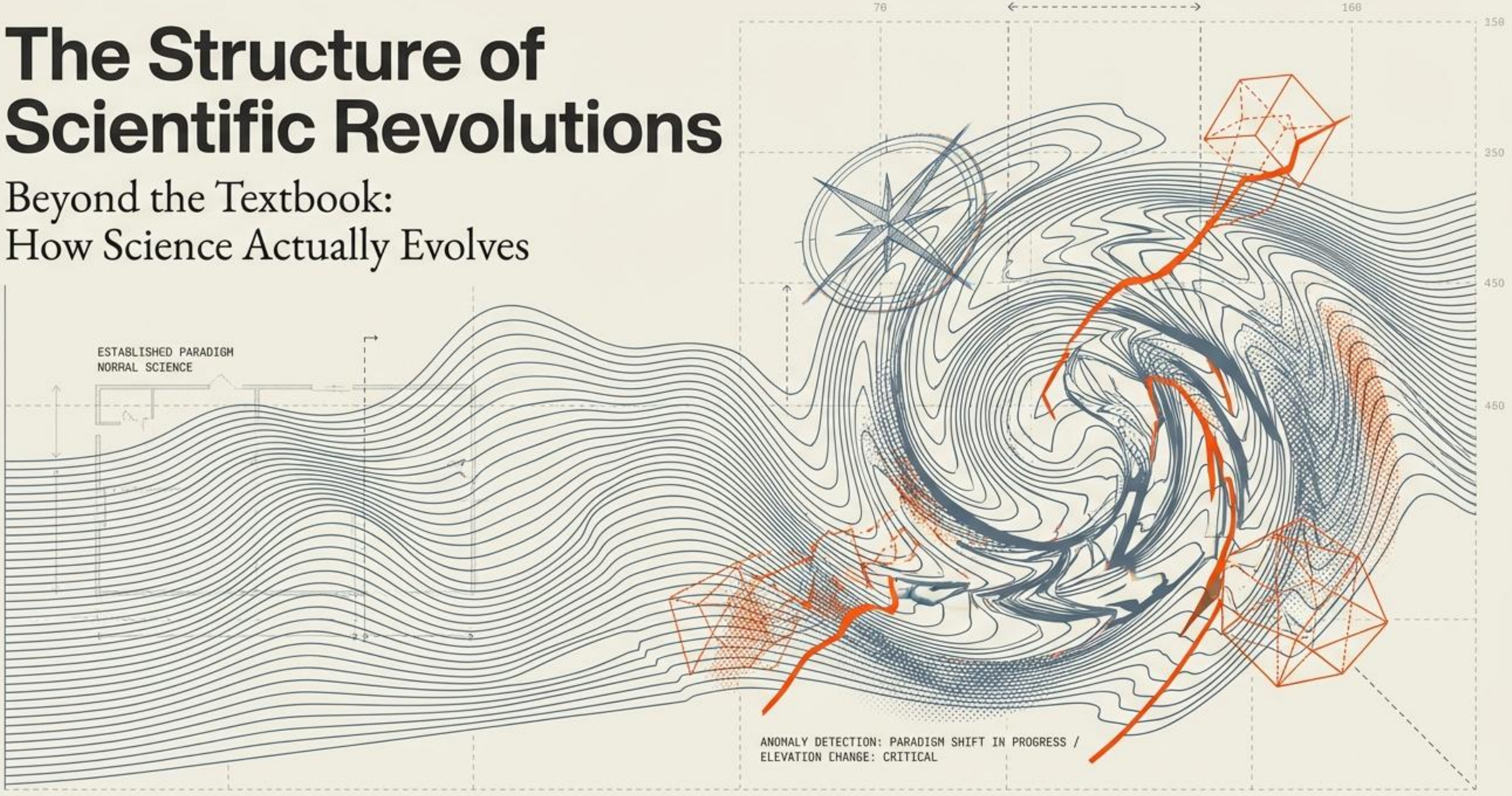
The Structure of Scientific Revolutions

Beyond the Textbook: How Science Actually Evolves

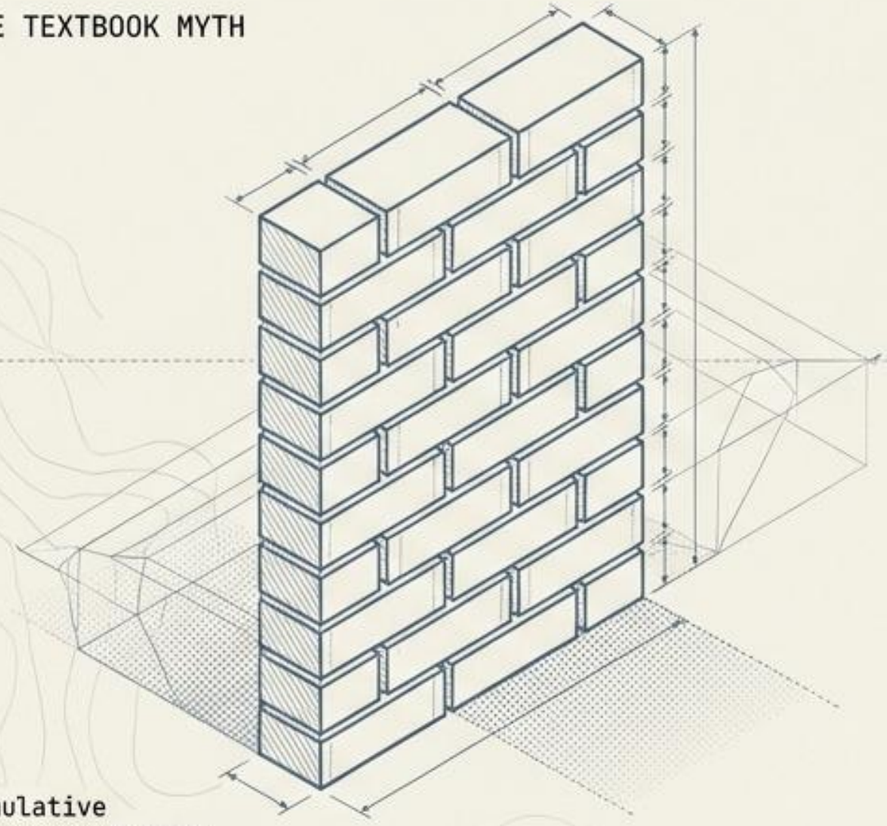


Based on the work of Thomas S. Kuhn

THE BRICKLAYER FALLACY

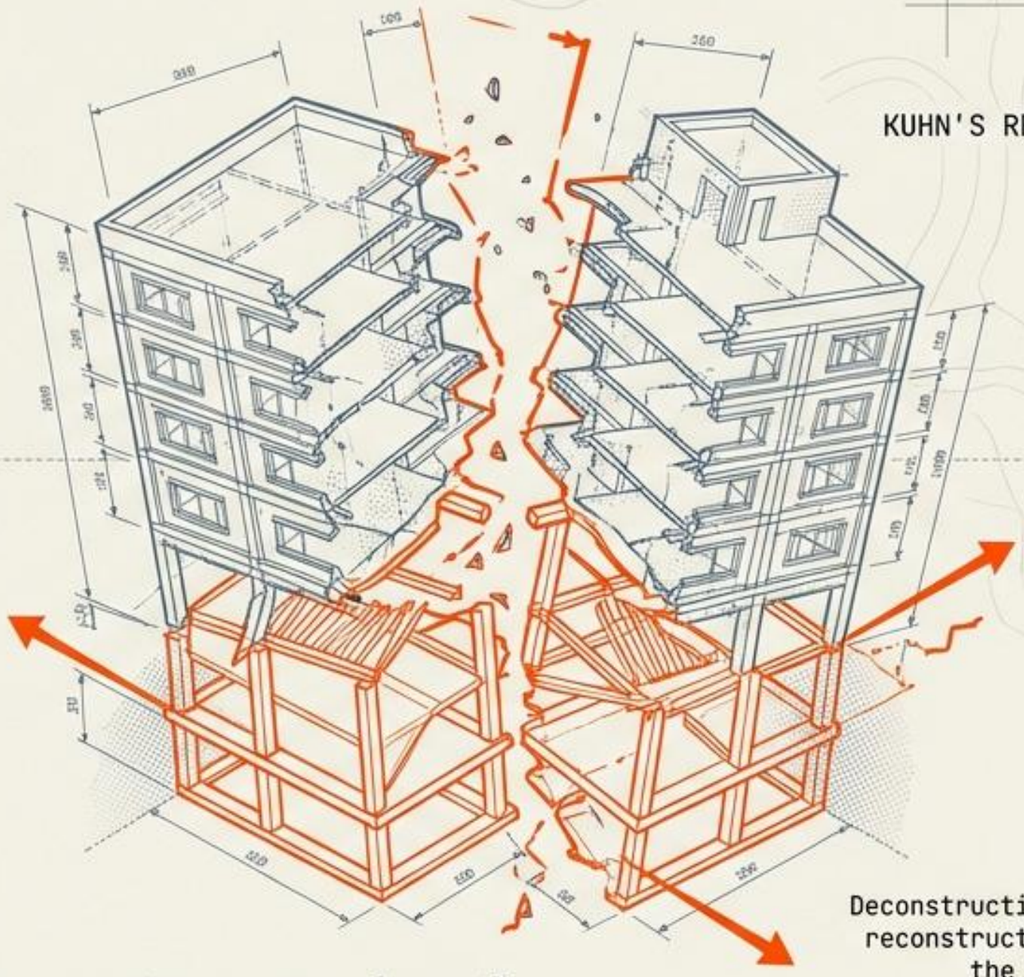
