Cognitive Wars: The AI Industrialization of Influence

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Between Nov 4–8, 2025 a corrigendum correcting Olfati-Saber, Fax & Murray (2007), a formal erratum, a Springer interdisciplinary

Title and Abstract

- This thesis-first brief argues that industrialization—broadly defined as the material, organizational, and communicative transformations associated with sustained increases in production, bureaucratic integration, and mass-mediated communication—reshaped the character of warfare by enabling and intensifying "cognitive wars": organized, large-scale contests over perception, belief, decision-making, and information environments. The core claim is that industrialization produced the capacities (mass communication infrastructure, standardized education and administration, and industrial organizational forms) and feedback dynamics that allowed states and non-state actors to wage cognitive campaigns at scale and continually refine those capabilities. Contemporary AI-driven influence

Theory-First Framework

- Theory precedes description: we develop a causal model linking industrialization to cognitive dimensions of war. "Cognitive wars" are defined as organized campaigns that target populations' information environments and psychological states to alter beliefs, preferences, and decisions relevant to political or military objectives. Core variables and causal pathways:
- - Production & Communication Capacities: physical throughput (printing presses, telegraph, radio, digital pipelines) that determine reach and latency.
- - State–Society Integration: bureaucratic capacity, literacy, and mass education that create shared referents and centralized channels.
- - Organizational Form & Coordination: industrial hierarchies and firms

Literature Review: Cognitive Wars

- This review synthesizes interdisciplinary literatures: information warfare, propaganda and PSYOP studies, computational propaganda, and political psychology. Key observations:
- - Historical scholarship documents state propaganda and mass mobilization in the industrial era; social scientists analyze persuasion, opinion dynamics, and mass communication effects.
- - Recent computational work highlights automated amplification and the role of network structure in information diffusion.
- - Gaps: many studies treat cognitive phenomena as auxiliary to kinetic capability rather than as structurally shaped by industrial and organizational conditions.
- Relevant traditions: political psychology (attitude/behavior change), sociology of knowledge (institutional production of belief), network

Foundations

- Why these anchors?
- Selection strategy prioritizes peer-reviewed, non-preprint anchors for core methodological and theoretical touchstones; when such anchors are absent for a specific subtopic, canonical papers from broader abstraction layers are used to ground first-principles reasoning. In the present compilation, one peer-reviewed anchor (an ACM conference paper on consensus and adversaries) serves as a methodological touchstone for modeling distributed belief dynamics and adversarial influence processes [^2]. Preprint and technical reports (graph-consensus literature) provide supplementary mathematical structure for networked opinion models [^1].
- Direct Sources (Layer 1)

Theoretical Grounding and Conceptual Framework

- Abstraction layers and concepts
- - Layer 4 (Foundational): information theory (channel capacity, noise), statistical learning (generalization, adversarial examples), game theory (strategic interaction, equilibria), and network science (connectivity, centrality).
- - Layer 3 (Abstract): social influence and persuasion (thresholds, conformity), opinion dynamics (consensus models, DeGroot-style averaging), and diffusion processes on networks (contagion vs. complex contagion).
- - Layer 2 (Domain): organized influence—PSYOP, strategic communications, computational propaganda—characterized by target selection, narrative design, and amplification strategies.

Historical Context: Industrialization and Wars

- Industrialization changed scale, speed, and social integration: mass production and transport reduced latency in moving troops and materiel, while telegraphy, print runs, radio, and later mass media enabled synchronized narratives across large populations. Mass education and bureaucratization produced standardized cultural referents (national curricula, administrative records) that both enabled mobilization and created centralized targets for cognitive operations. Wars increasingly targeted home fronts: conscription, rationing, morale campaigns, censorship, and propaganda made civilian populations central to strategic outcomes. These developments institutionalized state capacity to project narratives and to collect information, laying the groundwork for modern cognitive warfare.

Mechanisms: Industrialization's Influence on Cognitive Conflict

- Mechanism 1 — Mass communication infrastructure
- Industrial-era technologies (printing presses, telegraph, radio) expanded reach and reduced latency of messages, enabling synchronization of narratives across geographically dispersed audiences. This increased effective audience size and allowed coordinated campaigns (e.g., war bond drives, morale pushes), establishing playbooks for later media ecosystems.
- Mechanism 2 — Bureaucratization and standardized education
- Large bureaucracies created routinized channels (registries, schools, civil services) and shared mental models (national myths, civic obligations). These shared referents function as levers for cognitive campaigns—disrupting administrative trust or exploiting school curricula produces outsized social effects.

Hypotheses and Theoretical Claims

- H1: The deeper the industrialization of society—measured by communication density (channels per capita, message throughput) and bureaucratic capacity (administrative reach, standardized education)—the more central cognitive campaigns become in warfare strategy.
- H2: Industrialization moderates the effectiveness of cognitive interventions: highly integrated states achieve greater persuasive control due to leverage over centralized channels, but also face greater systemic vulnerability because saturation and contagion of misinformation can cascade through shared referents.
- H3: Technologies and organizational practices associated with industrialization produce structural asymmetries (e.g., centralized vs. polycentric media environments, open vs. closed data regimes) that

Methodology and Evidence Strategy

- Mixed-methods approach:
- - Comparative historical analysis: select conflicts across the industrial spectrum to observe variation in cognitive warfare salience.
- - Process tracing: document causal mechanisms in key episodes (e.g., WWI/WWII propaganda campaigns; interwar paramilitary communications; late-20th-century industrial-scale influence operations).
- - Quantitative indicators: media penetration (newspapers per capita; radio ownership; internet bandwidth), literacy rates, bureaucratic size (civil servants per capita), and measures of influence campaigns (volume of state broadcasts, bot prevalence).
- - Measurement of cognitive effect: public opinion shifts (surveys), institutional change (policy reversals, purges), decision disruption

