

Philosophy of Science I

8th March 2024

Session 7 - Science as a social endeavour



Mystery Box

Mystery Box





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Causal knowledge and imitation/emulation switching in chimpanzees (*Pan troglodytes*) and children (*Homo sapiens*)

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Abstract This study explored whether the tendency of chimpanzees and children to use emulation or imitation to solve a tool-using task was a response to the availability of causal information. Young wild-born chimpanzees from an African sanctuary and 3- to 4-year-old children observed a human demonstrator use a tool to retrieve a reward from a puzzle-box. The demonstration involved both causally relevant and irrelevant actions, and the box was presented in each of two conditions: opaque and clear. In the opaque condition, causal information about the effect of the tool inside the box was not available, and hence it was impossible to differentiate between the relevant and irrelevant parts of the demonstration. However, in the clear condition causal information was available, and subjects could potentially determine which actions were necessary. When chimpanzees were presented with the opaque box, they reproduced both the relevant and irrelevant actions, thus imitating the overall structure of the task. When the box was presented in the clear condition they instead ignored the irrelevant actions in favour of a more efficient, emulative technique. These results suggest that emulation is the favoured strategy of chimpanzees when sufficient causal information is available. However, if such information is not available, chimpanzees are prone to employ a more comprehensive copy of an observed action. In contrast to the chimpanzees, children employed imitation to solve the task in both conditions, at the expense of efficiency. We suggest that the difference in performance of chimpanzees and children may be due to a greater susceptibility of children to cultural conventions, perhaps combined with a differential focus on the results, actions and goals of the demonstrator.

Keywords Chimpanzees · Children · Imitation · Emulation · Causality

Introduction

Many of the tool-using activities of both chimpanzees and children involve a complex mixture of interconnected causal relationships between a tool and a reward, and much of this tool use is thought to be acquired, at least in part, by social learning (Boesch and Tomasello 1998). However, despite the considerable research effort that has been focused on both causal understanding and social learning, few studies have directly addressed the potential interaction between these fields of research. It seems likely that the way in which an individual learns to use a tool through observation will be significantly influenced by its interpretation of the causal relationships that are involved. This paper will examine whether knowledge of causal relationships influences the way in which chimpanzees and children learn by observation.

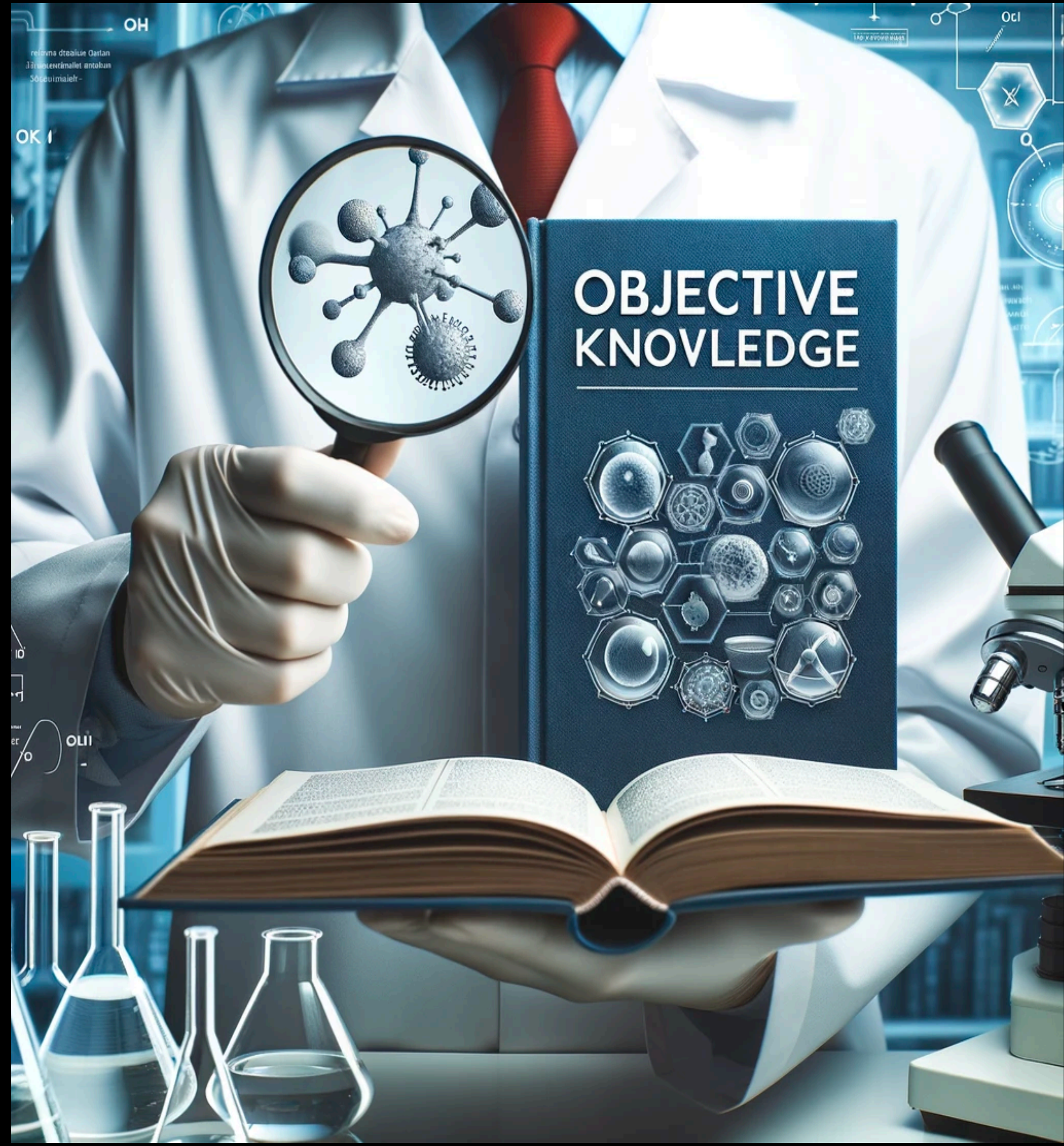
Social learning has been investigated for over a century, during which time numerous different learning strategies have been identified and categorised, each varying with respect to the match between the actions of the demonstrator and observer (Whiten and Ham 1992). However, within the recent comparative primate literature two particular strategies have received considerable attention; emulation and imitation.

Emulation refers to a process whereby through watching a model, an observer learns about the results of actions, rather than details of the behaviour involved (Tomasello et al. 1987). For example, an individual may learn to use

Where are we at?