Standard textbooks present science as a cumulative process—adding one fact to another like bricks in a wall. This is a retrospective illusion.

THE TEXTBOOK MYTH



Cumulative addition of facts.

KUHN'S REALITY

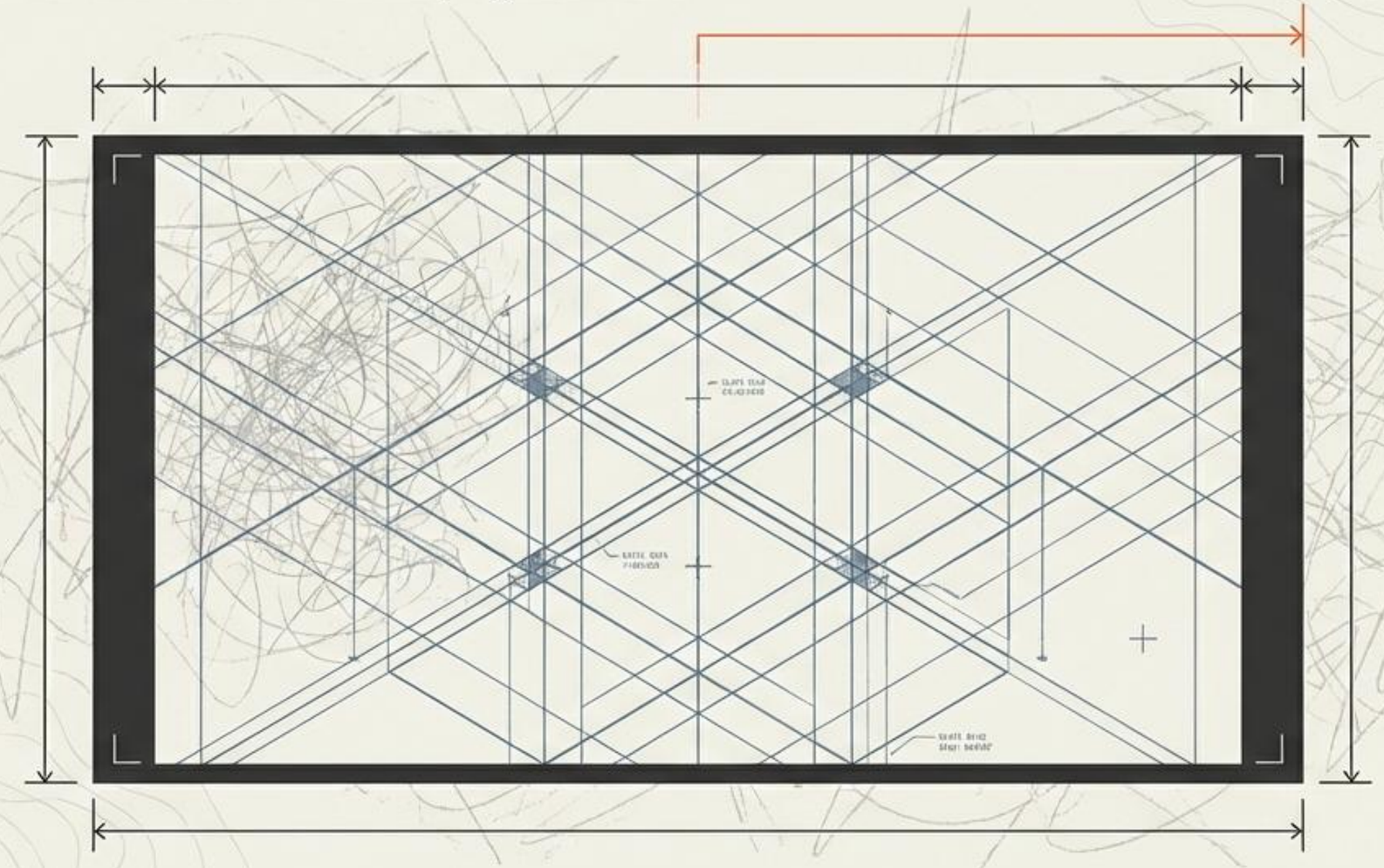


Deconstruction and reconstruction of the field.

