Power as Relative Position: A Foundational Theory of Systemic Asymmetry

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Abstract

Power is a pervasive feature of life: from dominance hierarchies in primates to coordination in human organizations and competition in international geopolitics, systems consistently exhibit asymmetries of influence and control. At the same time, perfect equality is vanishingly rare, yet despite this ubiquity, existing accounts of power remain fragmented, often conflating it with cultural norms, institutional rules, or personal traits. To address this gap, we provide a systemic account of biological and psychological evidence, highlighting how positional asymmetries—rather than individual differences or conventions—consistently shape access to resources, coordination, and influence. Building on this foundation, we advance a unified system-theoretic account of power, defining it as relative position in a system. From this definition we derive five lemmas that explain how power reinforces itself, converges, produces exponential distributions, resists local disruptions, and stabilizes against challenge. This framework clarifies when power is truly at play and establishes a foundation for rigorous system-level analysis of asymmetry.

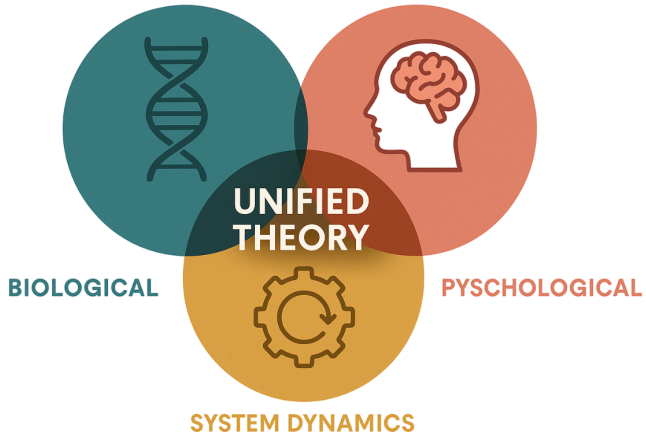

Figure 1: **Foundation Theory of Power:** Our unified framework integrates biological, psychological, and system dynamics perspectives, defining power as relative position in a system.

1 Introduction

Power is a pervasive feature of systems. In almost any setting, from animal groups to human institutions, some entities hold more influence, resources, or strategic options than others. Perfect

symmetry—where all participants are equal in every respect—is exceptionally rare. Power, in this sense, is a general system property, emerging from the arrangement of entities within a network of dependencies, options, and substitutes.

Despite its ubiquity, the concept of power is often applied without precision. In much of the social sciences and humanities, it has become a catch-all label for structural oppression, cultural dominance, symbolic control, or any perceived inequality—many of which are unrelated to the concrete positional asymmetries within a system. Without a unified definition, almost any tension can be called a "power" problem, while genuine system-level power dynamics go unnoticed. This overextension dilutes the concept, produces incompatible metrics, and obscures the structural mechanisms by which influence and control actually emerge.

In the natural world, the dynamics of power are especially visible. In primate dominance hierarchies, elephant matriarchal leadership, and cooperative hunting among canids, differences in position within a network of dependencies translate into differences in resource access, influence over group movement, and the ability to mediate conflict. Such patterns arise without formal institutions, cultural norms, or explicit rules—showing that power is a purely emergent property of the system.

This paper proposes a unified, mechanistic theory of power. We define power as *relative position in a system*: the structural location an entity occupies within a network of dependencies, available options, and potential substitutes. This definition strips away cultural and institutional overlays, revealing power as a general system property. Building on this definition, we show how positional asymmetries shape system behavior across biological and psychological domains, and formalize their dynamics in five general lemmas that apply to any system of interacting entities.

Our contribution. This paper redefines the foundations of power by proposing a unified, mechanistic account grounded in relative position within a system. Our key contributions are:

- Introduce a domain-independent definition of power as *relative position in a system*, stripping away cultural, institutional, and moral overlays to reveal it as a general system property.
- Integrate evidence from biological and psychological systems to show that positional asymmetries—rather than individual traits or social conventions—consistently determine access to resources, influence, and coordination capacity.
- Formalize the system dynamics of power in five general lemmas, deriving from relative position a unified account of how power amplifies, concentrates, and resists disruption across time in any system.
- Provide a conceptual basis for rigorous system-level analysis of power, clarifying when a problem is truly about positional asymmetry and avoiding the overextension that has diluted the concept in many disciplines.