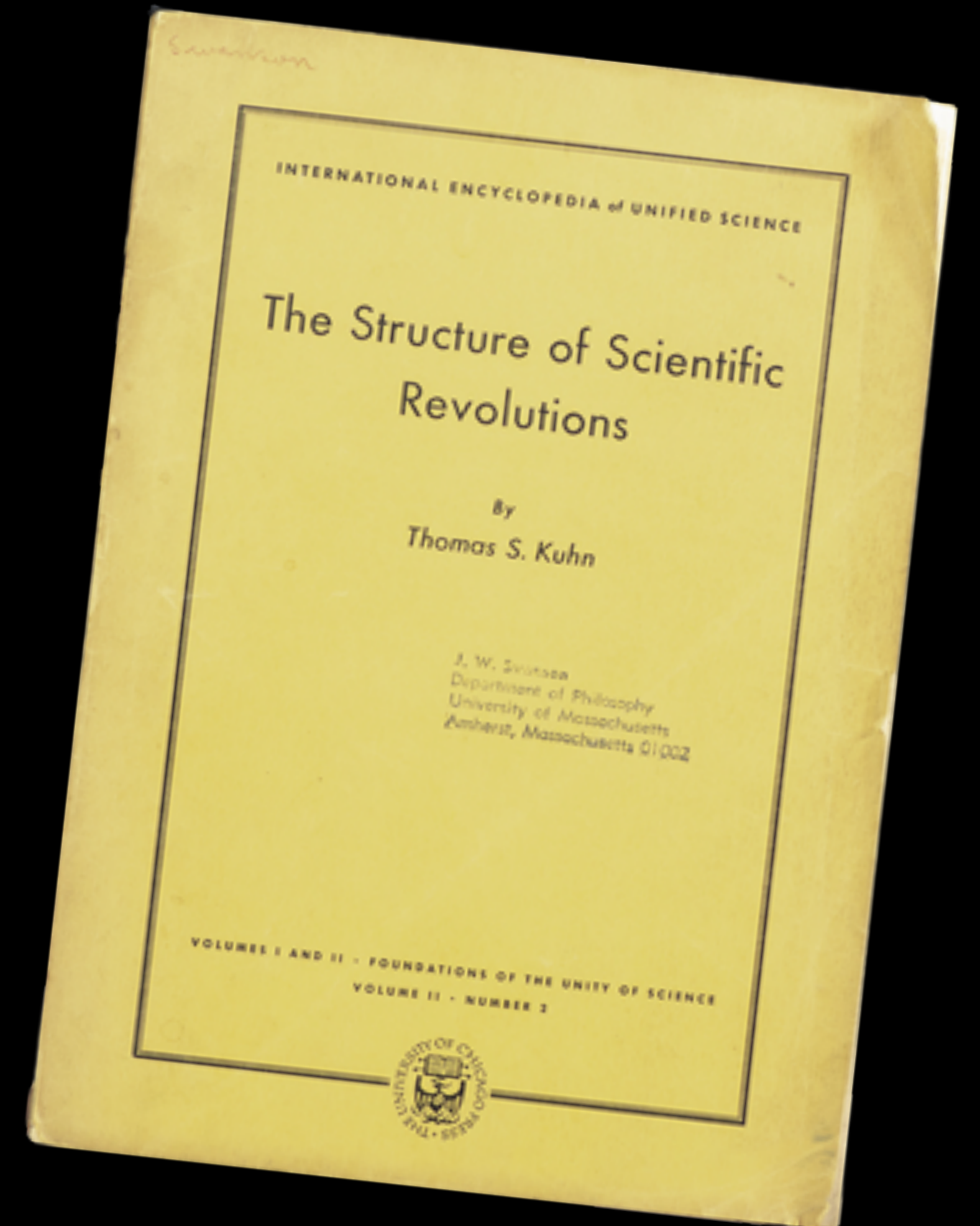
- Science seems to provide us with **objective knowledge** about the world
- This objective is guaranteed by the application of the **scientific method**
- Observations act as the **neutral** arbiter between our scientific theories
- **Science is progressive** in the sense that we know more about the structure of the world than we did previously

Q: Is it so?