"Science is not just adding new items to the pile; it is a reconstruction of the field."

THE PARADIGM AS A MAP

A Paradigm is a universally recognized scientific achievement that provides model problems and solutions to a community of practitioners.

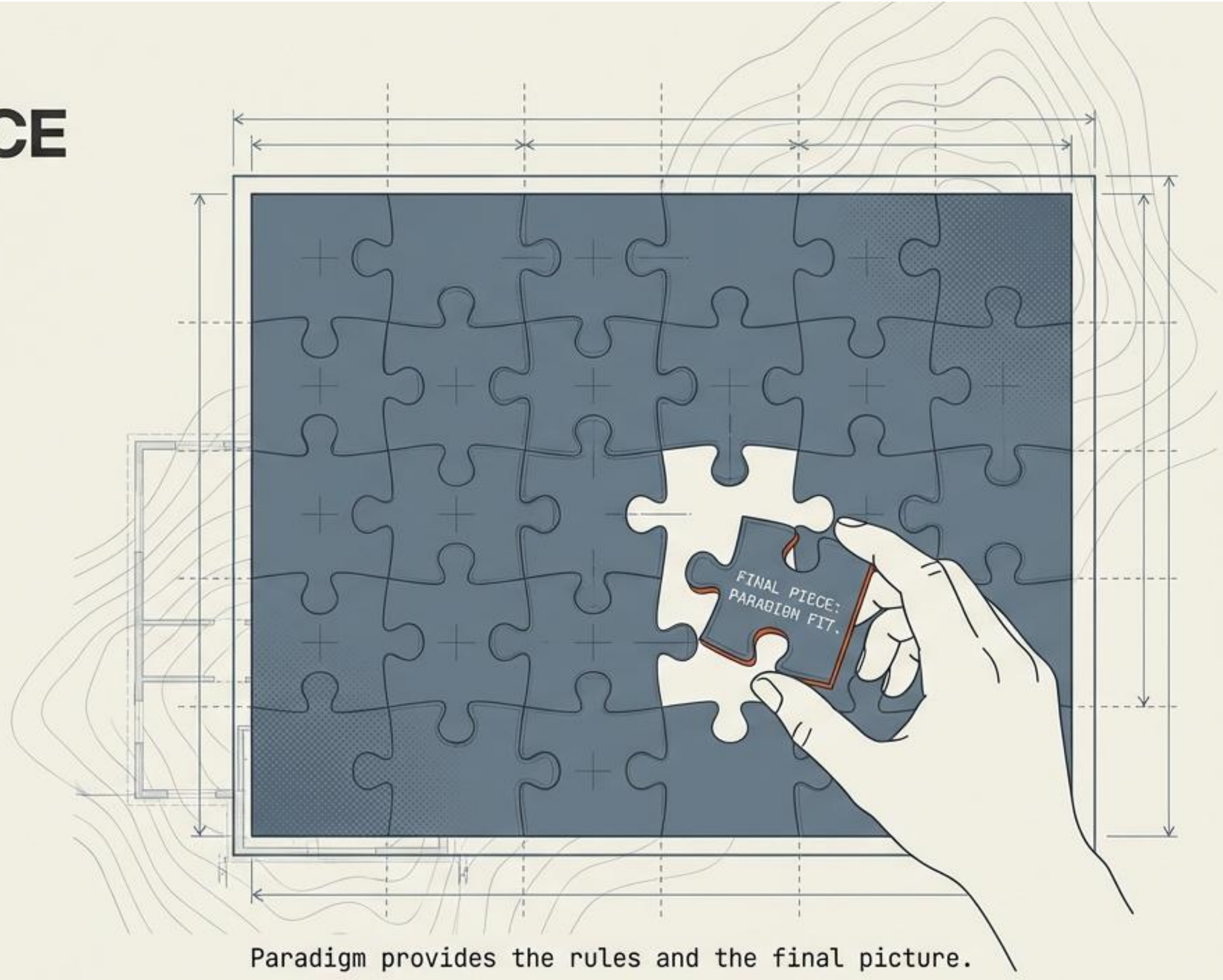


It functions as a filter. Without it, a scientist doesn't know what to look for or how to measure it.

NORMAL SCIENCE IS PUZZLE SOLVING

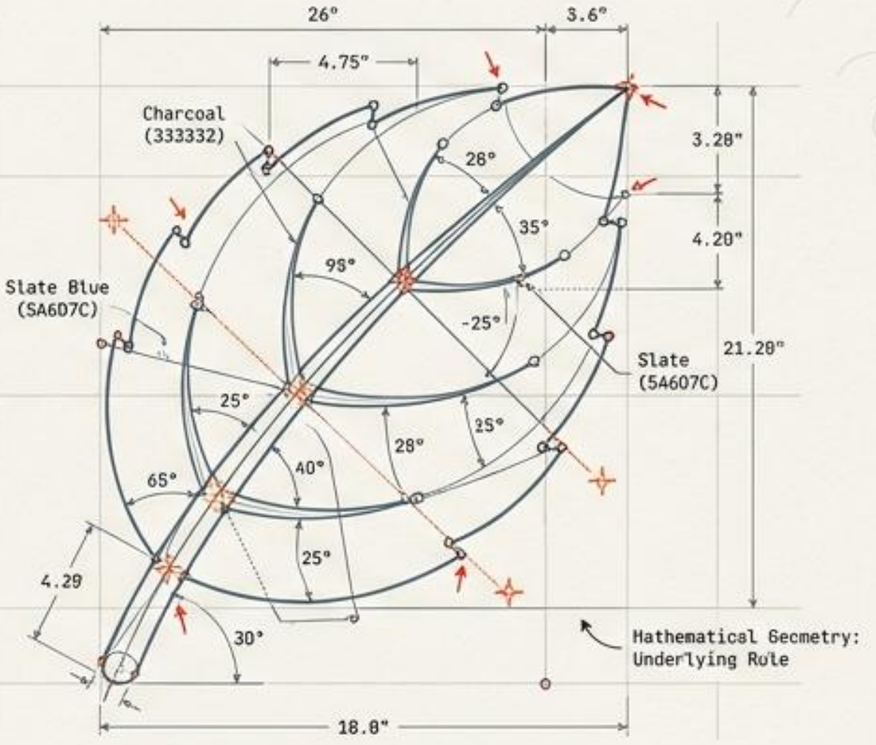
The goal of normal science is not to discover new rules, but to force nature to fit into the existing box (the Paradigm).

Dogma is functional. Strict adherence to the rules is necessary to explore a field deeply.



