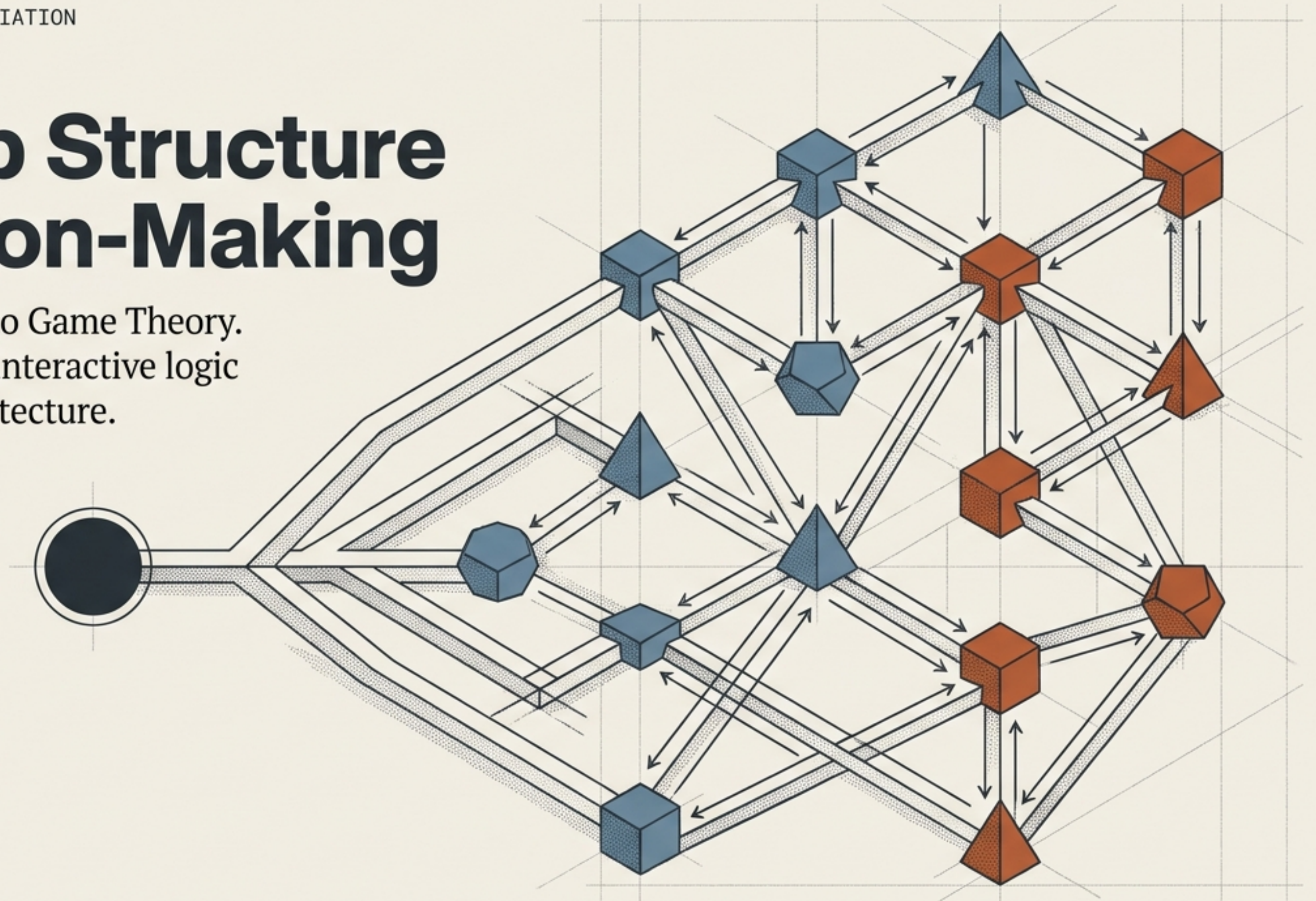


The Deep Structure of Decision-Making

A Strategist's Blueprint to Game Theory.
Distilling 21 lectures of interactive logic
into a single visual architecture.



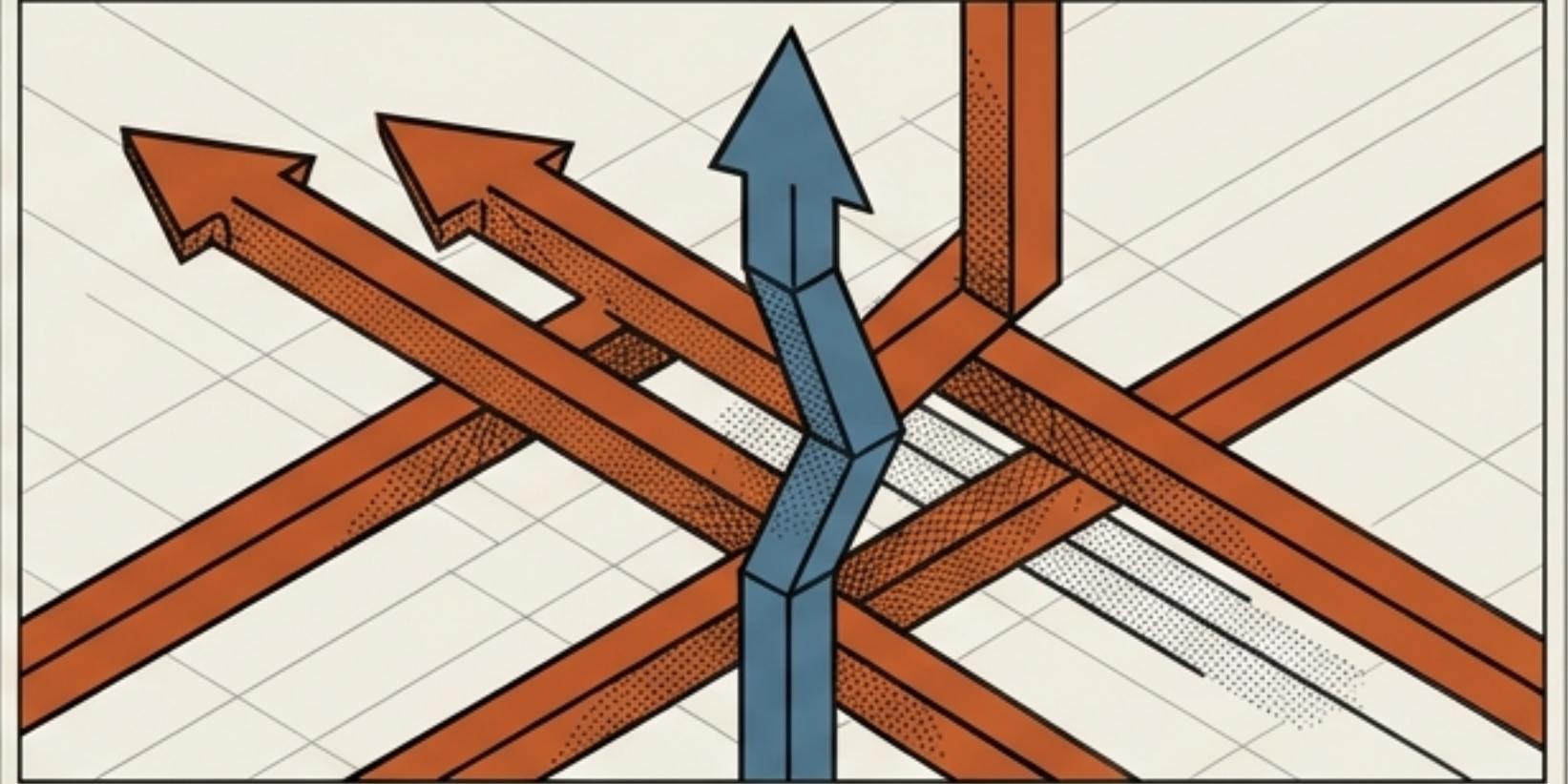
The illusion of the isolated decision-maker

Single-Player Optimization



Your payoff depends solely on your actions and fixed environmental parameters. (e.g., maximizing a supply chain in a stable market).

Interactive Decision-Making



Your payoff depends not just on your choices, but on the simultaneous, calculating reactions of others. You must optimize against an opponent who is optimizing against you.

Game Theory is the mathematics of this interdependence. It maps the chaos of real-world conflict into rigorous, predictable structures.