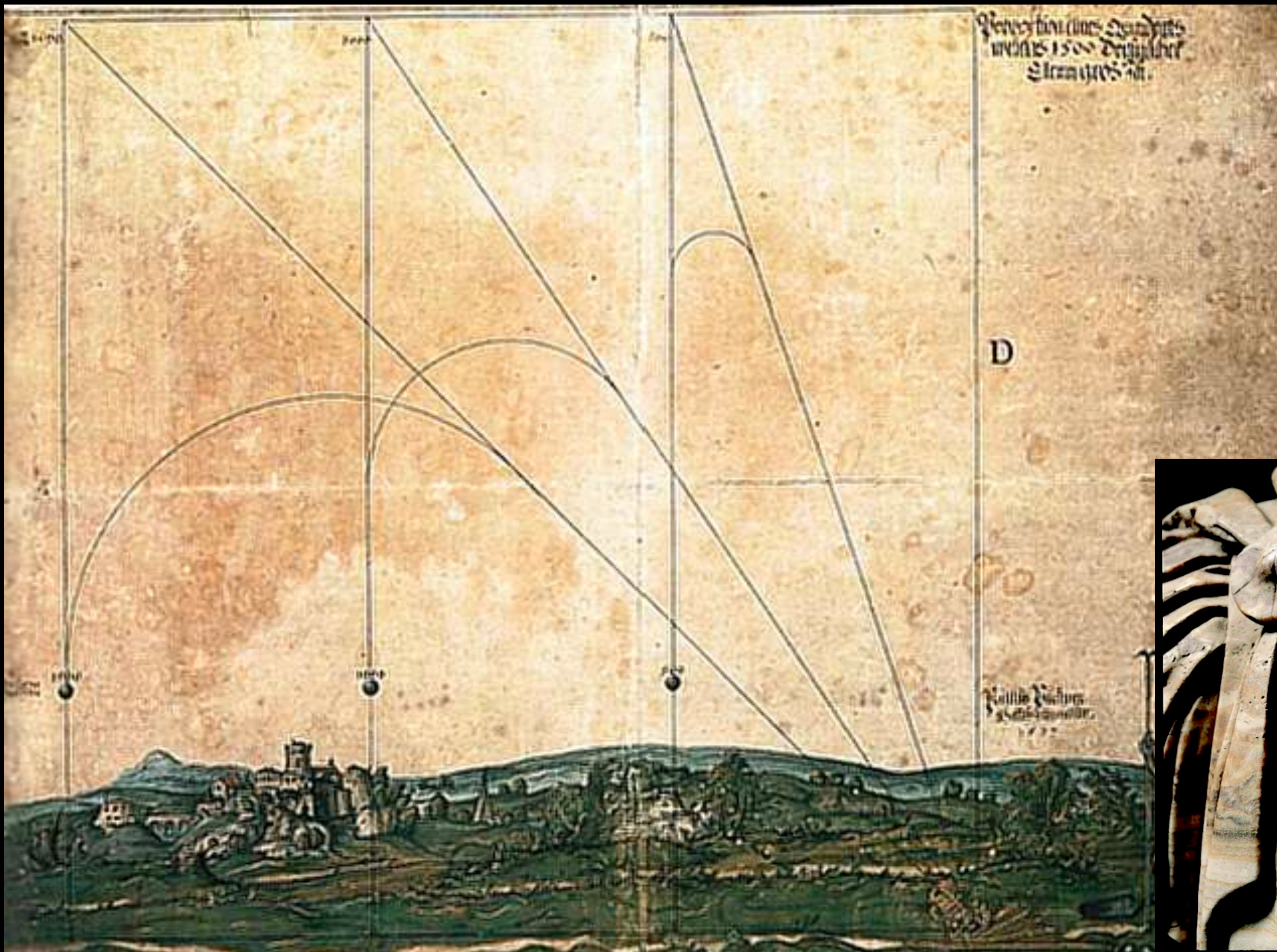


However, it seems that we keep running in trouble as we further analyze the history of scientific practice. It took a while, but in the 1950s philosophers of science changed the focus from normative views to consider from the very start how science is done instead of how it should be done.

Thomas Kuhn



Was Aristotle stupid?



Theagenes of Thasos

 **17 languages** 

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From Wikipedia, the free encyclopedia

Theagenes of Thasos (Greek: Θεαγένης ὁ Θάσιος) (typically spelled **Theogenes** (Greek: Θεογένης) before the first century AD) was an [Olympian of ancient Greece](#), famous for his victories.^[1]

Background [\[edit \]](#)

Son of Timosthenes, Theagenes was renowned for his extraordinary strength and swiftness. Aged nine, he supposedly carried home the bronze statue of a god he took a liking to from the [agora](#), then carried it back again.

As he grew up he became distinguished in every kind of athletic contest, and gained numerous victories at the [Olympian](#), [Pythian](#), [Nemean](#), and [Isthmian](#) Games. Altogether he was said to have won 1400 crowns at various Greek festivals. ^[2] He gained a victory at [Olympia](#) in the 75th Olympiad, 480 BC. (Paus. vi. 6. § 5.) The popular story among the [Thasians](#) was that [Heracles](#) was his father. Thomas Green claims that in the course of winning 1,406 [boxing matches](#), Theagenes killed "most of his opponents".^[3]

Statue and hero-cult [\[edit \]](#)

[Pausanias](#) relates a story regarding a statue of Theagenes made by [Glaucias of Aegina](#). A man in [Thasos](#) had a grudge against Theagenes for his victories, and scourged the statue by way of revenge. One night, the statue fell upon this man, killing him.

The statue was put on trial for murder, found guilty, and exiled by being thrown into the sea. The land then became barren. The [Oracle of Delphi](#) declared that the country would remain so until they restored the statue of Theagenes. Fortunately, the crew of a fishing vessel caught the statue in a net and brought it to shore so it could be returned to its original site. ^[4]



"When dealing with subjects other than physics, Aristotle had been an acute and naturalistic observer. In such fields as biology or political behavior, his interpretations of phenomena had often been, in addition, both penetrating and deep. How could his characteristic talents have failed him so when applied to motion? How could he have said about it so many apparently absurd things? And, above all, why had his views been taken so seriously for so long a time by so many of his successors? The more I read, the more puzzled I became. Aristotle could, of course, have been wrong, I had no doubt that he was, but was it conceivable that his errors had been so blatant?"



"One memorable (and very hot) summer day those perplexities suddenly vanished. I all at once perceived the connected rudiments of an alternate way of reading the texts with which I had been struggling, ... the permanent ingredients of **Aristotle's universe**, its ontologically primary and indestructible elements, were not material bodies but rather the qualities ... I mean by the discovery of a new way to read a set of texts. After I achieved this one, strained metaphors often became naturalistic reports, and much apparent absurdity vanished. I did not become an Aristotelian physicist as a result, but I had to some extent learned to think like one."

Claims about the world were embraced by learned people whose aim was to understand the world, similarly to our embracing of current theories. Thus, if this is the criterion to be used to define them as scientific, **then old claims such as myths, etc, should also be considered science.** To deny that, one would conclude that our current science is also just like the old myths.

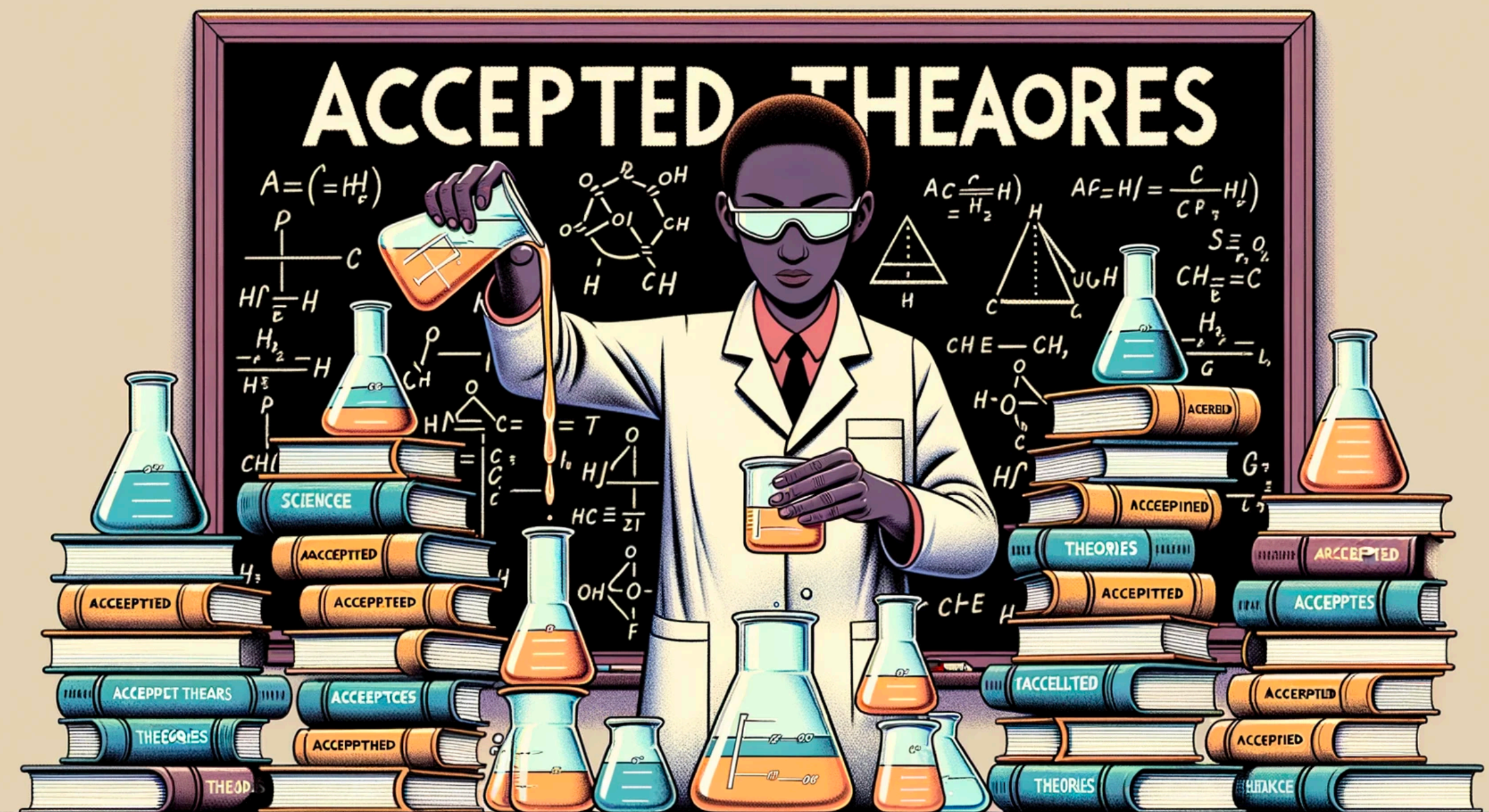
Normal . Science.