Paradigm provides the rules and the final picture.

The Rules of Vision

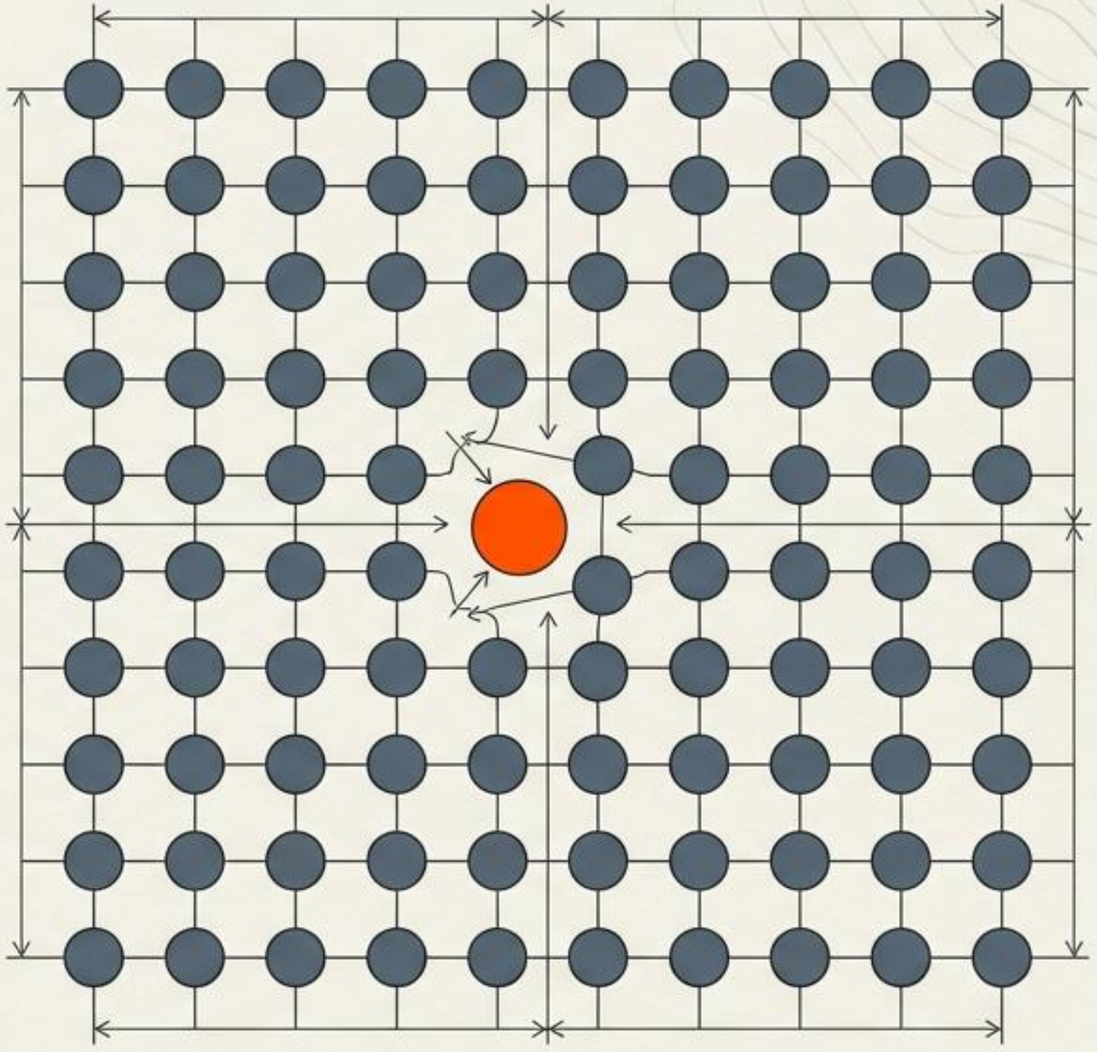


Wittgenstein argued that if you haven't learned the 'rule' of what a leaf is, you cannot recognize a leaf when you see one.

We only see what our paradigm prepares us to see.

The Anomaly

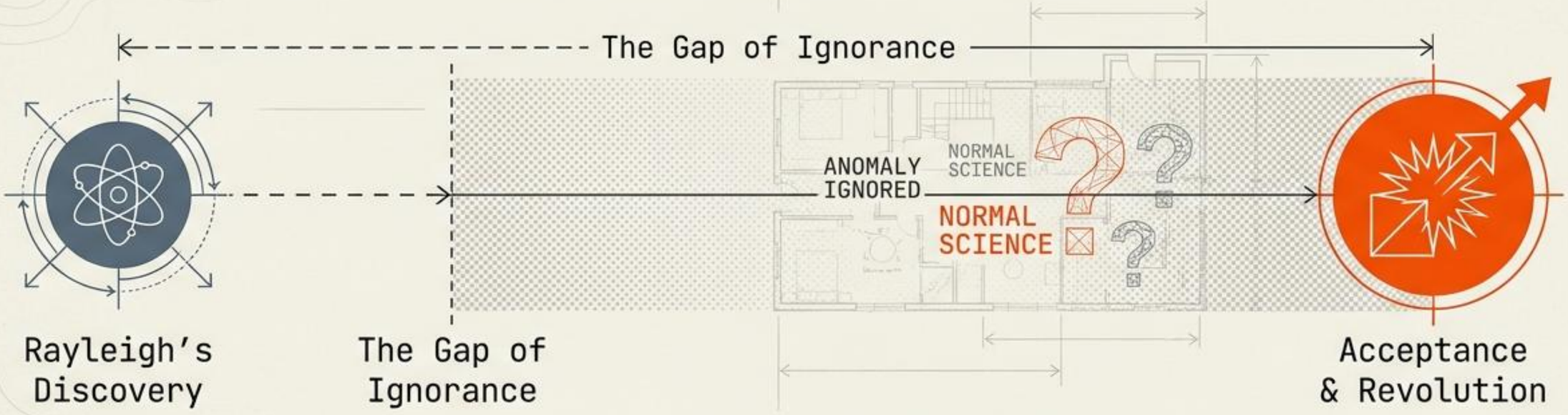
Sometimes, nature violates the expectations induced by the paradigm. Initially, scientists ignore the anomaly or blame their equipment.



Historical Example: Early electrical research data adjustments (Coulomb).

Case Study: The Lord Rayleigh Paradox

Lord Rayleigh suggested paradoxes in electrodynamics that were ignored for for years. Not because he was wrong, but because the Normal Science of his day couldn't process the information.