Deconstructing the architecture of conflict

$$\Gamma = \langle N, S, u \rangle$$

N (Players)

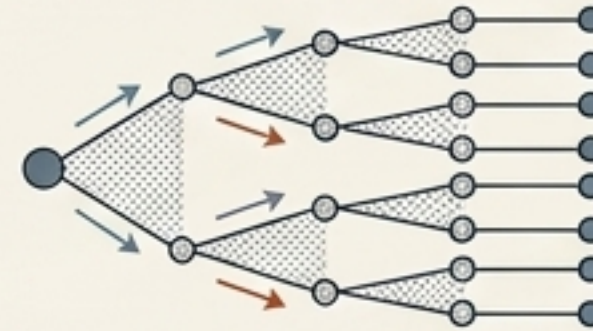
Who is at the table?



Defining the rational entities. It's not just identifying competitors, but recognizing 'Nature' or external probability as a silent player.

S (Strategies)

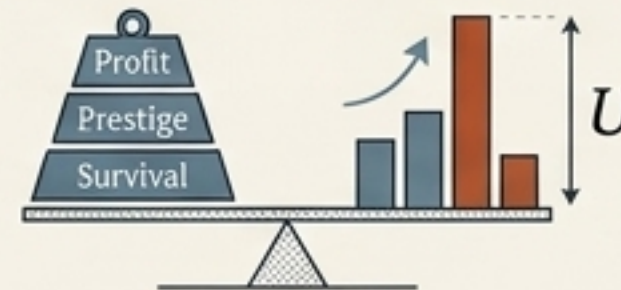
What is the complete playbook?



The exhaustive set of conditional action plans. A strategy isn't a single move; it is a comprehensive algorithm dictating responses to every possible future state.

u (Payoffs)

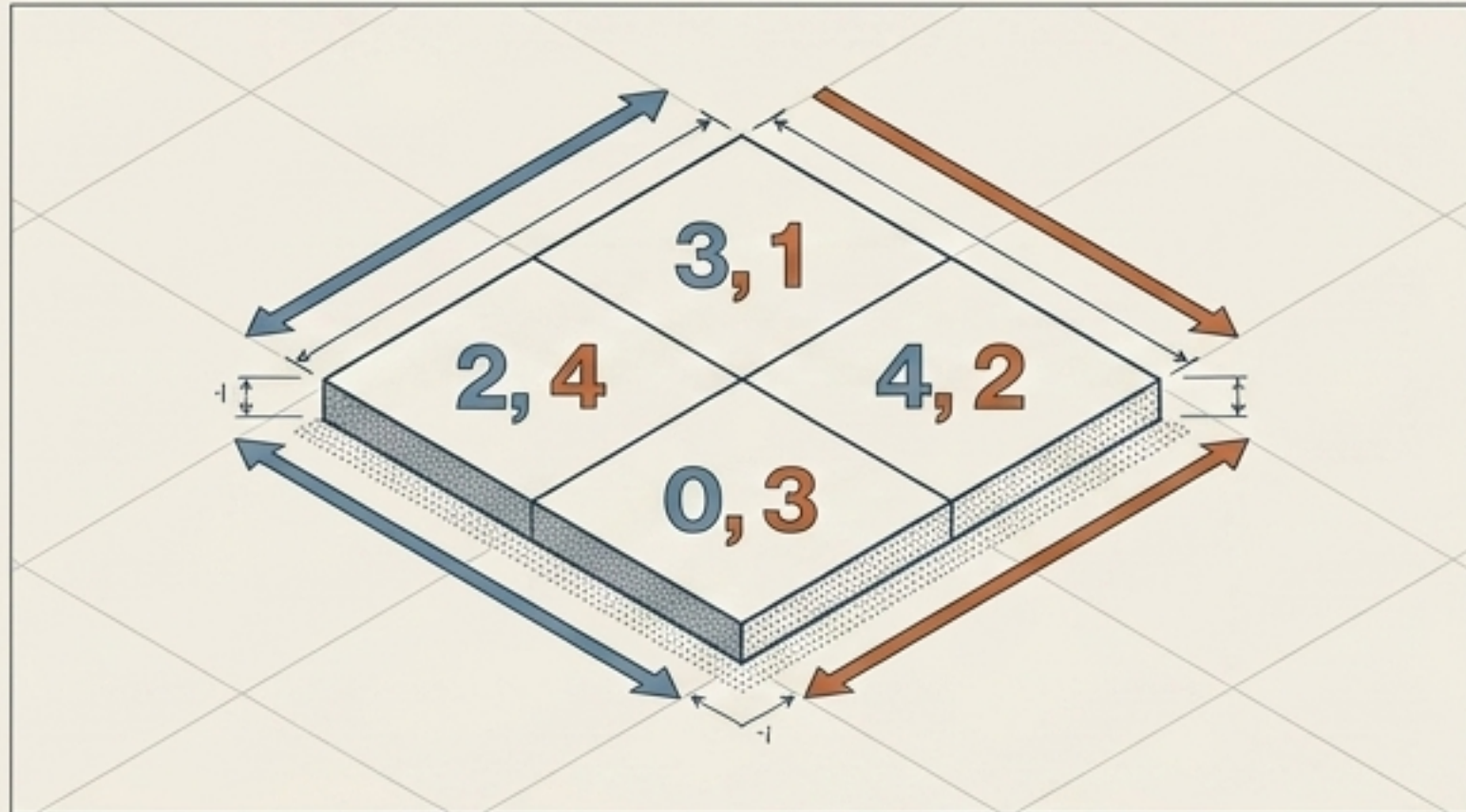
How is victory measured?



The utility function. Translating subjective human desires (profit, prestige, survival) into ordinal or cardinal numbers that drive behavior.

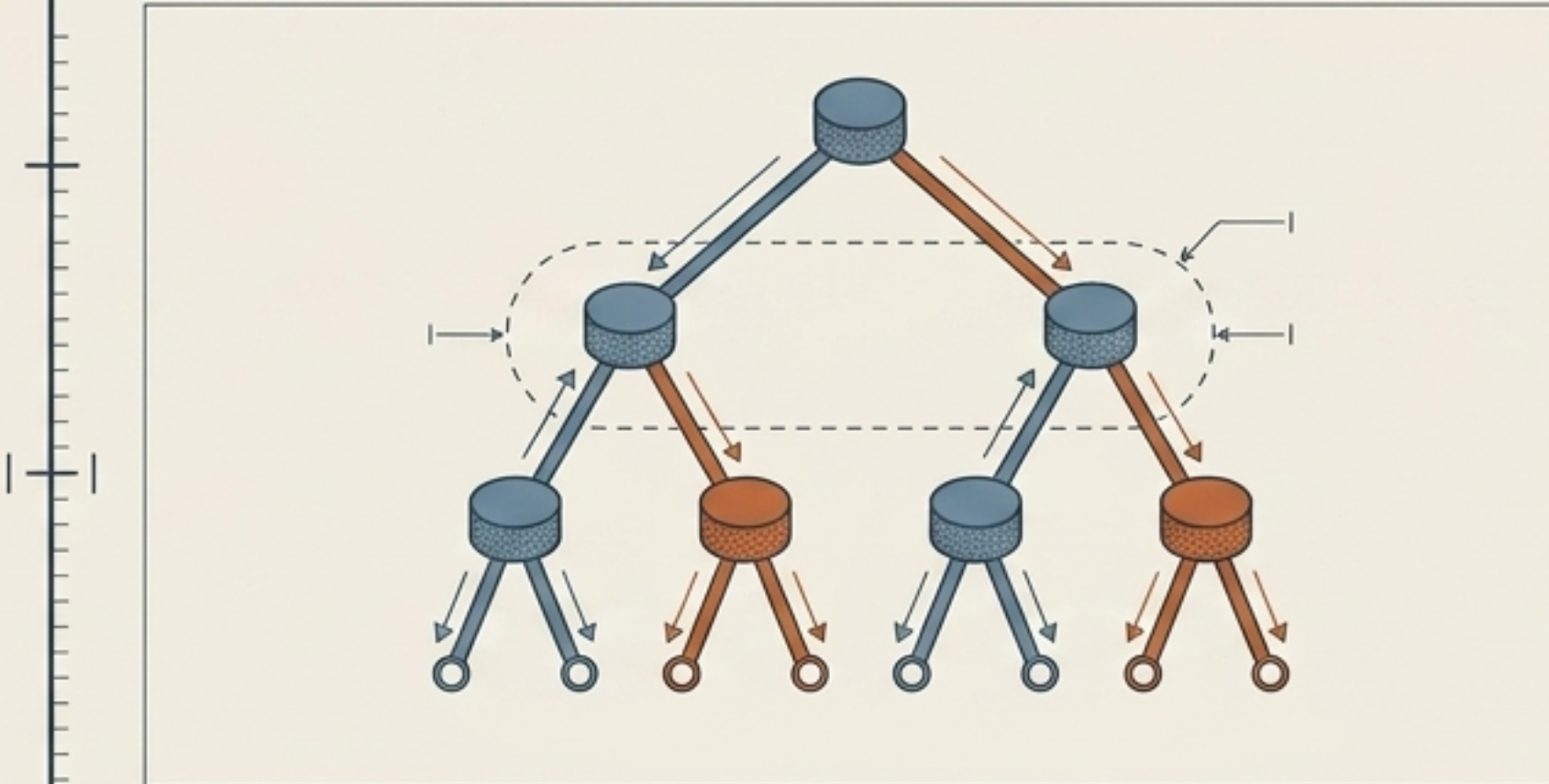
Choosing your analytical lens

Standard Form (The Matrix)