when the methods, instruments, directions, and problems that scientists focus on are determined by the current **paradigm**.

The paradigm goes beyond just simply formulation of the theories, as it also takes into account all the commitments that come with them.

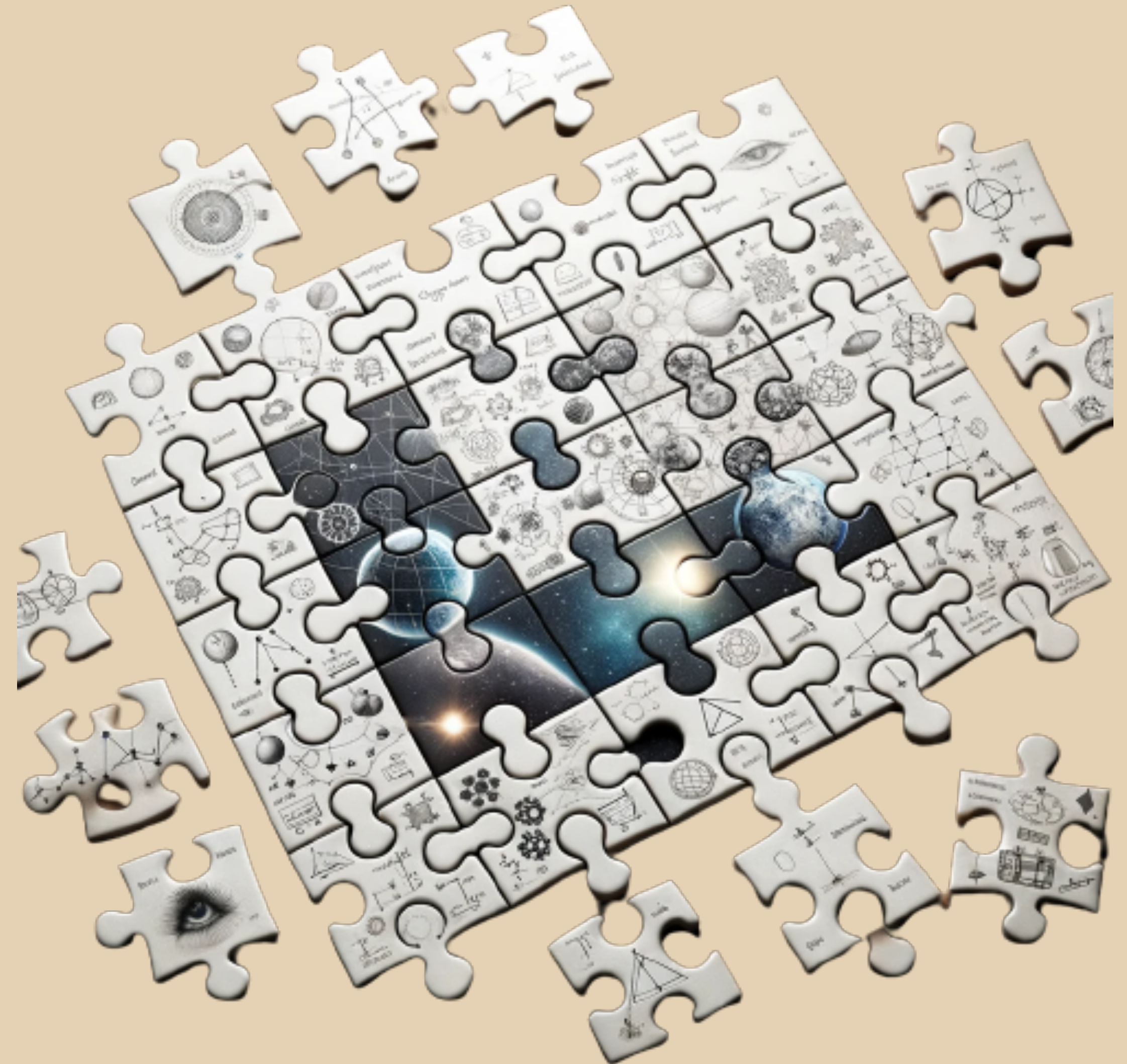
It's a “way of doing science”.

Q: Examples?



Kuhn's notion of paradigms has important philosophical implications for the nature of science:

1. Paradigms are **holistic**
2. Observation is **theory-laden**
3. Meaning is paradigm-dependent
4. Paradigms dictate ontology



During periods of **normal science**, research focuses on pushing the frontiers of knowledge by applying the paradigm itself to the explanation and prediction of data within its intended domain. The empirical focus tends to be towards:

- obtaining greater precision in previously established observations
- establishing facts that reinforce the paradigm
- experiments undertaken to solve problems to which the paradigm draws our attention

Q: Examples?