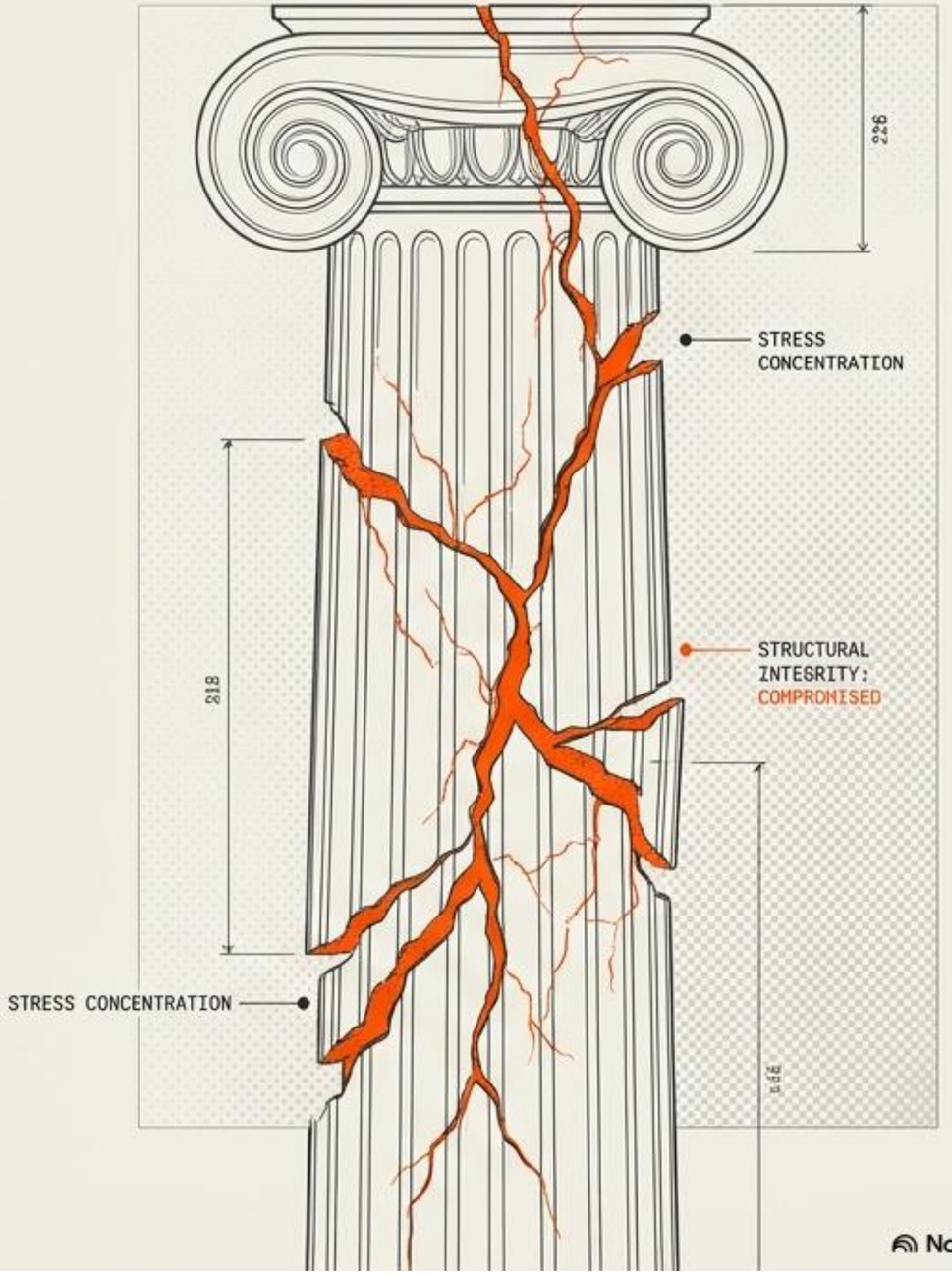


Science is often blind to truths that do not fit the current puzzle.

From Anomaly to Crisis

When anomalies become too numerous or strike at the core of the theory, the paradigm enters a Crisis.

Psychological State:
The community feels insecure.
The dogma is broken.

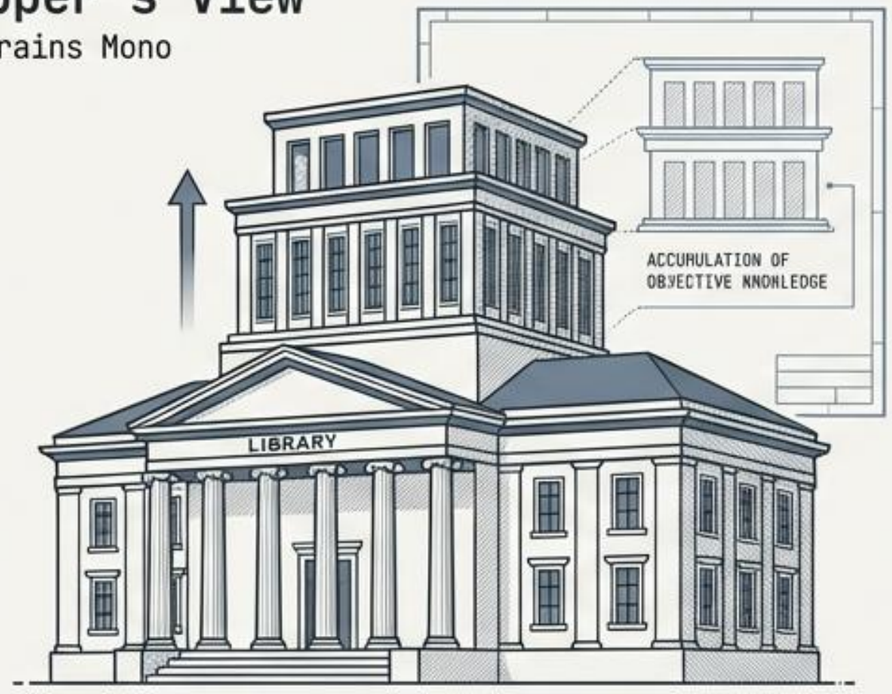


Revolution is Destruction

A scientific revolution is a non-cumulative event. It destroys the old framework to build a new one.