Case Studies

- Case A — Early industrial era
- Analysis focuses on 19th-century conflicts where telegraph and mass print began to coordinate political narratives—showing nascent cognitive operations (war reporting, diplomatic leaks) that shaped international perceptions and domestic mobilization.
- Case B — Mass-industrial era
- World War I/II: systematic propaganda, rationing, censorship, and home-front mobilization illustrate how mass media and bureaucracy institutionalized cognitive warfare; governments built dedicated propaganda ministries and used emerging communications networks to synchronize domestic behavior.
- Case C — Late/post-industrial era

Applications (Parameterized Vignettes)

- Vignette 1++ Disaster response under intermittent communications (civil protection and misinformation)
- Scenario parameters: urban population of 2M, primary communication channels: municipal broadcast + social platforms; intermittent connectivity (30% of neighborhoods experience >12-hour blackouts); adversarial actor capable of injecting false evacuation orders and fabricated imagery; AI tools generate credible fake local official messages.
- Objectives: ensure safe evacuation, maintain trust in official guidance, minimize casualties.
- Operational metrics (parameterized):
- - Mean Time to Acknowledge (MTTA) critical false alert: time from

Limits & Open Questions

- This section foregrounds operational assumptions and diagnostics, bounded-rationality, and adversarial communications models as explicit present assumptions. It also identifies open empirical and theoretical questions.
- Operational Assumptions & Diagnostics
- 1) Bounded-rationality assumption
- Assumption: human and organizational actors have limited attention, compute, and time; they use heuristics and satisficing rather than globally optimal strategies. This affects both defenders (e.g., moderators, commanders) and adversaries (resource-limited actors optimizing impact).
- Concrete triggers (operationalizable):

Synthesis

- Industrialization created a set of durable socio-technical conditions—high-throughput communication channels, bureaucratic homogenization, and industrial organizational capacity—that reconfigured warfare to include cognitive contests as central strategic domains. Contemporary AI-driven influence operations are a technical intensification of these mechanisms: automation reduces marginal costs, data increases targeting specificity, and platform architectures scale reach. Theoretical grounding in information theory and networked consensus elucidates why certain architectures produce vulnerability (centralized channels, homogenous referents) while others confer resilience (redundant, heterogeneous, locally trusted nodes) [^1][^2].
- From a policy perspective, the synthesis points to two high-level

Implications for Policy and Future Research

- Policy recommendations
- - Strengthen information resilience by decentralizing critical communication channels and pluralizing trusted nodes (local civic actors, certified community anchors).
- - Invest in adversary-aware technical primitives (provenance, Byzantine-resilient consensus for fused intelligence, provenance metadata) and explicit human-in-loop thresholds tied to mission criticality [^1][^2].
- - Institutionalize norms and legal guardrails to balance defensive cognitive measures with democratic values (transparency, oversight, redress).
- Research directions

Conclusion

- This brief makes a theory-first claim: industrialization is a foundational cause shaping the rise, form, and effectiveness of cognitive wars. The same socio-technical mechanisms that made propaganda and mass mobilization central in the 20th century are being replicated and intensified by AI and platform architectures today. Addressing cognitive wars requires combined technical, organizational, and normative solutions grounded in an understanding of how information propagates, how institutions shape belief systems, and how adversaries exploit structural vulnerabilities.
- [^1]: On graph theoretic results underlying the analysis of consensus in multi-agent systems. ArXiv.Org (2009).
- [^2]: Consensus of multi-agent networks in the presence of adversaries

Assumptions Ledger

- | Assumption | Rationale | Observable | Trigger | Fallback/Delegation | Scope |
- |---|---|---|---|---|---|
- | Industrialization causally transformed warfare by enabling large-scale cognitive campaigns ("cognitive wars"). | Historical evidence links the rise of mass communication, mass education, and centralized administration with deliberate state and non-state propaganda, morale campaigns, and home front targeting; these institutional and material changes plausibly increased reach, synchronization, and the ability to target beliefs at scale. | Historical patterns: growth in circulation and reach of print/telegraph/radio, creation of dedicated propaganda/PSYOP bureaus, archival records of mass mobilization campaigns, measures of public opinion volatility during

Notation

- | Symbol | Meaning | Units / Domain |
- |---|---|---|
- | \(n\) | number of agents | \(\mathbb{N}\) |
- | \(G_t=(V,E_t)\) | time-varying communication/interaction graph | — |
- | \(\lambda_2(G)\) | algebraic connectivity (Fiedler value) | — |

Claim-Evidence-Method (CEM) Grid

- | Claim (C) | Evidence (E) | Method (M) | Status | Risk | TestID |
- |----------|-------------|-----------|--------|-----|--------|
- | Industrialization increased the centrality of cognitive campaigns in warfare: greater communication density and bureaucratic capacity causally raise the strategic importance of organized influence (H1). | [2] (consensus/adversary multi-agent literature); [3] (historical-political communication studies on propaganda and mass mobilization); [5] (military doctrine/PSYOP describing bureaucratic capacity and centralized messaging). | Comparative-historical empirical analysis linking measures of industrialization (communication channels per capita, registries, literacy rates) to quantitative indicators of cognitive campaign centrality (propaganda budgets, censorship activity,