Q: What if that fails?

Normal science is also reflected in textbooks and the **consensus on the approaches to teach any given subject which is paradigmatic**. At the same time, **when that's not the case**, typically in the special sciences, that will reflect that **the discipline remains pre-paradigmatic**.

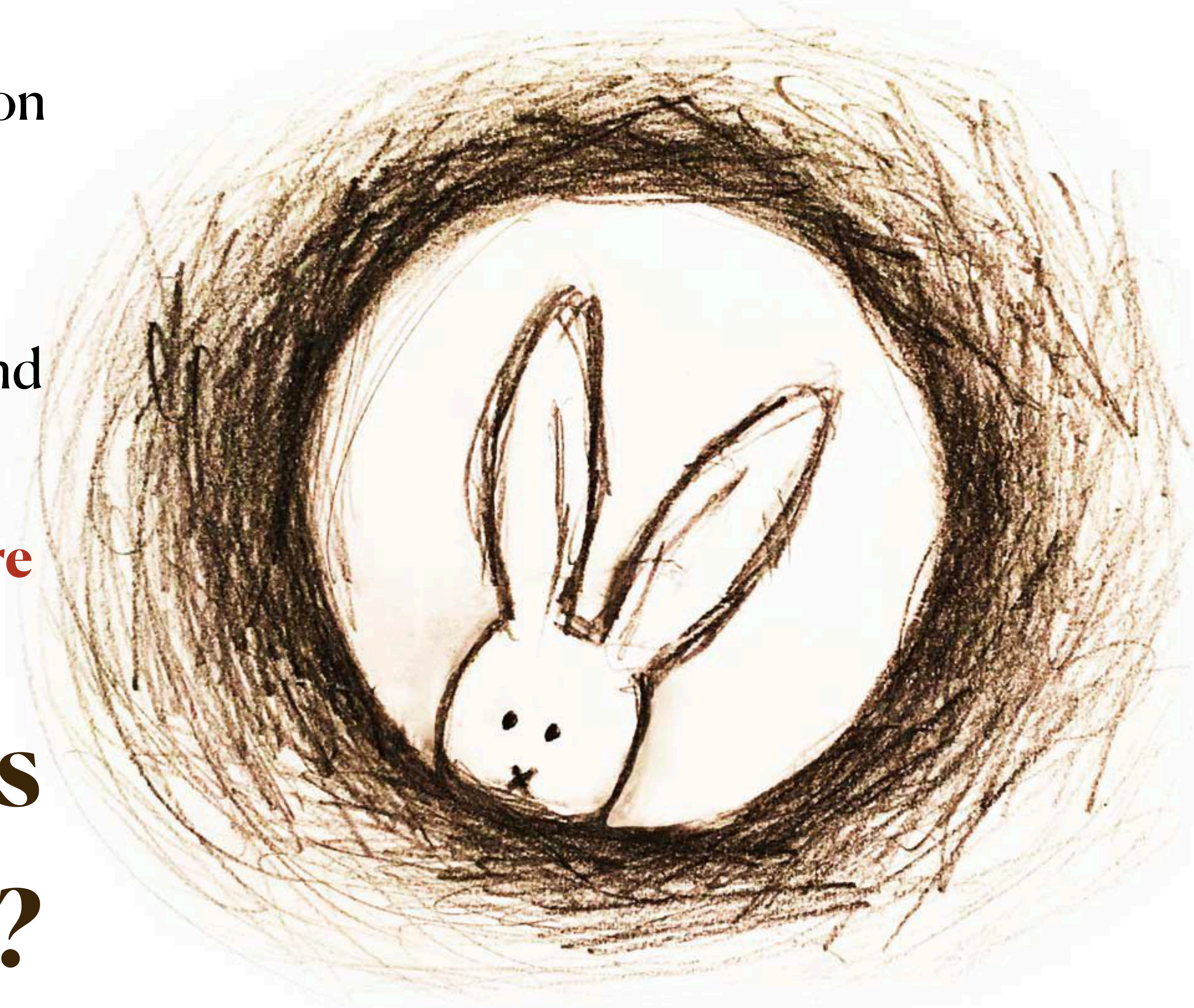
Q: Examples of current pre-paradigmatic science?



Kuhn made use of **several psychological experiments** to argue that **observations are not taken neutrally**, but rather they are interpreted within the paradigm itself:

- Our descriptions of our measurements depend on theoretical concepts that operate within the paradigm
- Our paradigms determine which observations and experiments are salient
- **Perhaps, even our perceptions themselves are theory-laden**