Popper's View

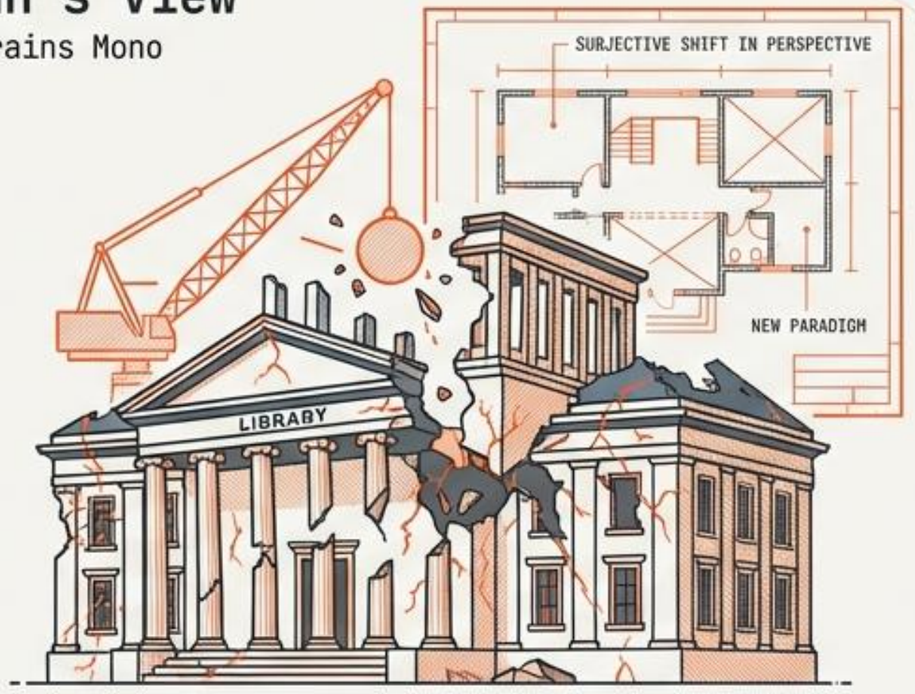
JetBrains Mono



Popper: Accumulation of objective knowledge.

Kuhn's View

JetBrains Mono



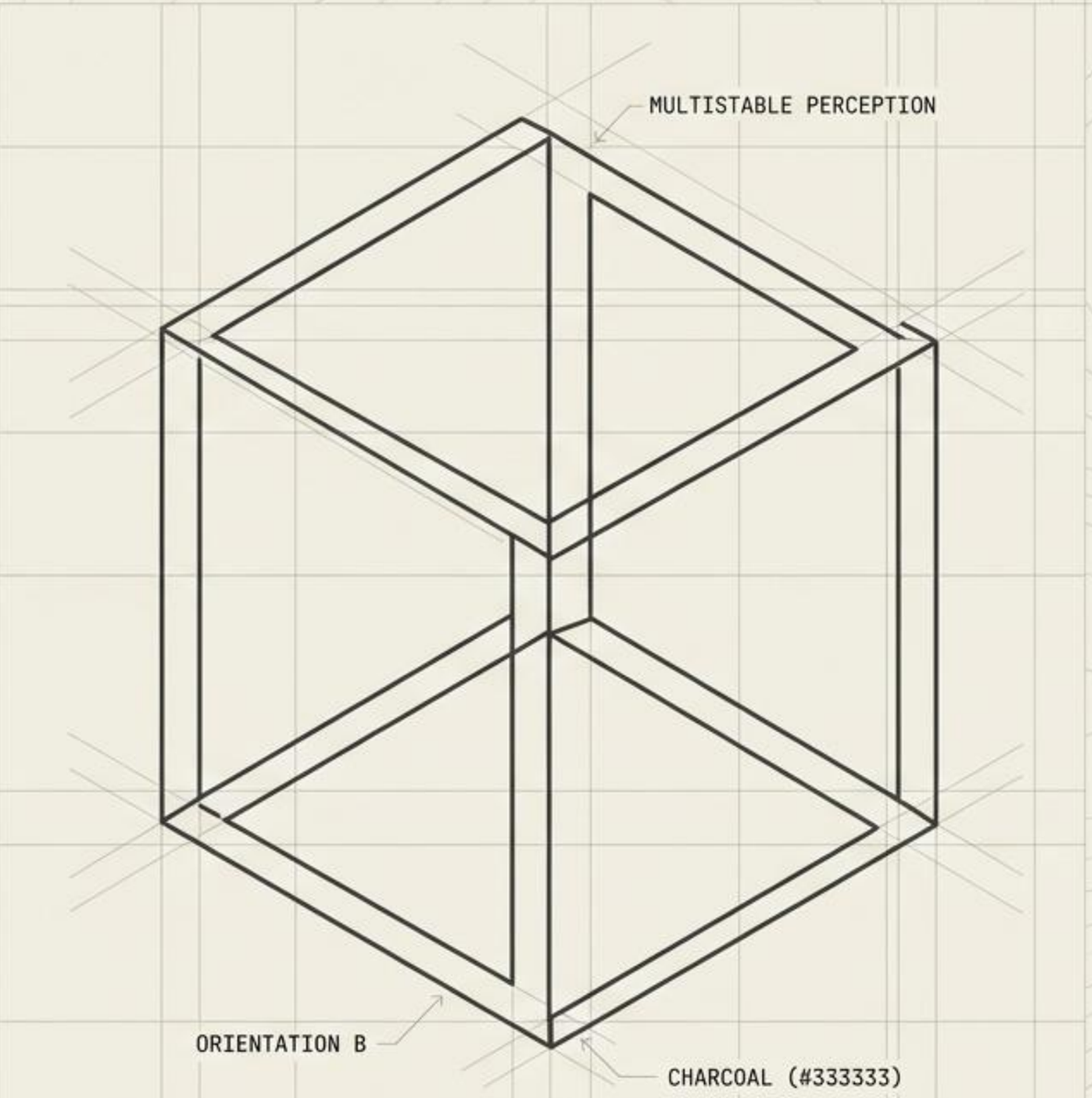
Kuhn: Subjective shift in perspective.

Popper: Accumulation of objective knowledge.
Kuhn: Subjective shift in perspective.

The Gestalt Switch

When paradigms change, the world itself changes with them.