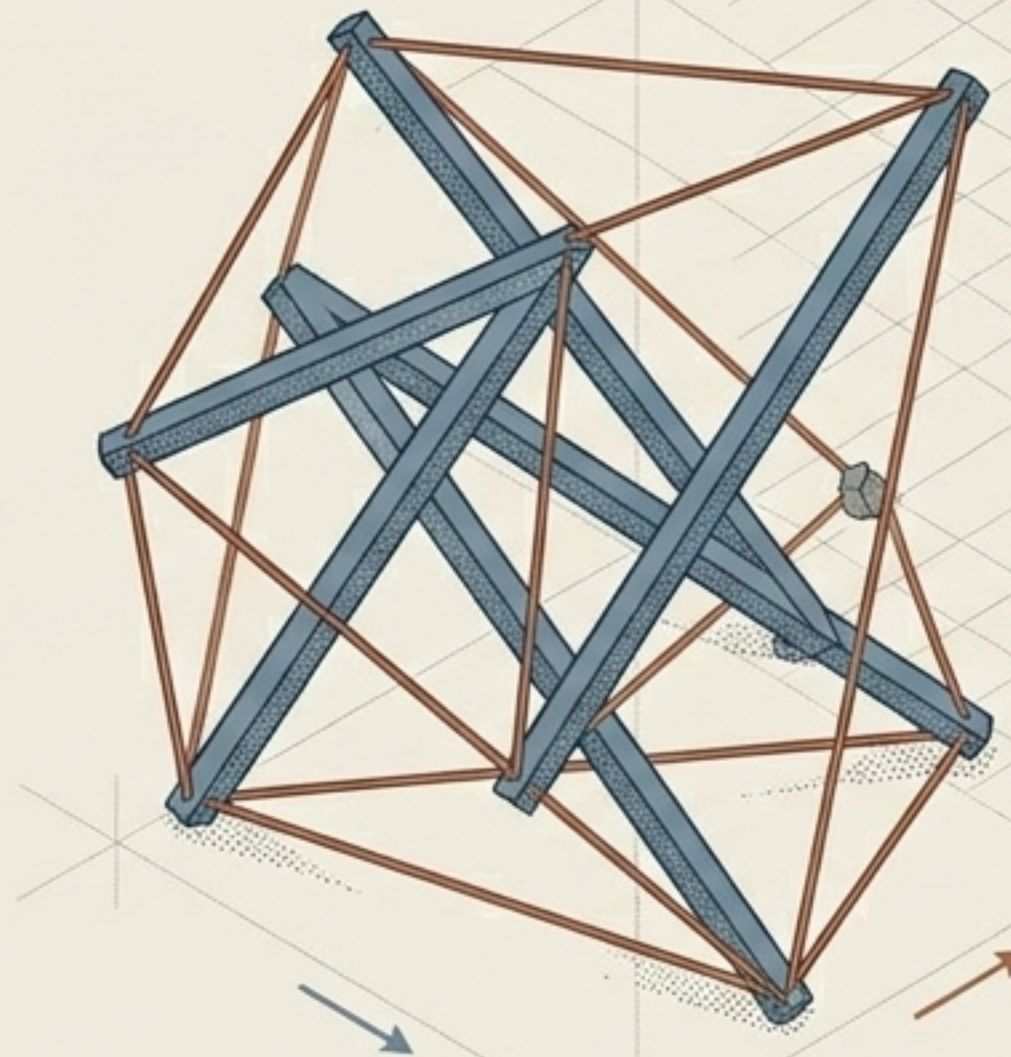
Context:	Simultaneous execution. Players move without knowing the other's choice.
Focus:	Strategic intersections, uncovering Dominant Strategies, and finding Nash Equilibrium.
Best Used For:	Blind auctions, simultaneous market entry, rock-paper-scissors dynamics.

Extensive Form (The Tree)



Context:	Sequential execution. Time and observation dictate the flow.
Focus:	Information sets, credible threats, and backward induction.
Best Used For:	Turn-based negotiations, chess, sequential oligopoly pricing.

The unavoidable pull of the Nash Equilibrium

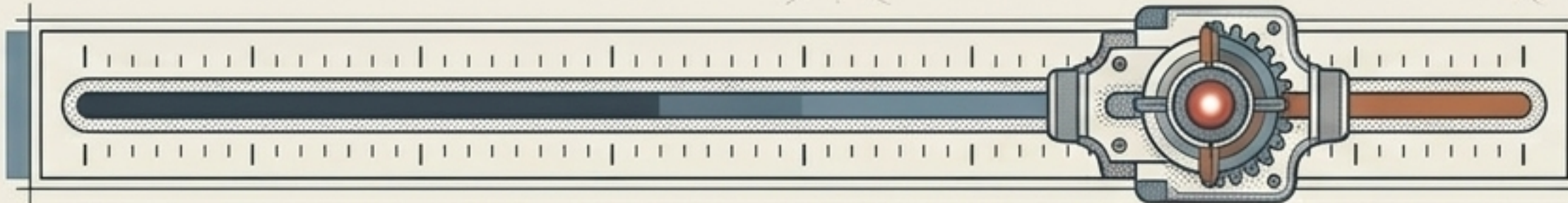


Core Concept Text

A Nash Equilibrium is not necessarily the “best” outcome for everyone. It is a state of mutual gridlock.

It is the exact coordinate where no single player can improve their payoff by unilaterally changing their strategy.

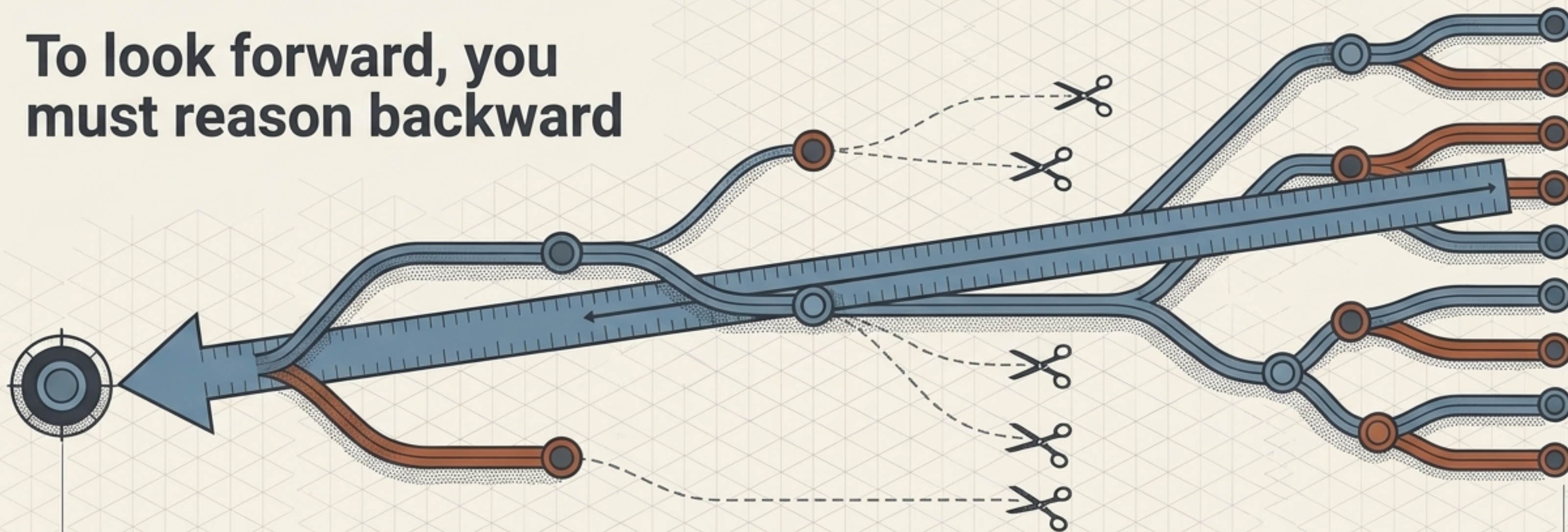
Pure Strategy
(Deterministic: I will always choose A)



Mixed Strategy
(Probabilistic: I will randomize my choices to remain unpredictable)

Annotation: When pure strategies lead to endless out-guessing (e.g., penalty kicks), players naturally gravitate toward Mixed Strategy Equilibria—calculated randomization to neutralize the opponent’s advantage.