2 Related Work

2.1 Power in Social Science

In the social sciences, power has been defined and studied through a wide range of theoretical lenses. Weber characterized it as the probability of imposing one's will despite resistance Weber [2019]; Dahl framed it in terms of control over decision-making Dahl [1957]; Foucault emphasized its diffusion through discourse and knowledge Foucault [1990]; Bourdieu linked it to forms of capital embedded in social fields Bourdieu [2018]; and Lukes advanced a "three-dimensional" view that extended power from observable conflicts to agenda control and even the shaping of preferences Lukes [2021]. These perspectives have generated extensive empirical work and shaped debates in political science, sociology, and anthropology.

However, these accounts are often tightly coupled to specific cultural or institutional contexts, making them difficult to apply across systems that lack similar structures. In many cases, "power" functions as a catch-all label for structural oppression, cultural dominance, symbolic control, or any perceived inequality—many of which bear little connection to the concrete positional asymmetries that govern influence and control within a system. As a result, the term's meaning has expanded unevenly across disciplines, leading to conceptual dilution, incompatible measures, and the obscuring of underlying structural mechanisms.

2.2 Power in Animal Behavior

In animal behavior and behavioral ecology, power is studied primarily through observable patterns of dominance, leadership, and resource control. Research documents how individuals in advantageous positions—whether due to size, age, experience, or coalition support—can monopolize resources, direct group movement, or mediate conflicts. Examples include primate dominance hierarchies Waal [2007], the leadership of elephant matriarchs Moss [2000], and coordinated hunting strategies in canids Mech [1999], where position within a network of dependencies directly influences access to food, mates, and safety.

Unlike human societies, these systems lack formal institutions, codified rules, or explicit cultural norms. Yet stable patterns of influence still emerge, driven purely by the structural configuration of relationships and the distribution of dependencies. This makes animal systems an important reference point: they demonstrate that power can arise as a property of the system itself, independent of human-specific social constructs, and that its effects can be observed and measured without recourse to cultural explanations.

3 A Unified Theory of Power

Power is a pervasive phenomenon, visible in everyday life across contexts from small group interactions to large-scale institutions. In nearly every system, some form of positional asymmetry emerges; perfect symmetry—where all entities have identical influence, resources, and options—is exceedingly rare. Despite its ubiquity, power lacks a single unified definition or mechanistic account. Instead, different fields employ a variety of overlapping and sometimes conflicting terms, leaving the concept fragmented and often unclear.

3.1 Why Power Needs a Unified Definition

Positional asymmetries are pervasive across systems, yet the absence of a clear definition means that almost anything can be labeled a "power" problem—including many issues unrelated to power itself. At the same time, many genuine power dynamics go unnoticed. Without a shared framework, the term is applied inconsistently across fields, often referring to entirely different phenomena or unrelated mechanisms. A unified, mechanistic definition is needed to identify when power is truly at play, to separate it from non-power phenomena, and to enable rigorous system-level analysis of how positional asymmetries shape outcomes.

3.2 Defining Power as Relative Position

We define *power* as *relative position in a system.* Rather than arising from culture, institutions, or morality, power is a general property of systems: entities' standing shapes their access to resources and their influence over others.

3.3 Why Relative Position Matters in Systems

Relative position is not merely a descriptive attribute; it shapes the system's capacity to act, adapt, and persist. Entities in advantaged positions can coordinate collective action more efficiently, mediate or suppress conflict, and control flows of critical resources or information. Conversely, when positional asymmetries are absent, systems may experience decision paralysis, persistent disputes, or unstable coordination. These effects arise from the structural logic of interaction itself, making positional analysis essential for understanding both the stability and the adaptability of complex systems.

3.4 Structure of the Unified Framework

The unified theory is developed in three main parts:

- **Biological Foundations** — Evidence from non-human social species, showing how relative position shapes access to resources, coordination, and stability.
- **Psychological Foundations** — Evidence from human cognition and behavior, detailing how people perceive and respond to positional asymmetries.

- **System Dynamics of Power** — From the core definition, we derive five lemmas that capture essential and universal dynamics of power within any interactive system.

Together, these sections form a cohesive account of power as *relative position in the system*, integrating empirical observations and formal principles into a single, unified framework.

4 The Biological Foundations of Power

4.1 System Asymmetries in Animal Behavior

In animal societies, power asymmetries are pervasive yet rarely static. Dominance hierarchies in primates Waal [2007], breeding priority in wolves Mech [1999], or access to prime foraging spots in birds Rohwer and Ewald [1981] all reflect relative positions that differ in replaceability, dependency, and available options. These asymmetries are not abstract; they are instantiated in observable behaviors such as coalition formation, spatial positioning, and the control of interaction flow.

