

Cognitive Wars: The AI Industrialization of Influence

The November ArXiv note corrects a serious
proof error in Olfati-Saber/Fax/Murray (2007),
publishes stronger theoretical extensions

Title and Abstract

- > **Disclosure & Method Note:** This is a *theory-first* brief. Claims are mapped to evidence using a CEM grid; quantitative effects marked **Illustrative Target** will be validated via the evaluation plan. **Anchor Status:** Anchor-Absent.

Introduction: theory-first framing

- A theory-first approach foregrounds causal mechanisms—how material and institutional changes causally enable new forms of cognitive combat—before seeking broad empirical generalization. This avoids descriptive conflation of distinct phenomena (propaganda, public diplomacy, psychological operations, computational propaganda) and provides analytical leverage to predict continuities and ruptures as technologies evolve.
- Central research question: How did industrialization influence the emergence, scale, and techniques of cognitive wars, and what does that historical relationship imply for the ongoing AI-driven industrialization of influence?
- Two methodological desiderata follow: (1) prioritize mechanism identification (transport, communications, production,

Theoretical Framework: cognitive

wars Definition: "Cognitive wars" are strategic contests that target human perception, beliefs, decision nodes, and collective cognition with the explicit intention to change behavior or political outcomes. They differ from kinetic war in objectives and mediating means: outcomes are cognitive states and social coordination rather than territorial control, though both interact.

- Interdisciplinary situating: Cognitive wars draw on political theory of war (strategy and objectives), cognitive science (belief formation, attention, memory), information theory (signal, noise, channel capacity), and sociology (collective behavior, institutions). Theoretical model links material infrastructures to three cognitive capacities:
 - - Reach: the set and scale of audiences addressable by messaging.
 - Salience & Dose: intensity and frequency of exposures required to

Foundations: canonical anchors and

selection strategy

- - Selection strategy: anchors are chosen across abstraction layers to ensure both domain specificity and theoretical depth. Direct sources (Layer 1) address contemporary mechanisms and empirical patterns of computational propaganda and influence campaigns. Domain sources (Layer 2) provide strategic and historical context for information operations. Foundational sources (Layers 3–5) offer canonical models—network diffusion, information theory, learning theory, and social psychology—that ground causal inferences from material infrastructures to cognitive outcomes.
- - Current anchor availability: the source corpus supplied for this brief is dominated by contemporary, accessible arXiv/preprint literature and domain reports (digital-era analyses). There are presently zero (0)

Theoretical Grounding and

Conceptual Framework

- Abstraction layers and concepts
- - Layer 1 (Specific): automated influence operations—botnets, coordinated accounts, generative media—operate as instruments of cognitive targeting capable of producing high dose and personalization at low marginal cost [^6][^3][^4].
- - Layer 2 (Domain): information warfare and psychological operations frame objectives, legal/ethical constraints, and the military-political logic of influence campaigns [^2].
- - Layer 3 (Cross-disciplinary): diffusion and social influence models (thresholds, cascades, weak ties) explain how messages propagate unevenly across networks and how local exposure thresholds produce macro-level cascades [^9][^10].
- Layer 4 (Theoretical): information theory (channel capacity, noise)

Literature Review: wars and

industrialization

Existing scholarship on industrialized war emphasizes logistics, mass mobilization, and technology (rail, telegraph, mass conscription) but often treats informational effects as consequential but secondary. Computational-propaganda research documents contemporary tactics and automation [^6][^2], and the fake-news literature models diffusion differentials between true and false information [^8][^7]. However, a gap persists: studies seldom theorize industrialization as a structural cause of cognitive modalities of war across historical epochs. Information-warfare treatments frequently analyze techniques and platforms without tracing long-term structural conditions—mass education, standardized production, and bureaucratic routines—which enabled durable cognitive campaigns.

• This brief connects historical and contemporary literatures by

Historical Context: industrialization

Claim: Industrialization reconfigured communications, transport, and media ecosystems in ways that altered the feasible scale and duration of cognitive operations.

- Mechanisms in the 19th and early 20th centuries: telegraphy reduced latency of cross-regional coordination; railways enabled synchronized mobilization and distribution of printed material; inexpensive printing and later mass broadcast standardized messaging; mass schooling created literate publics reachable at scale. Bureaucratization produced professional propaganda offices, routinizing message production and targeting.
- Patterns: (1) infrastructural enabling—faster, wider dissemination; (2) institutionalization—permanent propaganda arms within states and parties; (3) measurement primitives—circulation figures, literacy rates

Conceptual Section: defining

cognitive warfare Differentiation: Cognitive warfare differs from conventional kinetic warfare in its primary objects (cognition, decision-making) and from narrower propaganda in its scale, persistence, and integration with material infrastructures and organizational routines.

- Targets: individual beliefs and attitudes, group identity and cohesion, decision nodes (e.g., electoral publics, military command chains), and information environments (norms, trust metrics).
- Temporal qualities: durable influence (institutional embedding, norm change) versus transient influence (short-term persuasion, tactical misinformation). Metrics for analysis:
 - - Reach: proportion of target population exposed (absolute and weighted by influence centrality).
 - Dose: message frequency per unit time; cumulative exposures

Mechanisms: industrialization's influence on cognitive operations

Unique claim set (not repetition of summary): Industrial-era technologies changed five mechanism classes relevant to cognitive warfare:

- 1. Channel capacity and latency: Telegraph and postal rail networks increased information throughput and decreased delivery time, permitting synchronous narrative control over wide areas and enabling coordinated cognitive operations across fronts [^10].
- 2. Standardization and repeatability: Printing presses and later broadcast permitted identical message replication at scale. This lowered variance in message fidelity, making dose-response calibration tractable.
- 3. Audience legibility: Mass schooling and census/bureaucratic records produced legible target populations (demographics, literacy), enabling

Case Studies: industrial-era

cognitive campaigns Comparative historical examples reveal recurring patterns of infrastructural enabling, institutionalization, and measurable cognitive shifts.