To look forward, you must reason backward



Step 1: The Endgame

Evaluate the final nodes. What will the last player rationally do?

Step 2: The Pruning

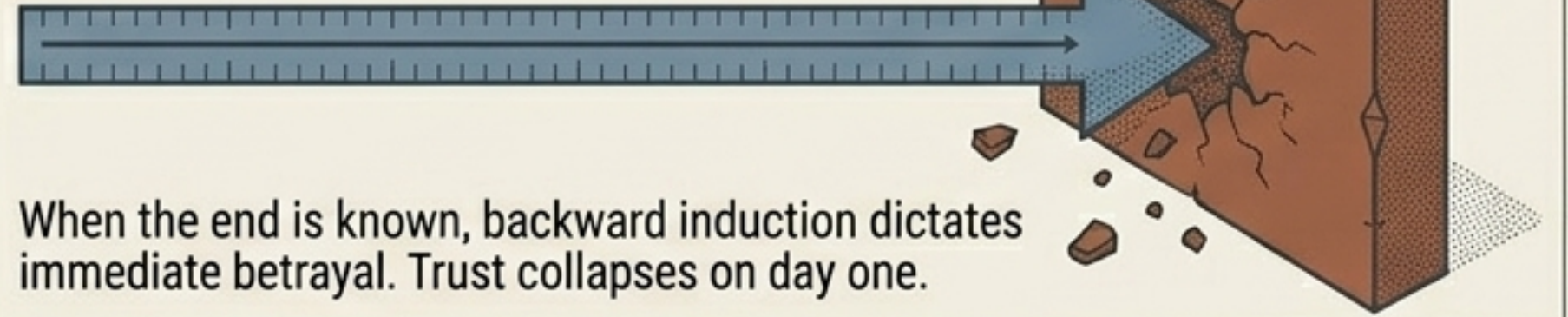
Eliminate irrational threats. (Subgame Perfect Nash Equilibrium). A threat to destroy the market is meaningless if carrying it out destroys the threatener.

Step 3: The Present Strategy

The optimal move today is entirely dictated by the anticipated rational moves of tomorrow.

How infinite repetition breeds spontaneous cooperation

Finite Time (The Prisoner's Dilemma)



When the end is known, backward induction dictates immediate betrayal. Trust collapses on day one.

Infinite/Indefinite Time (The Shadow of the Future)

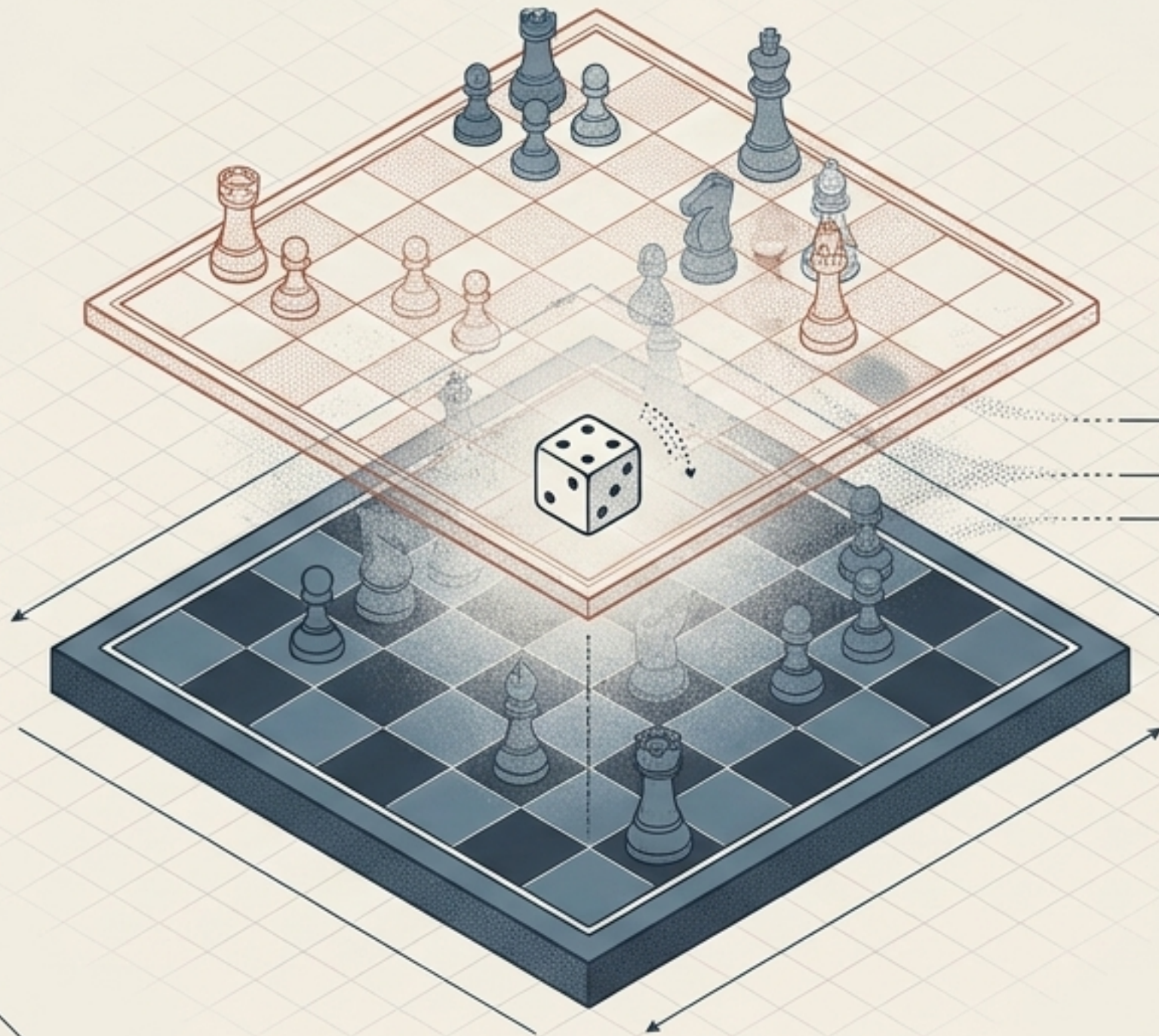


When interactions repeat indefinitely, the long-term value of cooperation outweighs the short-term temptation of betrayal.

Strategic Takeaway

'Tit-for-Tat' Mechanics: Cooperation is sustained not by morality, but by the mathematical certainty of future retaliation.