**How deep is
the rabbit hole?**



**What color is
this?**

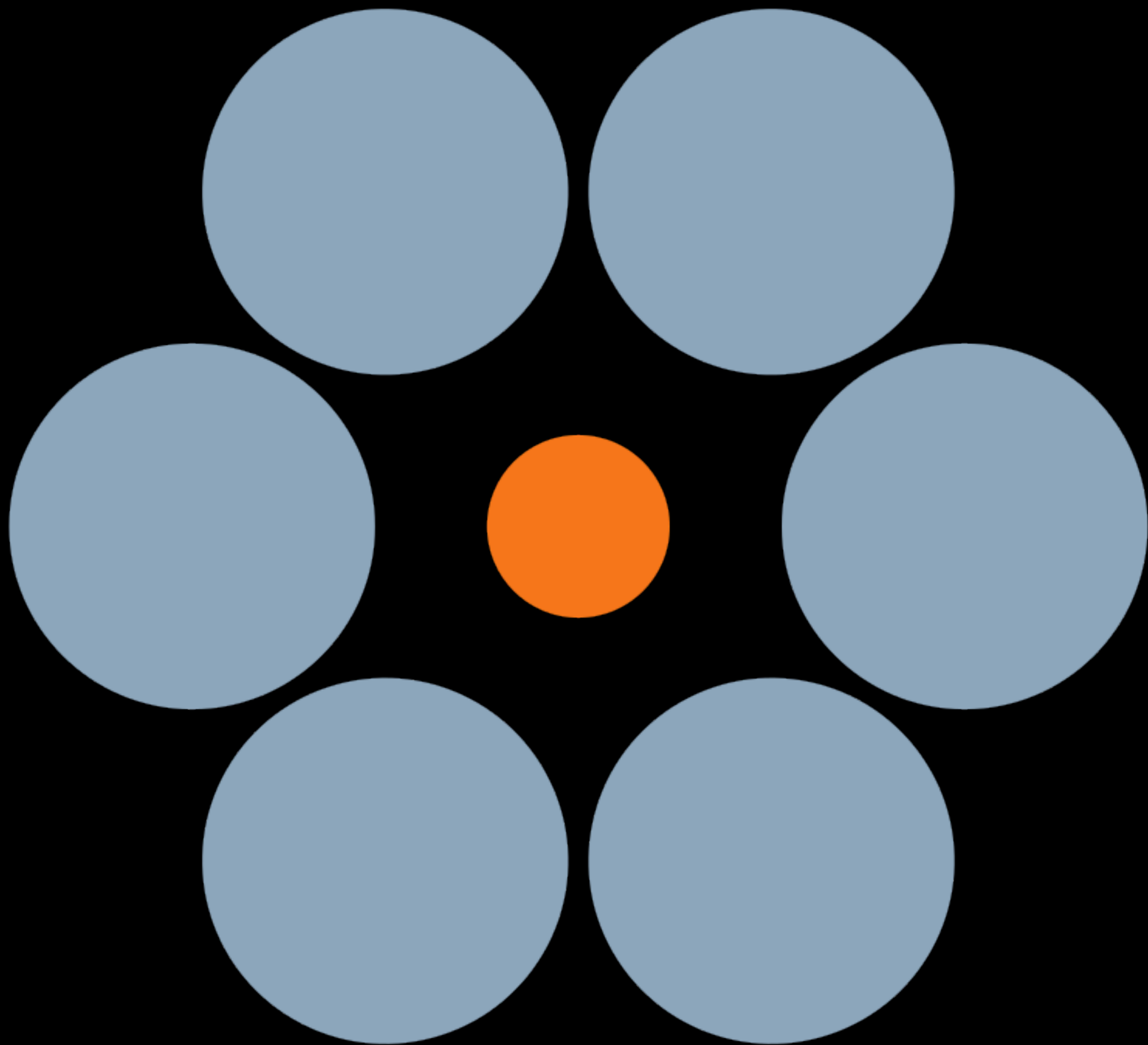
**What color is
this?**

Experiment on color perception: researchers found that Russian speakers, who have separate words for light blue ("goluboy") and dark blue ("sinii"), can distinguish between these shades more quickly than English speakers, who generally use the term "blue" for both.

This difference even manifests neurologically; when the colors shift from light to dark blue, Russian speakers' brains show a "surprise response," indicating a category shift, a response not observed in English speakers. In this case, **the language we speak acts as a paradigm that not only influences how we describe the world but also how we perceive and interact with it.** It illustrates how our linguistic framework can shape our cognitive processes, supporting Kuhn's notion that paradigms come with embedded assumptions that often go unnoticed but significantly influence how we approach scientific inquiries.

Question:

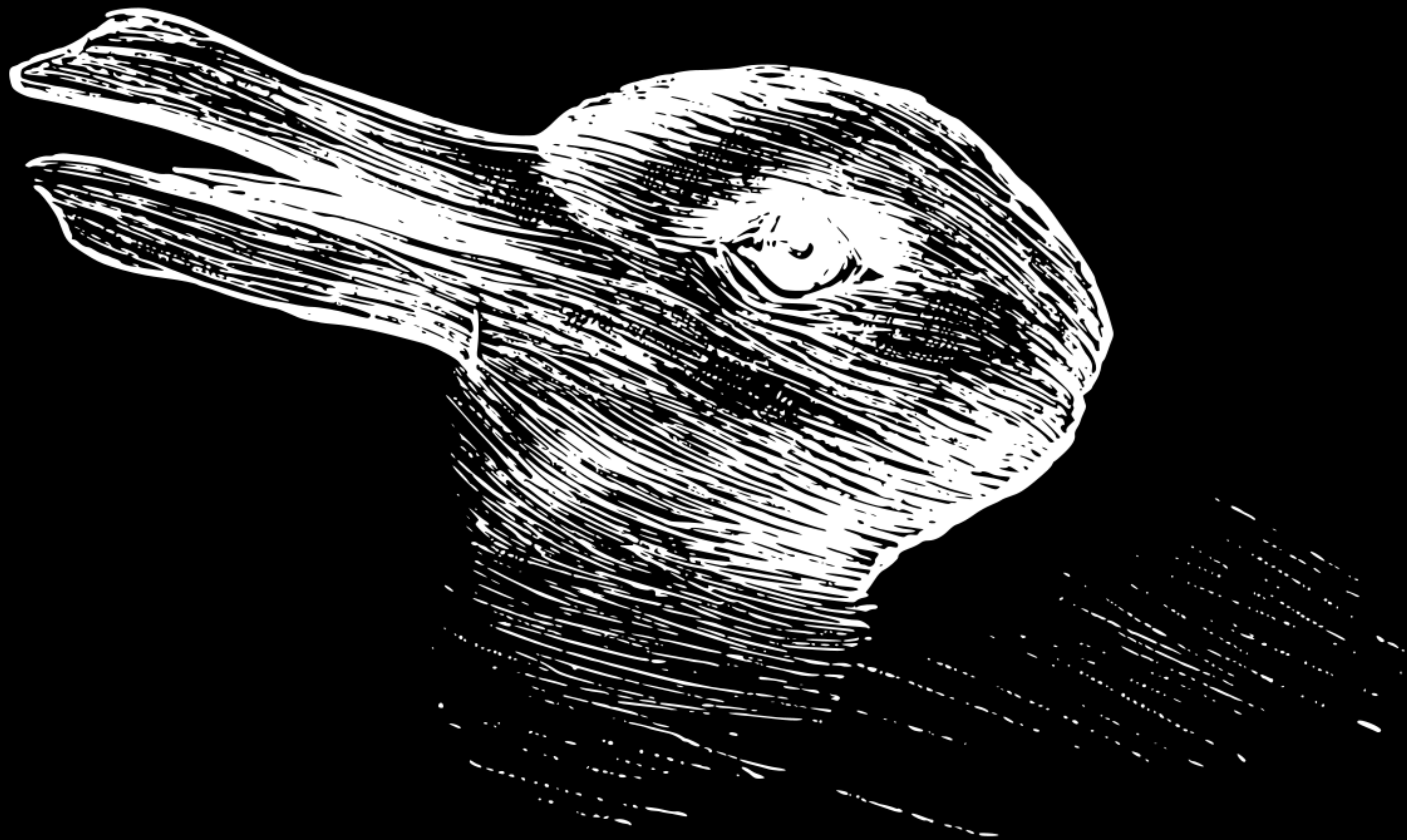
Do you know of other similar examples?











Questions?