Importantly, such asymmetries cannot be reduced to body size, aggression, or sheer resource possession. In many cases, smaller individuals gain leverage through alliances, privileged knowledge, or control of strategic bottlenecks. This highlights that power emerges from the configuration of the system itself, rather than being fixed in individual traits.

4.2 What Power Does in Biological Systems

In biological systems, power shapes both individual strategy and system-level outcomes. When defined as *relative position in the system*, power asymmetries provide several functional advantages:

At the individual level, power asymmetries provide advantages such as:

- **Resource Control:** Individuals in favorable positions can monopolize or mediate access to key resources, from food patches to mating opportunities Waal [2007].
- **Interaction Leverage:** High-power positions grant greater ability to initiate, block, or redirect social interactions, influencing the flow of group activities Kummer [2017].
- **Social Recognition:** For social animals, being recognized by the group is a core motivational state, fulfilling a psychological need for status and acceptance within the community Cheng et al. [2010].

At the group level, power also serves collective functions:

- **Conflict Mediation:** Well-positioned individuals can intervene in disputes, stabilizing relationships and reducing costly escalations De Waal and van Roosmalen [1979].
- **Collective Coordination:** Concentrated power can accelerate decision-making and align group actions, especially in movement or foraging Couzin et al. [2005].
- **Strategic Resilience:** Control over critical connections in the network allows power-holders to adapt rapidly to environmental or social changes Krause et al. [2007].

Taken together, these advantages show that power provides benefits at multiple levels: shaping strategies and interactions for individuals, while at the same time enhancing coordination and resilience at the system level.

4.3 Why Absence of Power Creates Problems

The absence of power asymmetries does not imply harmony. In biological systems, the lack of differentiated relative positions often leads to:

- **Coordination Failure:** In a system where all positions are equal, no decision can be finalized—every proposal can be contested without resolution, leading to paralysis Olson [2012].

- **Persistent Conflict:** Equal standing in contested situations can prolong disputes, as no individual or coalition can enforce resolution Smith and Price [1973].
- **Wasteful Competition:** Without mechanisms to mediate access, competition over resources may escalate into repeated, costly contests that drain the system's capacity Clutton-Brock and Parker [1995].
- **Vulnerability to External Shocks:** Systems without stable positional structure are less able to respond cohesively to environmental or social disruptions May [1972].

These outcomes suggest that power—understood as relative position in the system—is not merely a byproduct of competition, but a functional feature of coordinated, adaptive group life.

5 Psychological Foundations of Power

While power emerges from structural position in the system, its effects in human societies are mediated through perception and cognition. Humans do not directly compute network graphs; instead, they infer relative position from a range of social and environmental cues, and these inferences shape both their own behavior and their interpretation of others' actions.

5.1 How Humans Perceive Power

Human perception of power relies on heuristic evaluation of positional asymmetry, often integrating multiple sources of information:

- **Direct Information:** Explicit knowledge of others' formal roles, decision rights, or resource control, obtained from publicly available sources or unambiguous observation.
- **Status Recognition:** Information circulating within the group about who holds decision-making authority, influence, or centrality—e.g., repeated mentions of the same individual as the final arbiter.
- **Resource Signals:** Indicators of control over valued assets, including material resources, information, or access to social networks.
- **Dependency Awareness:** Recognition of asymmetric reliance, e.g., when one's goals or safety depend more heavily on another individual.
- **Option Set Comparison:** Implicit assessment of how many viable alternatives each party has in a given interaction.

These cues are rapidly integrated, enabling humans to estimate relative position in real time, without explicit calculation—a capacity that functions as a social heuristic rather than a deliberative process.

5.2 How Power Modulates Human Cognition and Behavior

Once relative position is inferred, it systematically influences cognitive processing and behavioral strategy:

- **Attention Allocation:** High-power individuals focus more on goal-relevant information and less on monitoring others' evaluations; low-power individuals allocate more attention to social threats and approval cues Fiske [2018].
- **Risk and Decision-Making:** Elevated power correlates with greater risk tolerance and faster decision initiation, while low power promotes caution and deliberation Anderson and Galinsky [2006].
- **Social Strategy Selection:** High-power positions enable more proactive behaviors—initiating negotiations, setting group agendas—whereas low-power positions favor reactive or avoidance strategies Galinsky et al. [2003].
- **Prestige Bias:** Individuals tend to preferentially attend to, imitate, and adopt information from those perceived as having higher prestige or status, reinforcing the influence of well-positioned actors regardless of content accuracy Henrich and Gil-White [2001].

These patterns mirror the functional logic observed in other social species: relative position reshapes the dynamics of interaction and the way others perceive and respond to the individual. In humans, this shows that once positional asymmetries are in place, they reliably shape cognition and behavior in predictable ways—further supporting a unified system-theoretic account of power, where what ultimately matters is relative position in the system.