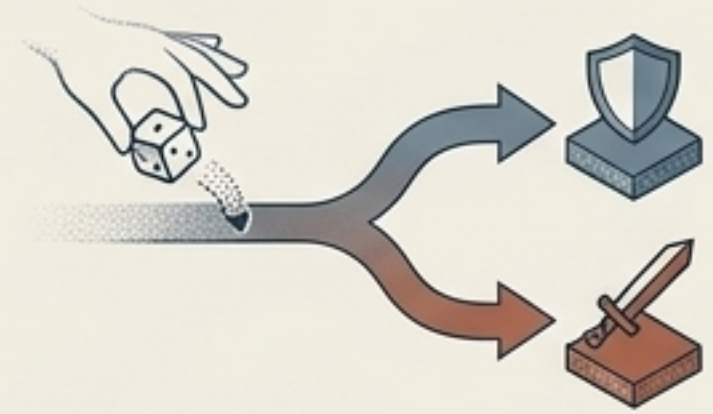
Playing against ghosts in the machine



Harsanyi's Transformation

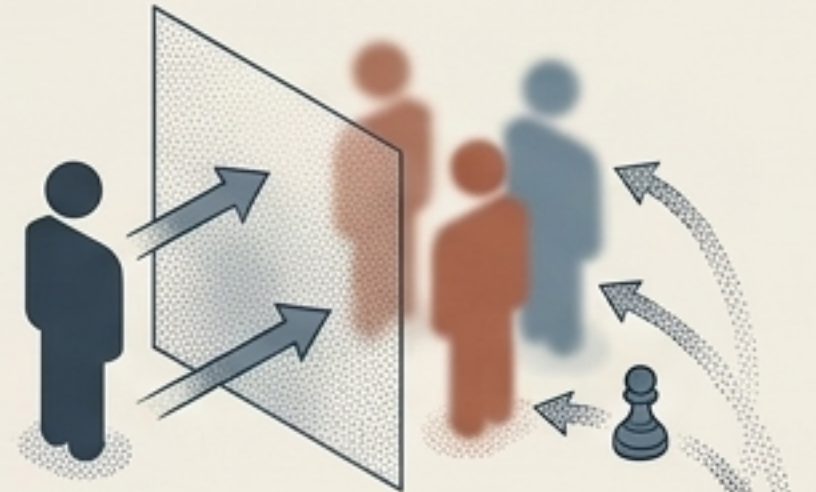
1. Nature's Move

The game begins with an invisible die roll by 'Nature,' assigning your opponent a private 'Type' (e.g., Aggressive or Passive, High-Cost or Low-Cost).



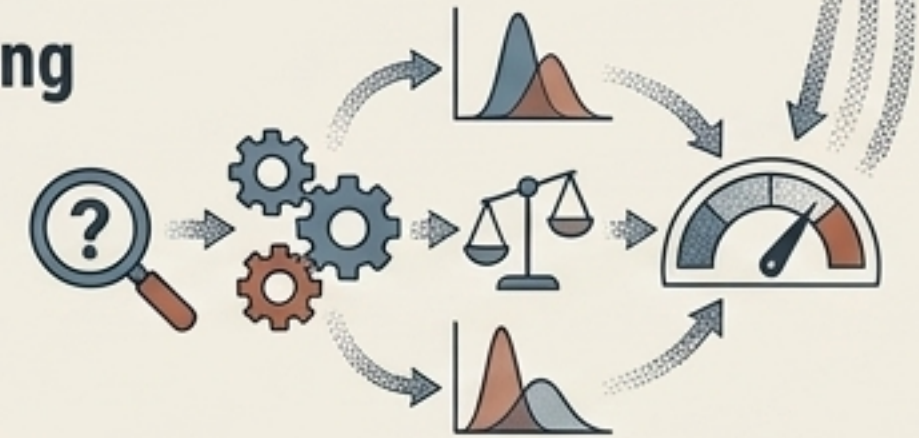
2. The Veil

You only see the opponent's actions, not their true Type.



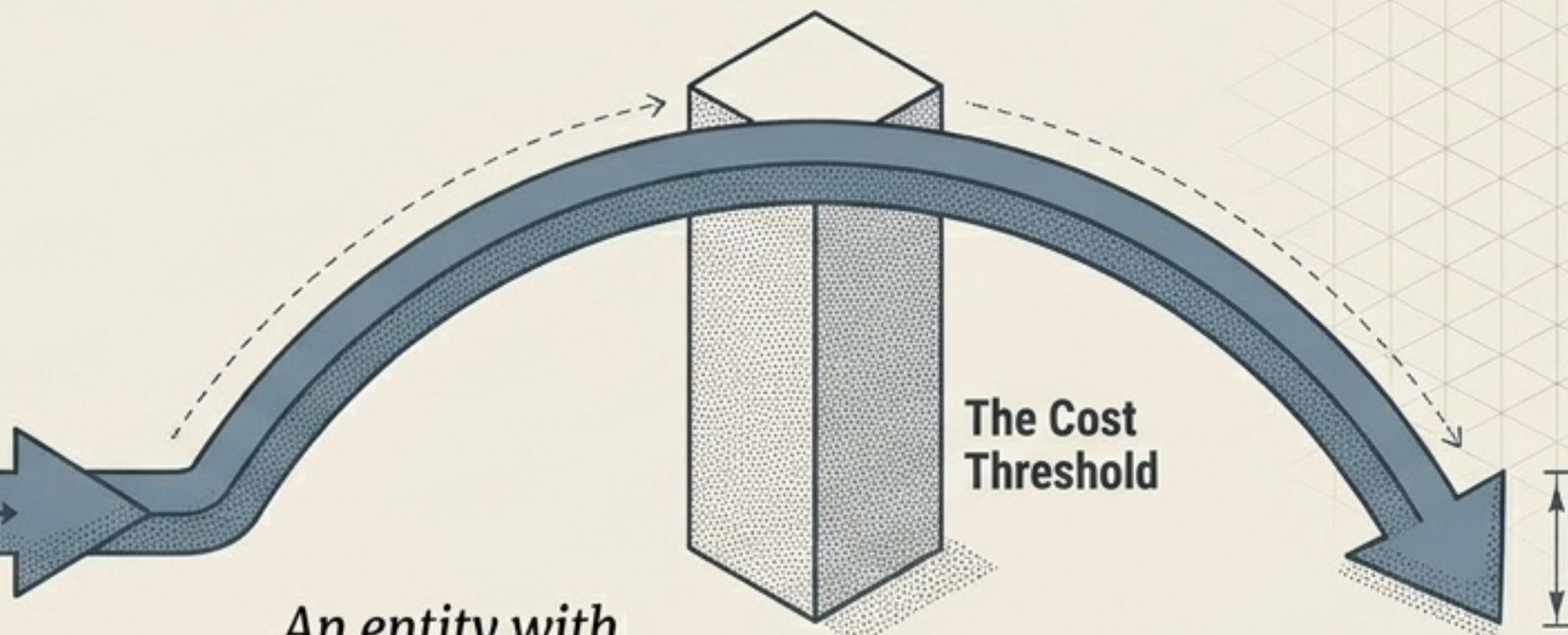
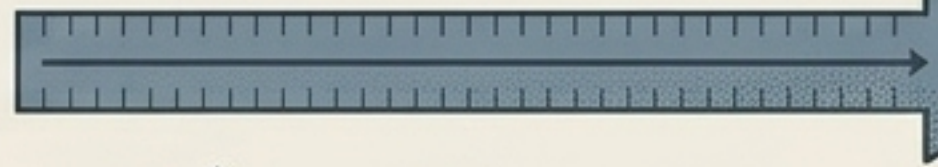
3. Bayesian Updating

You must optimize your strategy against a **weighted average of all possible opponent Types**, logically updating your beliefs as they reveal clues through their moves.



Extracting truth and projecting strength

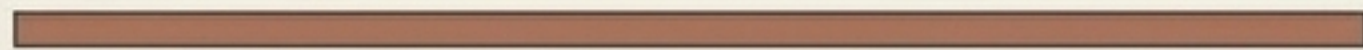
SIGNALING (Sender-Driven)