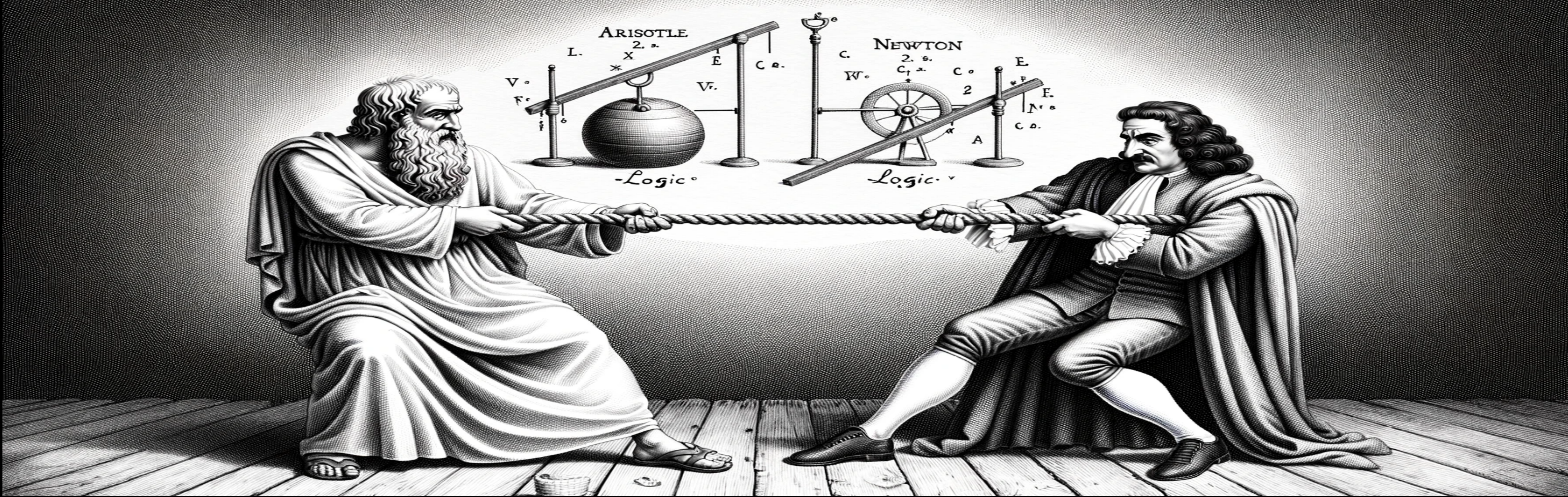
Scientific Revolutions

A new paradigm emerges and replaces the old one:

1. **Anomalies** appear within the normal scientific period reflecting problems to account for some data
2. If they persist, it becomes a **crisis**
3. Slowly, the crisis draws attention of more and more scientists that start to focus their efforts on resolving it, until most of the discipline's research program orbits the unsolved anomalies
4. Usually, it happens that some scientist, quite often younger, proposes **a radical solution to the problem**, which takes seriously that the anomaly hints towards a departure from the ideas of the current paradigm.

Q: Examples?



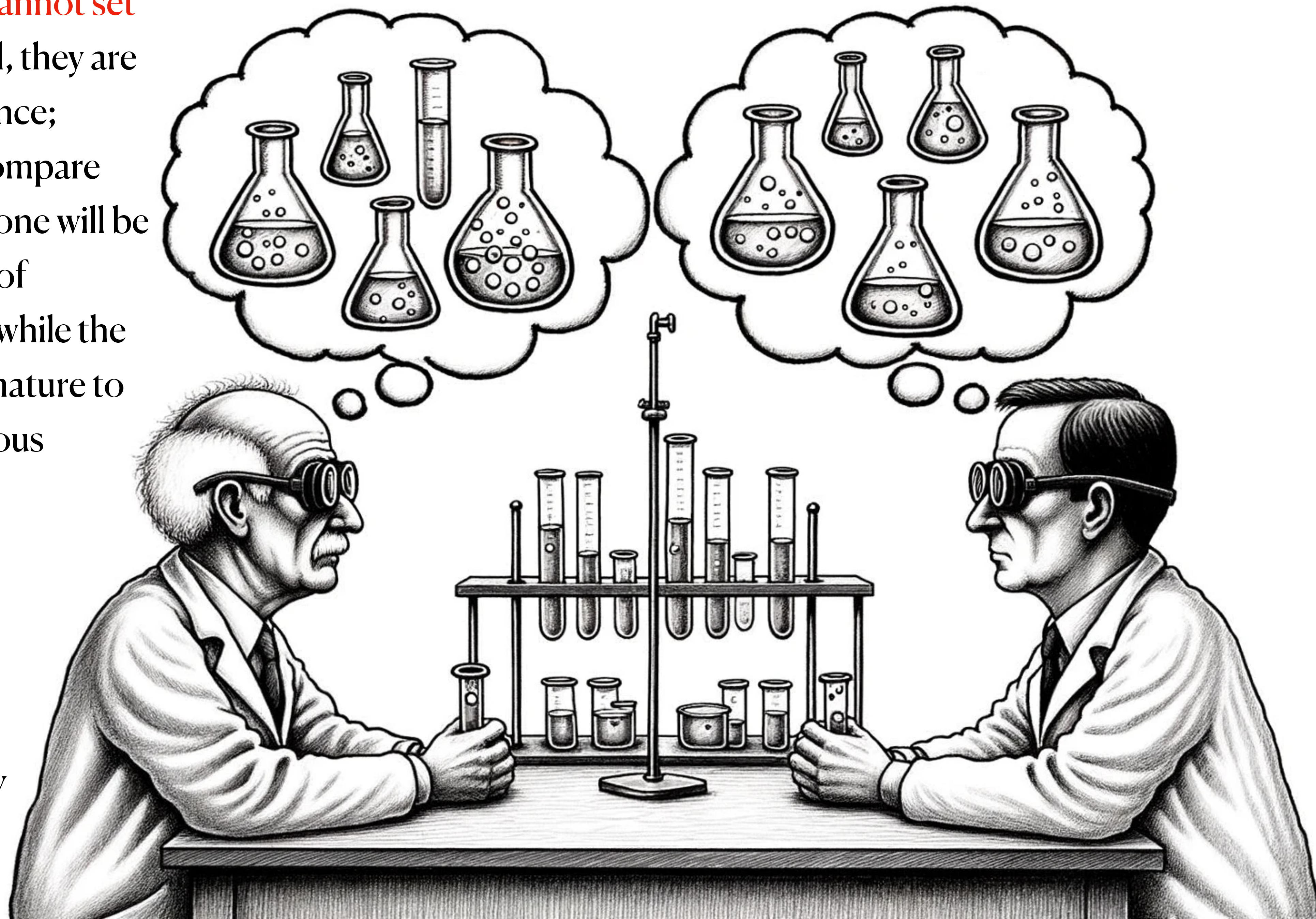


During the period of competition between paradigms, **scientists do not act in a completely rational way.**

On one hand, it takes some degree of blind belief to let go of the old paradigm and all the weight that comes from its accomplishments to focus on anomalies as the source of inspiration for a radical new understanding of nature; **on the other hand**, to insist on the old paradigm over and over again after a long period of crisis can be seen as denial, especially in light of the history of science.