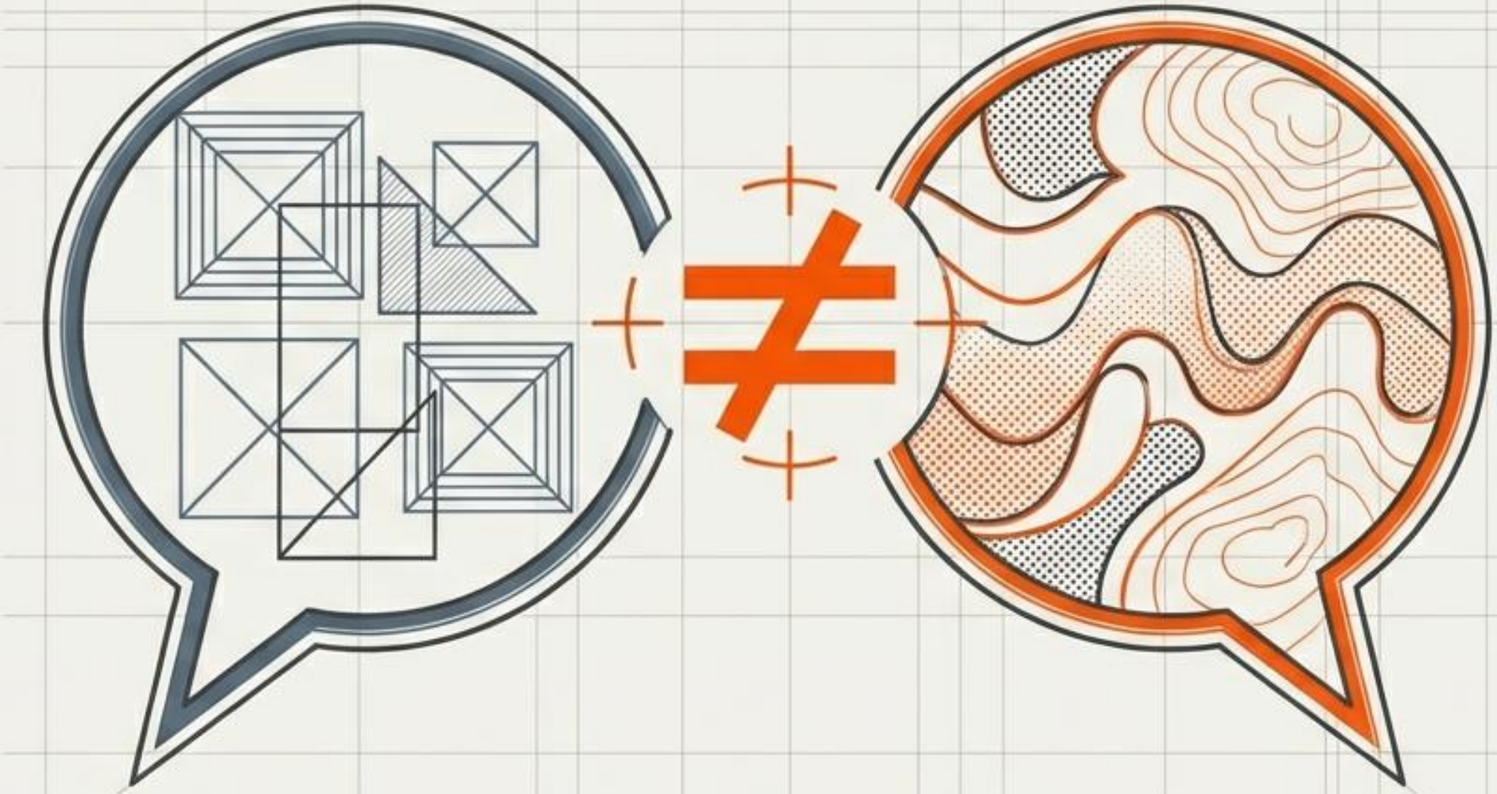
Scientists handle the same data but see different things. It is a sudden transfer of vision—a ‘lightning flash’ that cannot be pieced together slowly.



Incommensurability

You cannot strictly compare old and new paradigms because they use different vocabularies.

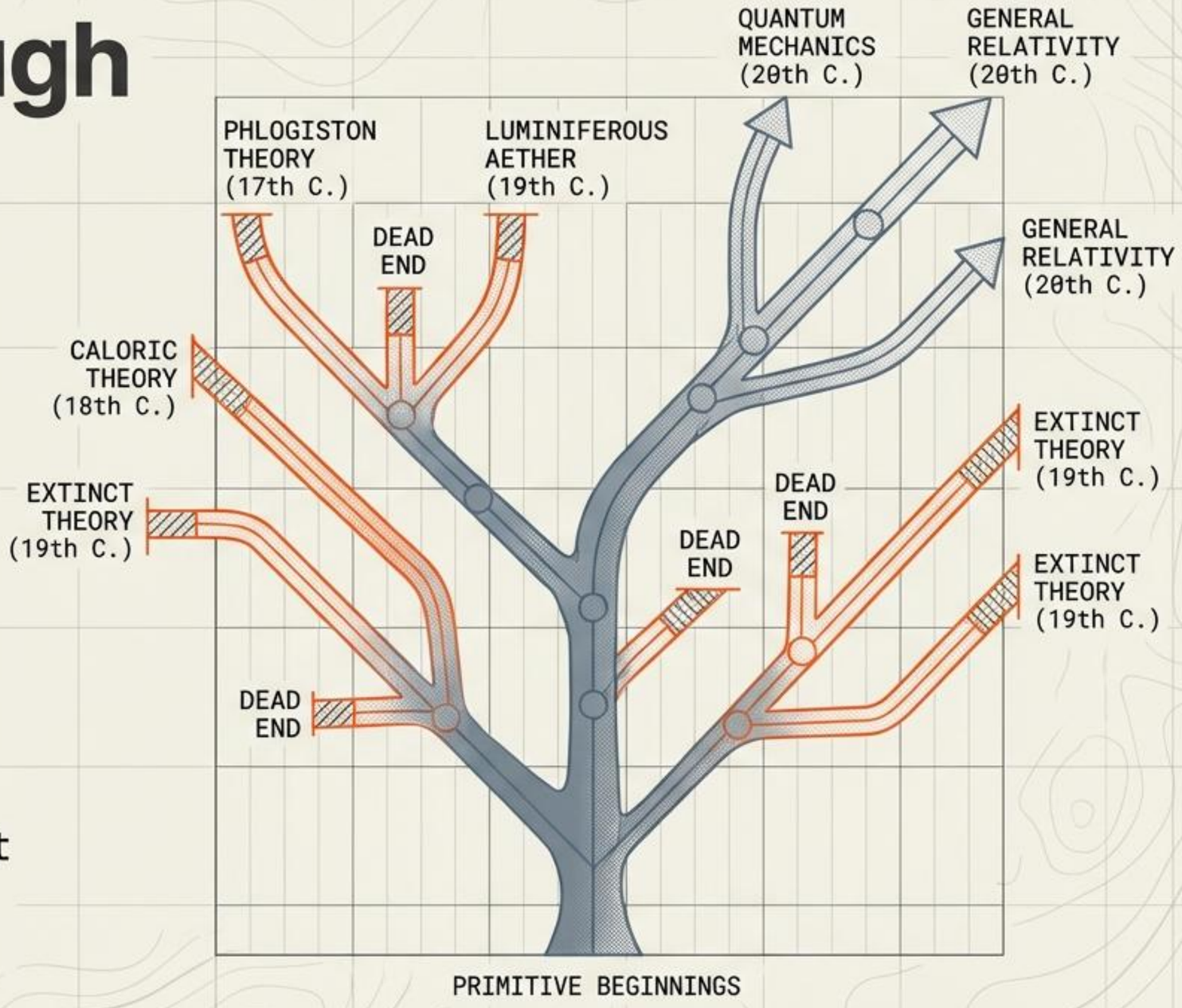
Proponents of competing paradigms are always at cross-purposes. There is no neutral language to decide who is right.