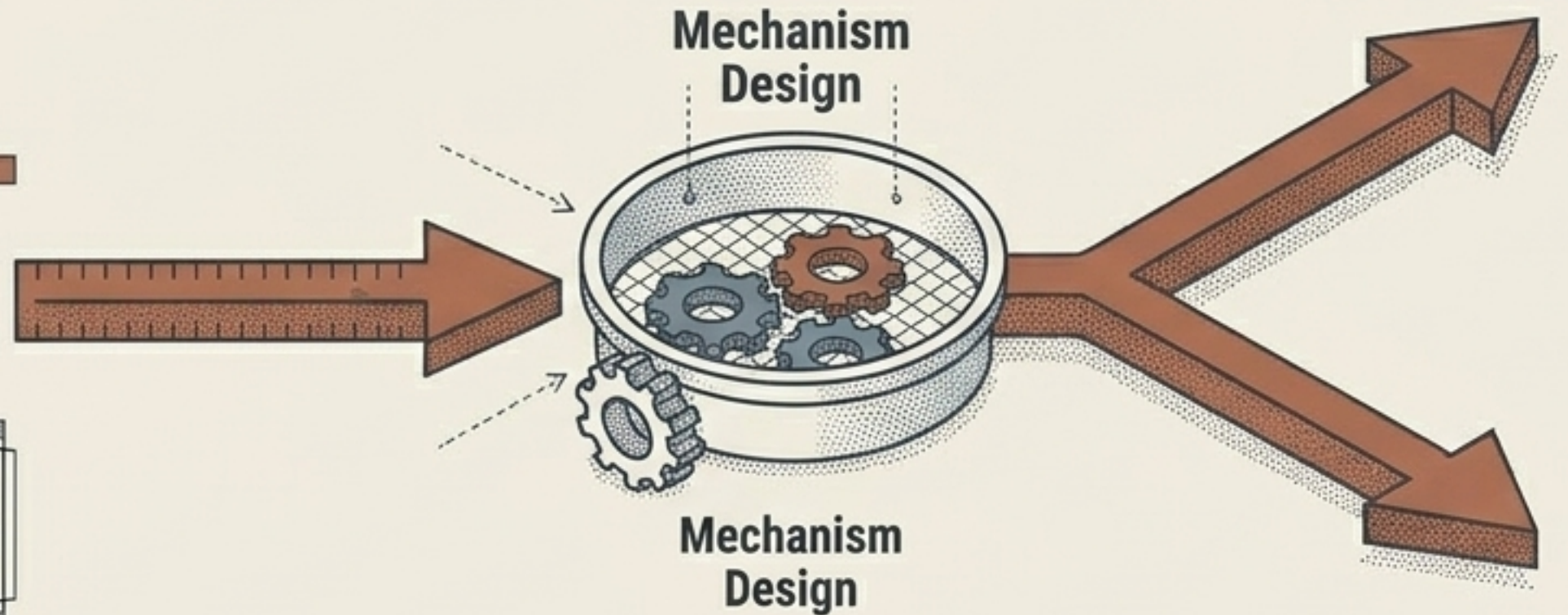
An entity with hidden strengths wants to prove it.

Rule: A signal is only credible if it is too expensive for a 'weak' type to fake. (e.g., A multi-year university degree signals competence because the incompetent cannot easily survive the cost/effort).

SCREENING (Receiver-Driven)

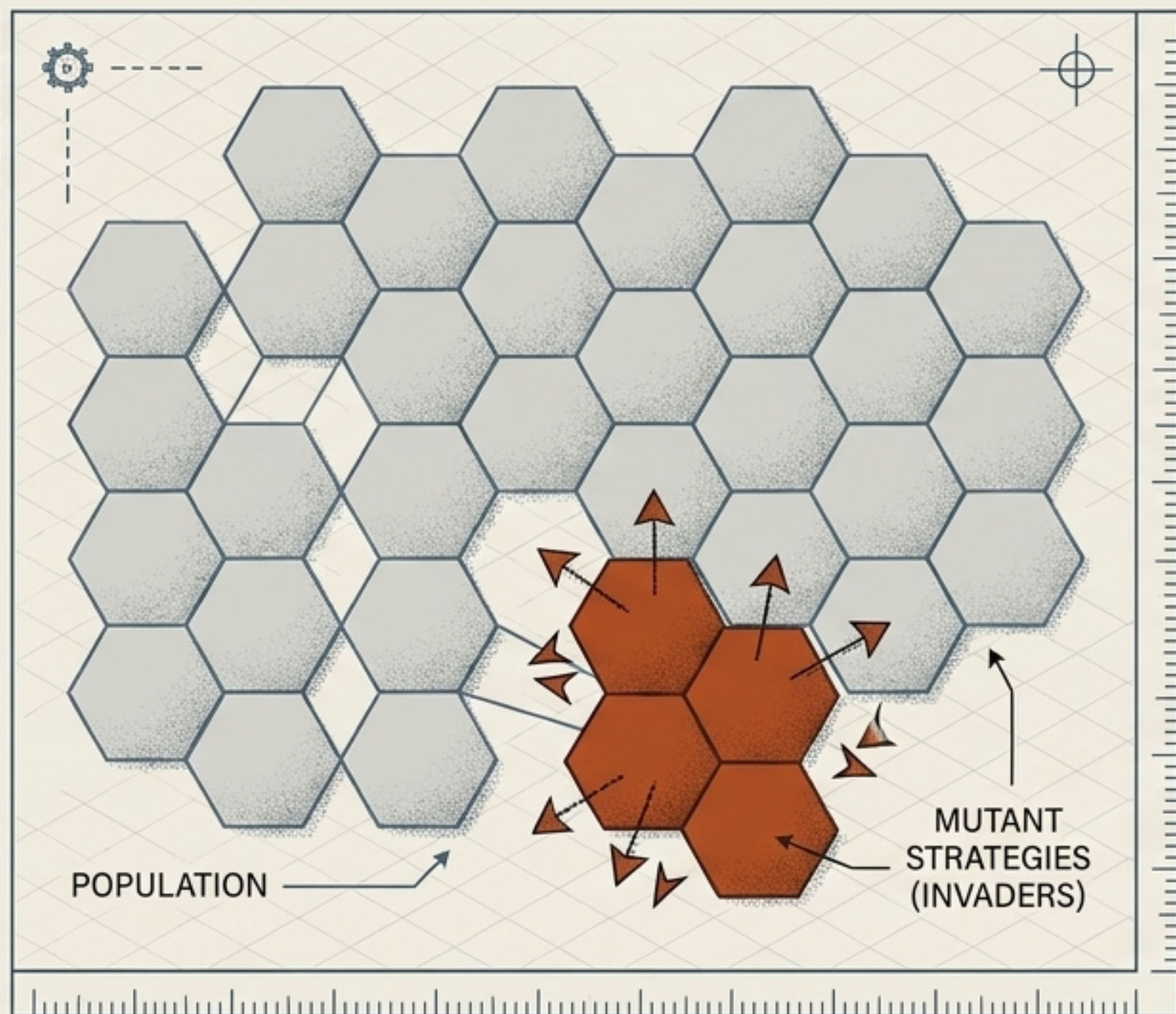


An entity facing unknown opponents wants to force them to reveal themselves.



Rule: Offer a menu of contracts designed so that different 'types' naturally sort themselves by their choices. (e.g., Insurance deductibles sorting high-risk vs. low-risk drivers).

Evolution as the ultimate strategist



Evolutionarily Stable Strategy (ESS):
A strategy that, if adopted by a population, cannot be invaded by any rare alternative strategy.