- 1. 19th-century nationalism and print culture: mass-circulation newspapers and serialized novels created shared imaginaries and reinforced national identity across disparate regions; mass literacy increased receptivity to standardized narratives.
- 2. Colonial counterinsurgency propaganda: bureaucratic pamphlet campaigns and controlled press in imperial territories used standardized messaging paired with administrative records to target and reshape local political identities, though success varied with cultural legibility and local networks.
- 3. World War I homefront mobilization: state-run ministries of

Methodology

- Design: mixed-methods, comparative-historical approach.
- - Qualitative: archival research (propaganda office records, circulation reports), discourse analysis, and process tracing to identify mechanisms and sequencing.
- - Quantitative: proxies to operationalize industrial measures—print runs, telegraph/parcel traffic volumes, literacy rates, and, where available, circulation or audience metrics. For contemporary analogues, use bot prevalence, engagement rates, and diffusion timestamps from platform data [^6][^2][^8].
- Case selection logic: choose cases that vary on infrastructure intensity while holding other variables (regime type, wartime exigency) constant where possible—this isolates industrialization's effect on cognitive capacity.

Applications: parameterized

vignettes, metrics, and failure modes

Context: A multinational disaster-response operation must coordinate evacuation and medical resource allocation across a region with partially disrupted networks (cell towers down in 40% of districts). The operation uses a hybrid industrialized messaging pipeline: pre-produced multilingual SMS templates (industrial-scale content), radio broadcast, and opportunistic social-media amplification via automated agents to reach mobile populations.

- Parameters and metrics:
- - Reach target: 80% of affected population within 48 hours.
- - Mean Time to Alert (MTTA): target \leq 4 hours from event detection to first broadcast message in affected districts

Limits & Open Questions

- This section foregrounds operational assumptions, diagnostics, and bounded-rationality and adversarial communications models as explicit present assumptions rather than deferred questions. It also outlines open research questions.
- Operational Assumptions & Diagnostics (presented assumptions)
- 1. Bounded-rationality assumption
- - Statement: Agents (human or algorithmic) involved in cognitive operations have limited information, finite computational resources, and heuristic decision rules. Automated modules approximate ideal Bayesian updates but use heuristics for tractability.
- - Concrete triggers (diagnostics):

Implications for theory and policy

- Theoretical implications
- - Reconceptualize war: Cognitive modalities should be treated as central objects of strategic analysis where infrastructure and organizational routines are explanatory variables rather than mere vectors.
- - Infrastructure–cognition feedbacks: Theorize the mutual reinforcement between information infrastructures and social cognition—how routinized messaging changes norms which in turn alter diffusion dynamics.
- Policy implications
- - Preparedness: Invest in measurement infrastructure (platform co-operation for circulation metrics, independent media audits) and in human-in-loop capacities to adjudicate adversarial or ambiguous

Synthesis

- Industrialization transformed influence by converting persuasion into an engineered, repeatable system: lowered marginal costs, increased coordination capacity, and routinized feedback—conditions that changed the scale, persistence, and organizational embedding of cognitive operations. Contemporary AI-driven systems represent a further industrialization layer: automation of production, micro-personalization, and closed-loop optimization. The combined theory suggests continuity (mechanisms remain: capacity, standardization, legibility) and acceleration (automation intensifies dose and personalization), producing both novel opportunities (rapid public-health messaging) and systemic risks (closed-loop adversarial optimization).
- Operationally, resilience demands three pillars: measurement and

Conclusion and avenues for future

research

Contributions: This brief refines the concept of cognitive wars, links industrial-era material transformations to cognitive modalities of strategic influence, and outlines mechanisms and operational implications for modern AI-enabled systems. It provides a theory-first template for comparative-historical and contemporary empirical work.

- Future research paths:
- - Longitudinal case studies tracing infrastructure introduction (telegraph, radio, internet) to measurable cognitive outcomes.
- - Cross-regional comparisons to identify contingent conditions (cultural legibility, institutional robustness) mediating industrial effects.
- - Modeling work that integrates diffusion thresholds, bounded rationality, and adversarial signal models to produce

Assumptions Ledger

- | Assumption | Rationale | Observable | Trigger | Fallback/Delegation |
Scope |
- |-----|-----|-----|-----|-----|
- | Industrialization (transport, mass media, bureaucratic routines, mass schooling) was a structural cause that materially enabled large-scale, durable cognitive influence operations (i.e., 'cognitive wars'). | Historical changes in infrastructure and institutions—rail, telegraph, print, broadcast, mass schooling and bureaucracy—clearly lowered costs, increased throughput and coordination capacity; these changes plausibly map onto greater reach, repeatability, and persistence of messaging. | Correlations and process-traced sequences linking expansion of communication/transport metrics (print runs, telegraph traffic, newspaper circulation, literacy rates, formation of

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 converted influence from episodic persuasion into an industrialized, repeatable, scalable system (a structural reconfiguration) that enabled large-scale, durable "cognitive wars". | [2] [6] [5] | Comparative-historical process tracing + archival quantification (print runs, telegraph/broadcast capacity, bureaucratic records) combined with illustrative contemporary case studies of coordinated online campaigns; causal inference via within-case mechanism tracing. | E cited; M pending archival process-tracing and cross-case synthesis | If false, the theoretical framing (structural industrialization → cognitive wars) is undermined; policy and resilience measures premised on structural institutional layers (rather than tactical