < 0.70
  pre_c4: corrected Works 15-18 conditions met
  output: Omega > Omega_min AND G[K] > 0
VERIFICATION (13 tests target):
T1: dual instability A_s + E_b [lambda_max > 0]
T2: control degeneracy at U=0
T2b: controllability rank = 7
T3: feedback stabilizes A_s, T_i
T4: Nash => epistemic void
T5: noisy transcritical
T6: epistemic void saddle-node
T7: stable region with control
T8: closed-loop diagnostic
T9: signal starvation test [G_K -> 0 at high A_s]
T10: cross-trap multiplier verified
T11: control window theorem
T12: D_info sign consistency
T13: invariant epistemic trap (Theorem B)
R1: param sweep
R1b: alpha_as stress test
Series: 10.5281/zenodo.19112296
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