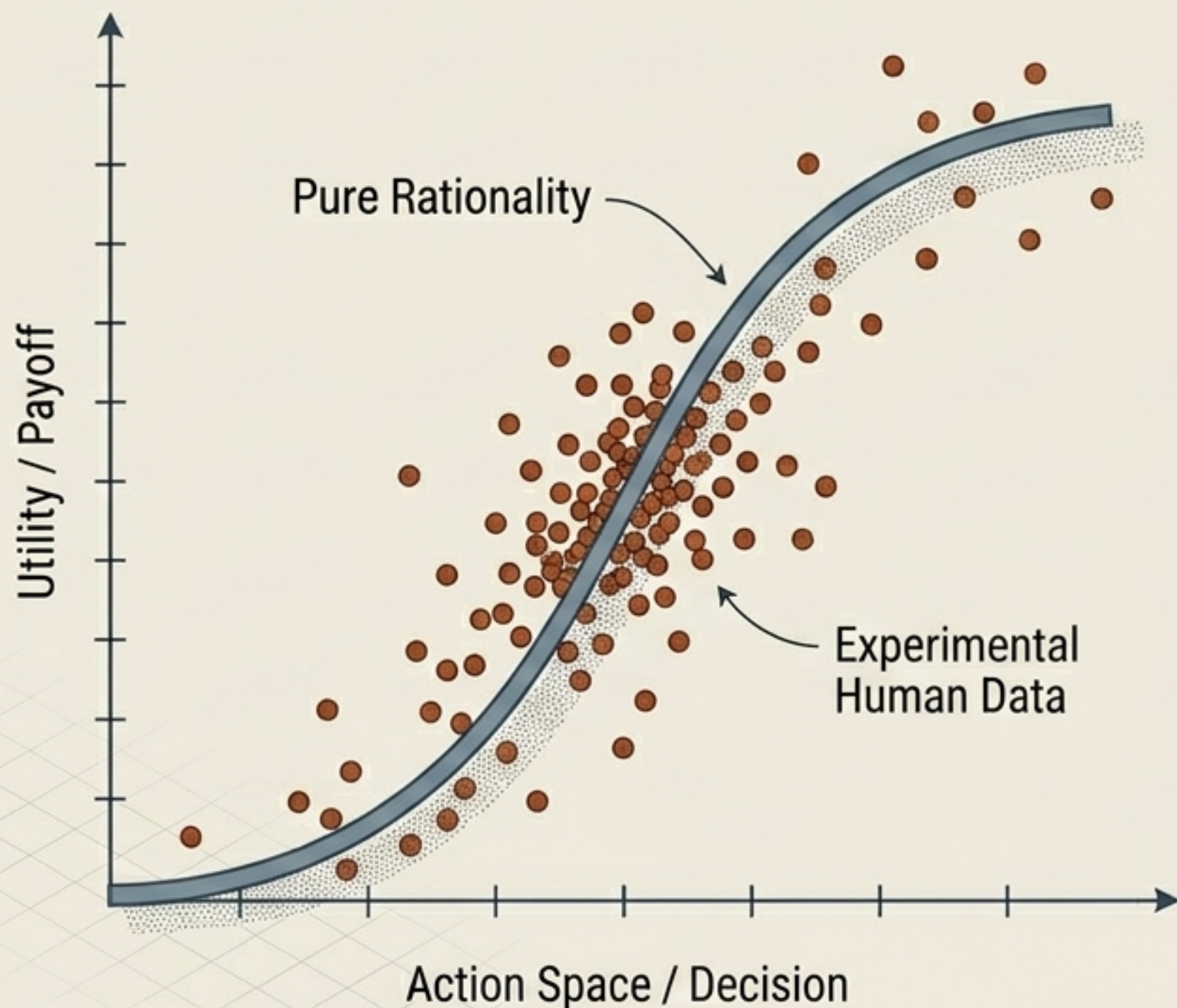
The Shift

We strip away the assumption of hyper-rational calculation. Instead, strategies are simply genetically or culturally encoded routines.

The Mechanism

High-payoff strategies reproduce; low-payoff strategies die out. The pure math of Nash Equilibrium applies perfectly to the brutal optimization of natural selection.

The cognitive bounds of the human player



Social Preferences

Humans will irrationally burn their own money to punish perceived unfairness (e.g., rejecting low offers in the Ultimatum Game).

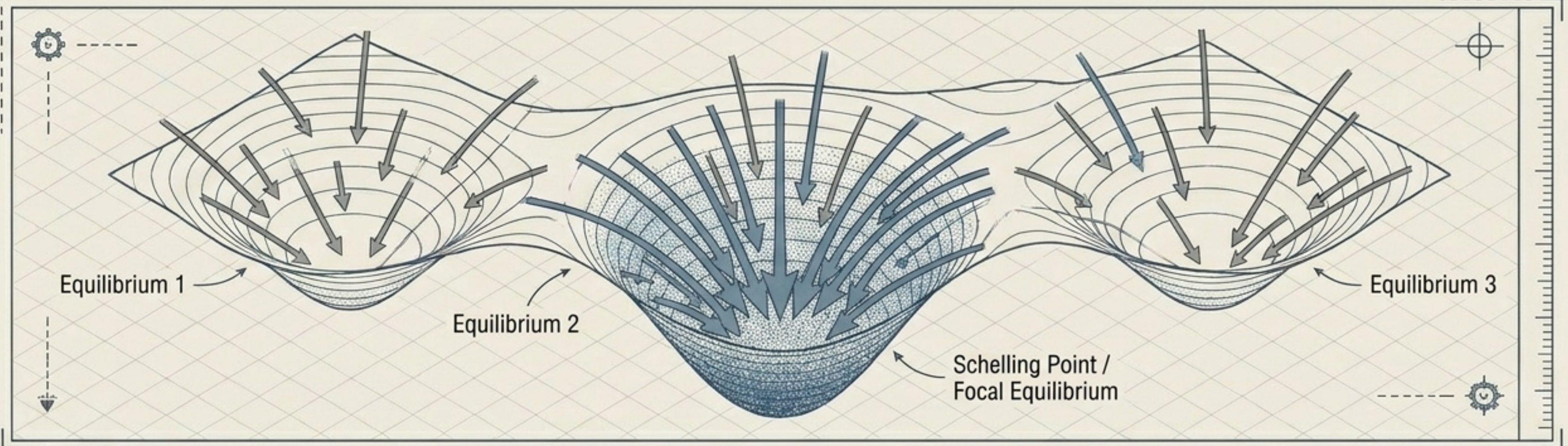
Bounded Rationality

Humans cannot compute infinite backward induction; we typically think only 2 to 3 steps ahead (Level-k Thinking).

Framing Effects

The exact same mathematical payoffs yield radically different behaviors depending on whether they are framed as “losses” or “gains”.

Solving the chaos of multiple equilibria



The Problem

Many games have multiple Nash Equilibria (e.g., Which side of the road do we drive on?). Math alone cannot tell us which one players will choose.

The Solution: The Schelling Point

An outcome that people choose by default in the absence of communication, relying on shared cultural contexts, symmetry, or historical precedent.

The Result

Societal norms are not arbitrary rules; they are simply deeply entrenched equilibrium selection mechanisms.

Mapping theory to the battleground



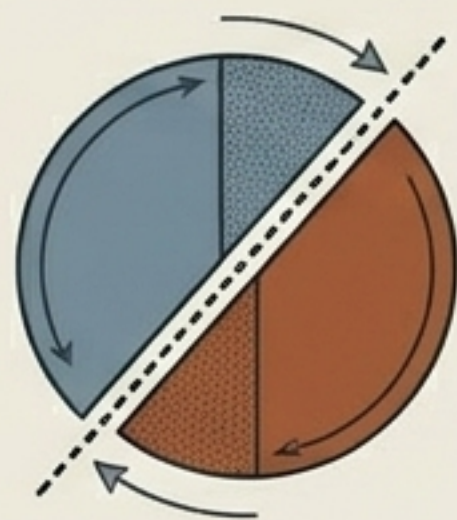
Oligopoly & Markets (Lec 15)

Cournot/Bertrand competition, price wars, and market share equilibrium.



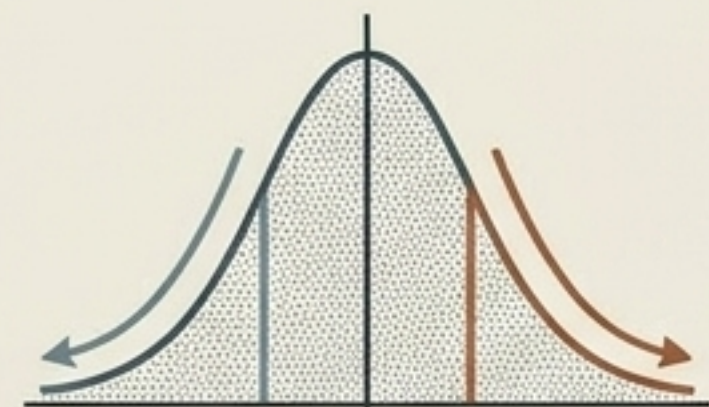
Entry & Deterrence (Lec 20)

Building credible threats, burning bridges, and monopolistic defense.



Bargaining & Negotiation (Lec 14)

The Nash Bargaining Solution, patience as leverage, and outside options.