VISUAL METAPHOR: COMPETING PARADIGMS EMPLOY DIFFERENT LANGUAGES

Progress through Evolution

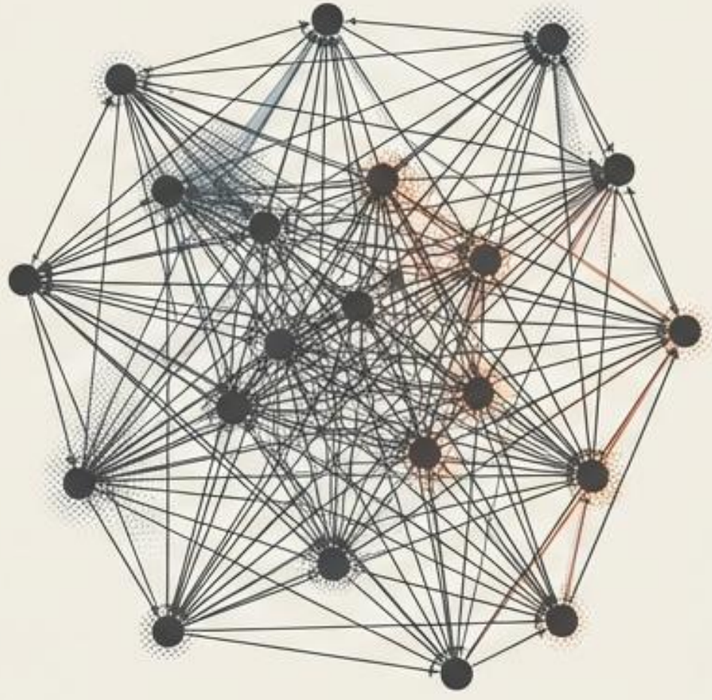
Scientific progress is like biological evolution. We are moving AWAY from primitive beginnings, but not necessarily TOWARD a fixed Truth.



Key Takeaway: There is no pre-set goal, only adaptation.
JetBrains Mono 'Charcoal'

Science is a Community

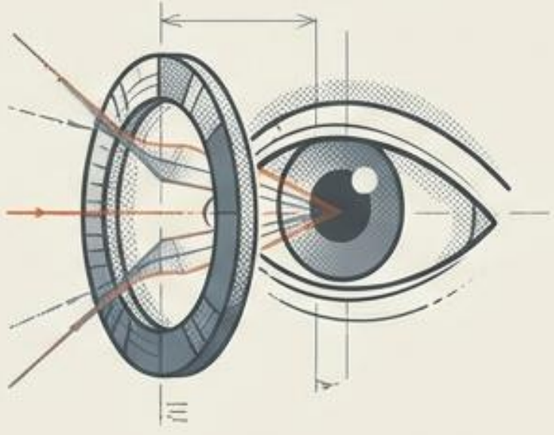
A paradigm is defined by what a scientific community shares. Truth is determined by the consensus of the group, not just abstract logic.



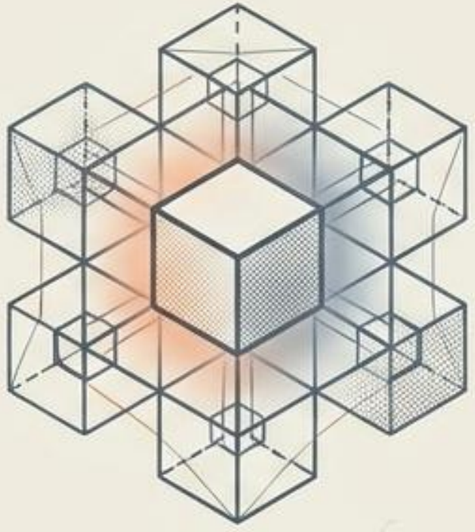
The Cycle of Science

1. Science is not cumulative; it breaks and rebuilds.
2. Paradigms dictate what we see.
3. Revolutions change our World View.
4. Progress is evolutionary, not goal-oriented.

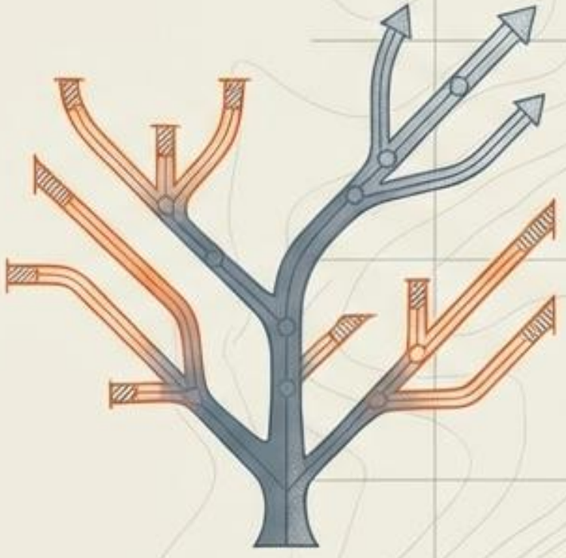
CYCLE BREAKS



PARADIGM FILTER

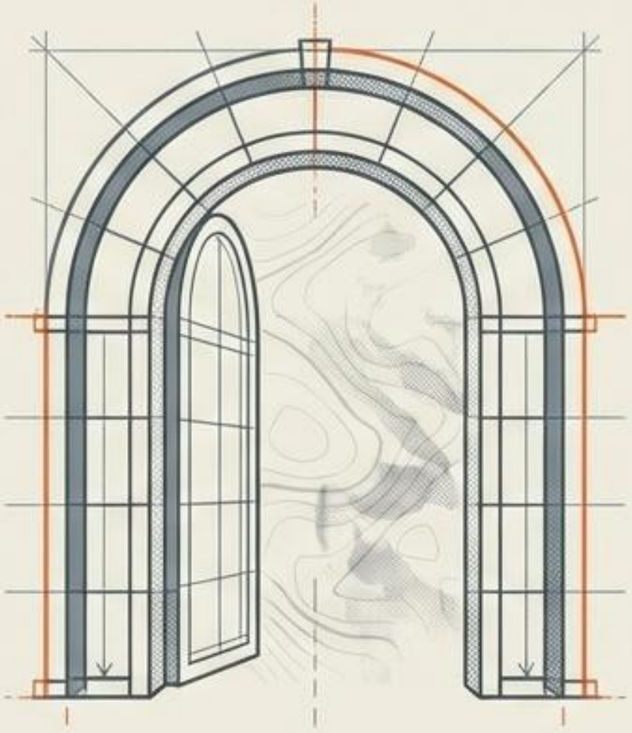


WORLD VIEW SHIFT



EVOLUTIONARY PROGRESS

The Next Paradigm



Can you identify a dogma in your current field of study?

If science doesn't move toward a fixed Truth, but only evolves…
what does that make the facts you are learning today?