Figure 2: Visual summary of the five systemic lemmas of power, derived directly from our core definition of power as relative position. Reinforcement, convergence, exponential distribution, resilience, and stability jointly explain how systemic asymmetry emerges and persists.

6 The System Dynamics of Power

Before presenting the five lemmas, we briefly recall our definition of power. We define *power* as relative position in a system: the structural location an entity occupies within a network of dependencies, available options, and potential substitutes. From this definition, a set of core system-level properties follows directly. In what follows, we derive five lemmas that capture the essential dynamics of power. Together, they describe how relative position translates into reinforcement, convergence, distribution, resilience, and stability.

6.1 Lemma 1: Power Operates Through Strong Reinforcement

Lemma 6.1: Strong Reinforcement

Power as relative position entails simultaneous reinforcement of stronger positions and compression of weaker ones; over time these effects compound exponentially, producing accelerating divergence.

Example. Merton's classic analysis of the Matthew Effect showed how small early advantages are amplified over time, producing cumulative disparities in recognition and resources Merton [1968].

6.2 Lemma 2: Power Exhibits Strong Convergence

Lemma 6.2: Strong Convergence

Strong reinforcement simultaneously amplifies advantages and compresses disadvantages; over time these dynamics compound exponentially, forcing systems to converge on a few dominant positions while those behind are left with nothing.

Example. Small initial advantages in technology adoption can cascade into path-dependent lock-in, as shown in Arthur's theory of increasing returns Arthur [1994].

6.3 Lemma 3: Power is Distributed Exponentially

Lemma 6.3: Exponential Distribution

The long-term result of reinforcement and convergence is an exponential distribution of relative positions: a small minority accumulate disproportionate control, while the majority retain marginal influence.

Example. Pareto's classic study of wealth revealed that economic resources follow a heavy-tailed distribution, with a minority holding the majority share Pareto [1964].

6.4 Lemma 4: Power Resists Local Disruptions

Lemma 6.4: Resistance to Local Disruptions

Relative position distributes exponentially, so small perturbations to individual positions leave the overall imbalance intact: when one element weakens or disappears, dependencies reallocate in ways that preserve the heavy-tailed structure.

Scale-free networks remain structurally imbalanced even after random node removal, demonstrating systemic resilience to local shocks Albert et al. [2000].

6.5 Lemma 5: Power Stabilizes Through Challenge Difficulty

Lemma 6.5: Stability Through Challenge Difficulty

Relative position stabilizes as advantaged positions command the overwhelming share of resources and dependencies. Even when many smaller positions combine, the exponential distribution ensures they cannot match incumbents, making systemic change difficult without some degree of alignment with dominant actors.

Example. As Arthur showed in his model of competing technologies, early network advantages compound into path-dependent lock-in, making it prohibitively difficult for challengers to displace incumbents Arthur [1989].

7 Future Directions

This framework invites several lines of further research. First, empirical studies across species, organizations, and political systems can clarify the boundary conditions of positional asymmetries: identifying contexts where their effects on access, coordination, and influence are amplified, constrained, or transformed. Second, formal models—ranging from network theory to agent-based simulation—can be developed to capture how local interactions generate the characteristic distributions of power. Finally, applied work can explore the consequences of system-level power for domains as diverse as organizational design, international relations, and multi-agent artificial intelligence. Together, these directions extend a system-theoretic view of power from theoretical foundations to empirical scope and practical application.

8 Conclusion

Power is a universal feature of collective life, from animal hierarchies to human institutions and global politics. Yet despite its ubiquity, existing accounts remain fragmented, often treating power as a matter of personal traits, cultural conventions, or institutional rules. To address this gap, we began by analyzing the biological and psychological mechanisms through which positional asymmetries shape access, coordination, and influence.

Building on this foundation, we advanced a unified system-theoretic definition of power—as relative position within a system—and derived five lemmas that capture its self-reinforcing, convergent, unequal, resilient, and stabilizing dynamics. Together, these principles consolidate otherwise fragmented perspectives and reveal a common logic underlying power across domains.

By grounding a general account of power in both empirical regularities and system-theoretic reasoning, we provide a framework that clarifies when power is truly at play and sets the stage for rigorous cross-disciplinary analysis of asymmetry, from biological hierarchies to human institutions and global politics.

Declaration of LLM Usage

The authors used OpenAI's ChatGPT to assist in refining phrasing and improving clarity. All theoretical arguments and interpretations are original and authored by the researchers.

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