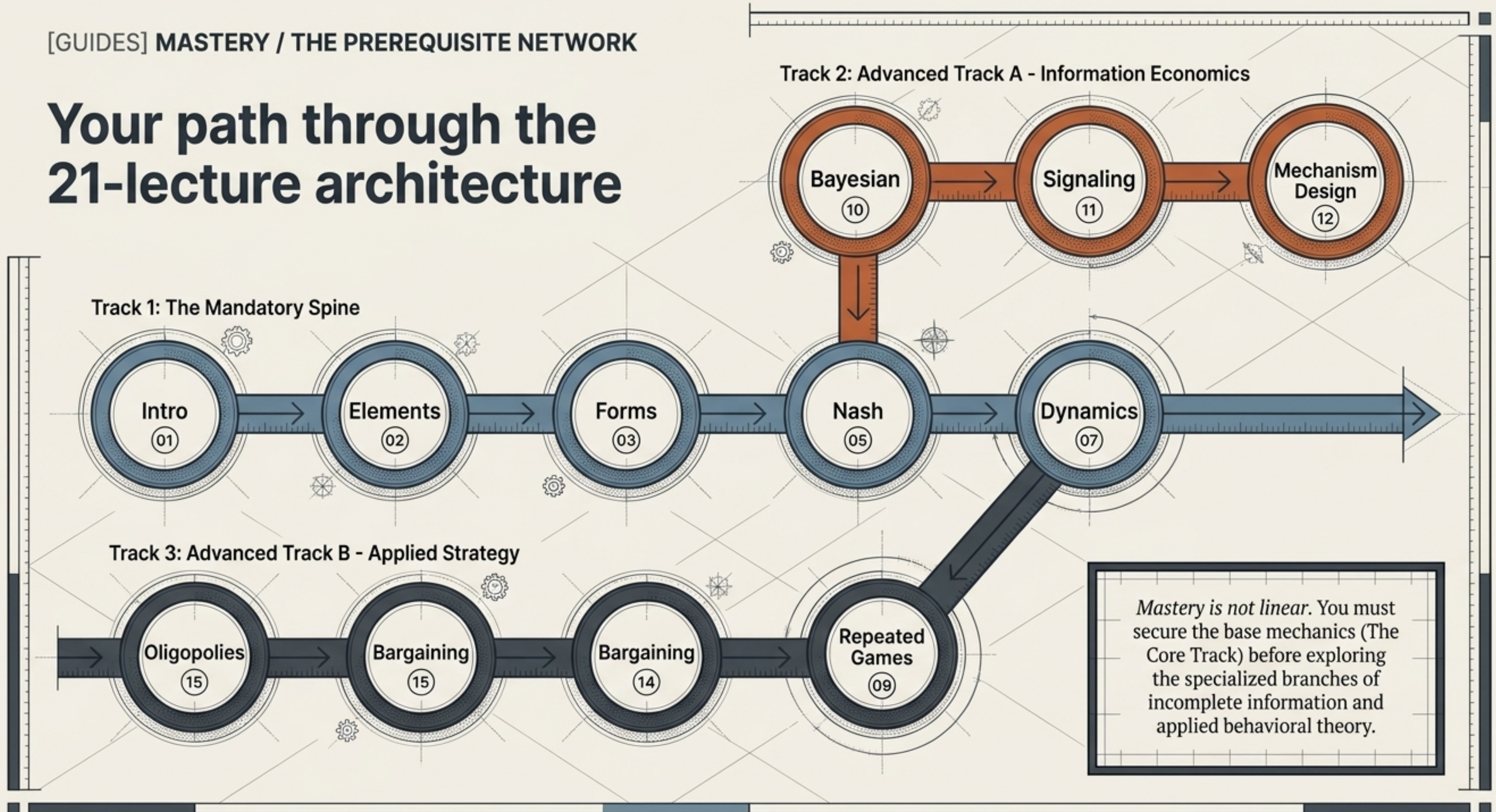
Politics & Voting (Lec 21)

The Median Voter Theorem, coalition building, and institutional design.

Median Voter



Your path through the 21-lecture architecture



Translating theory into strategic execution



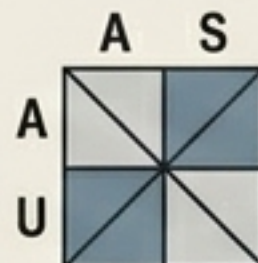
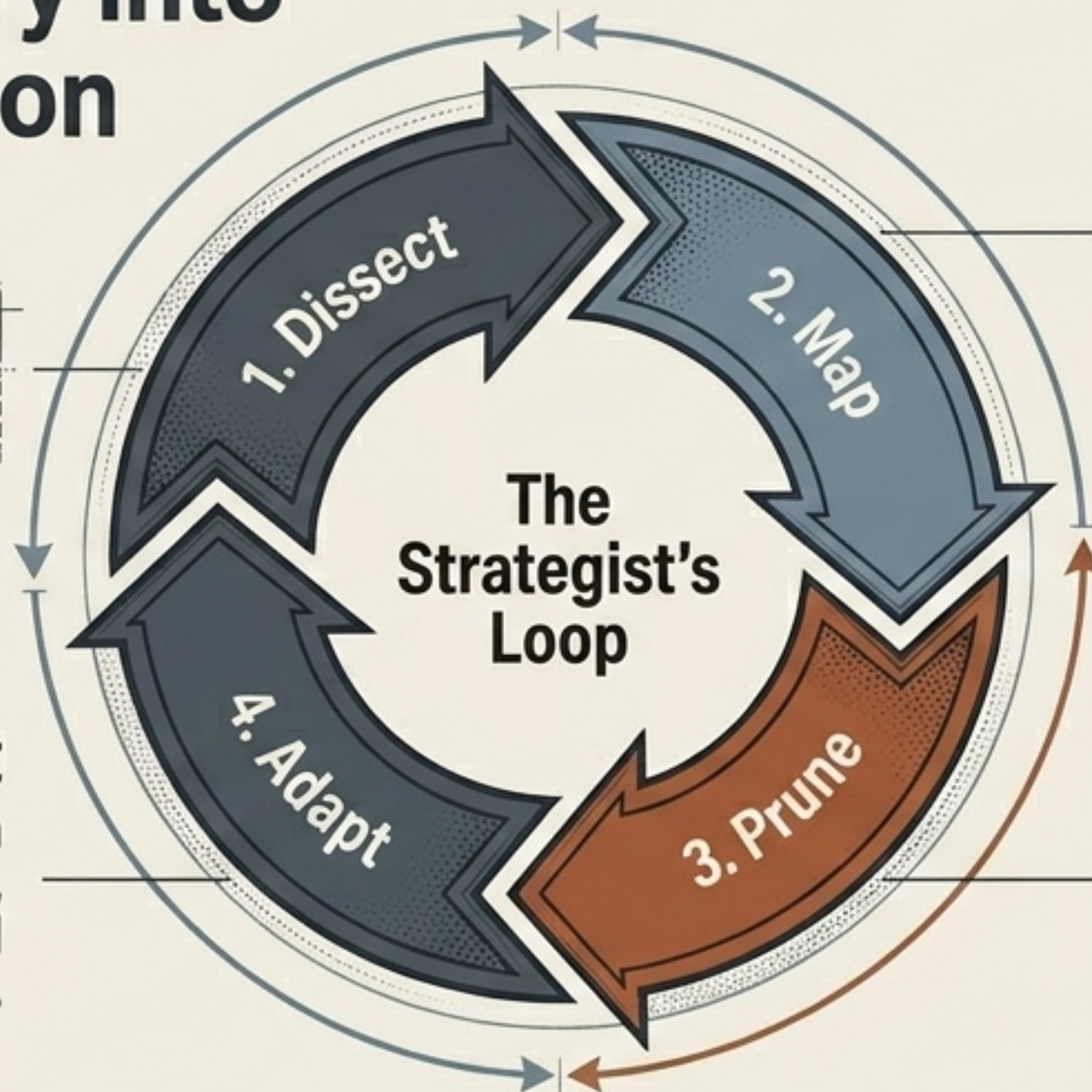
1. Dissect

Define N, S, u. Who is actually playing, and what do they truly value?



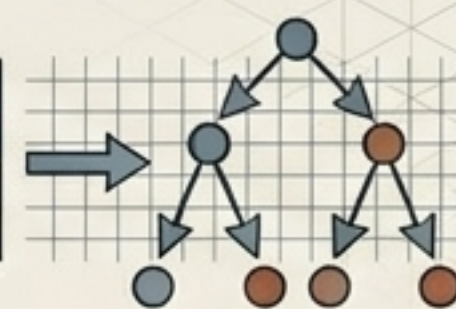
4. Adapt

Inject reality. Factor in incomplete information, behavioral blind spots, and the shadow of the future.



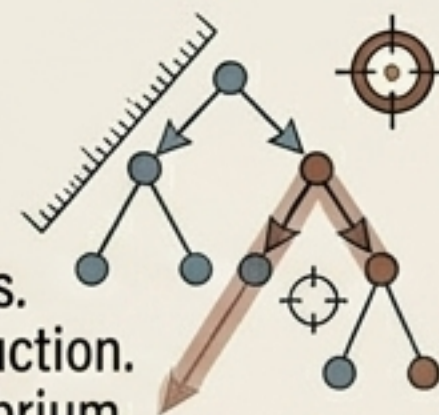
2. Map

Choose the terrain. Is the game simultaneous (Matrix) or sequential (Tree)?



3. Prune

Eliminate strictly dominated strategies. Apply backward induction. Find the Nash Equilibrium.



Do not merely observe the game. Map the structure, anticipate the equilibrium, and rewrite the rules.