Meanwhile, **observations cannot set the competition**. First of all, they are the very cause for its existence; second, it will be hard to compare both paradigms as the old one will be down-weighted for its way of accounting for anomalies, while the new one might be too premature to properly account for previous evidence.

For Kuhn, it will not be possible to decide between the paradigms in a clearly rational matter.



Question:

Can we even compare the paradigms?

Kuhn argues that embracing different paradigms is analogous to be living in different worlds, to the extent that they are **incommensurable** with one another: **it's not even possible to translate all the statements across the different paradigms.**

This is the reason why **he would argue that paradigms do not improve on one another**, that science does not accumulate in the direction of successive approximation to the truth, and something that was not a problem within a paradigm can become a question that needs to be addressed in another.





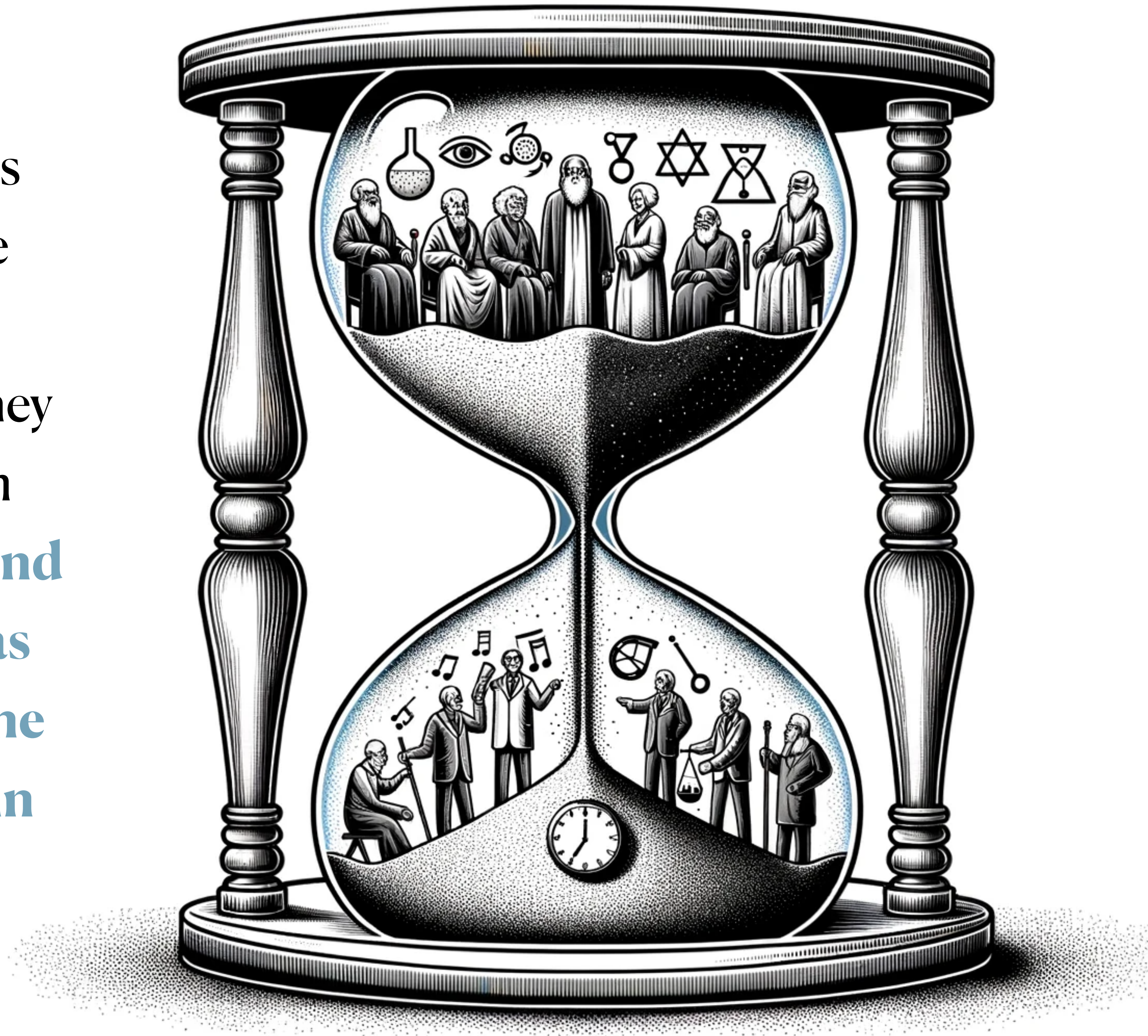


What about reduction? It demands that ontological commitments should remain mostly the same. Even when one theory is “recovered” from within another, as Newtonian mechanics is recovered in special relativity, fundamentally **the main ontological entities, despite sharing the same name, involve very different concepts.**

Nonetheless, quite often scientists will talk as if reduction obtained. Kuhn argues, though, that this is only possible in hindsight, and that usually **what is reduced is some mathematical equivalence between the reduced theory and the old paradigm**, but the reduced theory does not carry the commitments contained in the old paradigm.



As a change of paradigm involves such a big change of world-view, quite often it is too big of a shift for well-established scientists. Not only will they resist to the change, but most of them might not be able to make the shift. **And literally old paradigms fade away as their proponents die off, leaving the proponents of the new paradigm in command of the field.**



During periods of normal science, there is progress as more puzzles are solved. But **revolutionary periods are like dramatic changes in the environment**, which leads to a change in the adaptive problems a paradigm must solve.

Finally, **Kuhn argues that science is not different from other disciplines**, and cannot make claims to epistemic superiority. **Rather we should view the succession of paradigms in the way that we view changes in fashion, literature, music, art, political movements, and culture broadly.**

Kuhn writes towards the end of his book:

We may, to be more precise, have to relinquish the notion, explicit or implicit, that changes of paradigm carry scientists and those who learn from them closer and closer to the truth.

Q: What do you think?

Reading Exercise:

Okruhlik - Gender and the Biological Sciences

Next Time (Mar 15th) - Science and Values

- To read (all on Athena):
 - Douglas - “Inductive Risk and Values in Science”
 - Longino - “Values and Objectivity”