

Part II

Worldviews: The Problems of Scientific Progress and Scientific Truth

Chapter 3

Worldviews, Progress, Truth: Introduction

3.1 Homework

Readings – DW 1-2, Kuhn, Introduction

Study questions – Give a short answer to the following questions:

1. What is the old view of science that Kuhn think is misguided? What is the old way to do the history of science that corresponds to the old view of science?
2. What are the main problems that the old style historian of science faces?
3. What is the new method in history of science that Kuhn advocates?
4. What is the new view of science that Kuhn advocates?
5. Explain what a worldview is, according to DeWitt. Explain how a worldview differs from a mere collection of independent beliefs.
6. Give two examples of core beliefs in the Aristotelian worldview which conflict with core beliefs in the Newtonian worldview.
7. Explain what the correspondence theory of truth is. Explain what problems it faces.
8. Explain what the coherence theory of truth is. Explain what problems it faces.

3.2 Introduction

Goals of this chapter:

1. Understand that the view which takes the development of science to be cumulative is misguided

2. Understand the notion of a worldview: a consistent and well supported system of beliefs about what the world is like
3. Understand Kuhn's view of the development of science: long periods of normal science, with scientific revolution in between. A scientific revolution amounts to a change in our entire worldview
4. Understand how difficult it is to define what is "truth", and what impact this has on the possible sense in which a worldview, and scientific theories, can be said to be "true".
5. As always with philosophy: awaken your sense of wonder about the simple things we usually take for granted

3.3 Worldviews: Aristotle vs. Newton

Worldview – A worldview is a *system of beliefs*.

The notion of *system* implies that:

- it is **not** a mere collection of unrelated beliefs
- the beliefs are *articulated* with one another
- there are core beliefs and peripheral beliefs – there exists a hierarchy of beliefs

The core beliefs cannot be modified without the whole system to fall apart.

DeWitt: analogy with a puzzle. Not very convincing (what are the core pieces?)

Other possible analogies:

- the tree (cf. Descartes and the tree of knowledge) – metaphysics, physics, morals
- the egg (cf. Stoics) – physics, ethics, logic
- construction (foundations etc.)

Aristotle vs. Newton – here is a rough overview of parts of Aristotle's and Newton's worldviews:

Aristotle	Newton
Earth stationary at the center	Earth moving around the Sun
Universe made of 5 elements	Universe made of ca. 100 elements
Sublunar/ superlunar distinction	Universal Gravitation
Movement: Elements have natural notion, natural place	Movement: comes from External forces
A body at rest remains where it is	Inertia (a body continues to move unless forced otherwise)

Fundamental Incompatibility – Aristotle’s and Newton’s worldviews are fundamentally incompatible, that is to say, the core beliefs are incompatible

An obvious incompatibility is about the place and movement of the Earth, but there is more than this. The shift from Aristotle to Newton involves fundamental changes in the scientific worldview. Among others:

1. The notion of *universal gravitation*: it is one of the most important of Newton’s achievements: he reunified the universe. The world is not split into two realms anymore. *A stone fall onto the ground just as the Moon moves around the Earth.*
2. The notion of external tendencies vs. external forces – Aristotelian qualities/faculties – *virtus dormitiva* of opium
3. The notion of inertia vs. natural/forced motion – what is inertia is far from obvious! It has been rejected by some scientists of the time (such as Descartes) as an “Aristotelian quality”.

What they have in common – Both Aristotle’s and Newton’s worldviews have the following features in common. These features seems to be what made them, at a certain time of the history, both scientifically acceptable.

1. Consistent systems of beliefs
2. Neither of them is neither common-sensical, nor completely supported by direct evidence

Aristotle: no direct evidence/common sense of the existence of the fifth element

Newton: no direct evidence/common sense that the Earth is moving, or that massive bodies have inertia

3. Based on *indirect empirical evidence* and a well-articulated *scientific method*

Aristotle is the first *empiricist* and also one of the first philosopher to write about the proper method in the natural sciences: all knowledge is based on experience. Science

consists in inducing the causes by generalizing from experience. Cf. *Metaphysics*, chapter 1, *Posterior Analytics*

Newton: in the inheritance of the scientific revolution, a good deal of which was about scientific method. Roughly, Newton’s ideal was to derive the laws of nature from the experimental laws.

Example:

Experimental law: elliptical orbits

Law of nature: inverse square law

Given the assumption that interaction between bodies is due to external forces, then the forces need to be of an inverse square form. Notice the assumption!

Note: this is very different from Bacon’s view, which prescribes to derives the laws of nature directly from the observation of the phenomena by induction. We shall come back to this later.

Conclusion – We have seen that:

1. Newton’s worldview replaced Aristotle’s worldview
2. Both worldviews are in a sense scientifically acceptable
3. Both worldviews were accepted as true for quite a long time (close to 20 centuries for Aristotle, only about 3 for Newton, if we consider that we are in the middle of shifting worldviews now)
4. These worldviews are fundamentally incompatible: there is a radical conflict between the core beliefs

The conclusion is that the development of science, as it actually occurred in the history of science, is *not* an accumulation of facts from which we derive theories always closer to the truth. Rather, it seems to be a succession of worldviews, that is, consistent systems of beliefs about what the world is like. This idea is articulated in Kuhn’s text.

3.4 Worldviews, Normal Science, and Scientific Revolutions

Kuhn – former researcher in theoretical physics, one of the most influential philosophers in the philosophy of science of the 20th century.

- His star book: *The Structure of Scientific Revolution*.

- Launched the historical movement in the philosophy of science: argued that the way science appears to be from the close study of the history of science does not correspond to the orthodox view of science (which you probably take for granted).

- Some of his views are controversial, but his influence is really important.

Kuhn's aim – his aim is clearly stated in the book: it is to show how the consideration of the history of science sheds new light on our view of science. At the end of the day, his aim is to articulated a new view of science.

The Old View – the orthodox view of science in Kuhn's times (and probably still yours now) is that:

- The scientific method is to obtain facts from experiments, and to logically derive laws from these facts by generalization
- The development of science is mostly linear and cumulative, even if sometimes delayed by obstacles like prejudices etc.
- The history of science consists in finding out when, by whom, and against what prejudice scientific discoveries are made. The way in which the history of science is understood is : how is it that we managed to shift from myths to real science. The past is understood as oriented towards the present. The assumption of a cumulative progress dictate the method in the history of science.

Problems with the old view – two main problems:

1. Difficulty to find individual discoveries. History is much more continuous, much more complex than the “accumulation of discoveries by geniuses” has it.
2. Difficulty to categorize the old views as “myth” and our views as “good science”

As a result of the difficulties encountered by historians of science, a new method in the history of science emerges, from which stems a new view of science.

The argument is here is the following:

- *IF the development of science is an accumulation of individual discoveries piling up to lead us always closer to the truth, then the historian of science should be able to find these individual discoveries*
- *PROBLEM: It is very difficult to read the past in this way*
- *CONCLUSION: the history of science is not an accumulation of individual discoveries piling up and leading us always closer to the truth*

The New View of History of Science – according to Kuhn, the new history of science consists in:

- Study the past for itself, instead of reading it through the filter of the future development of science
- Make the most sense of the past view, instead of categorizing them as “old myths” that we manage to grow out of.

The New View of Science – Kuhn's influential and controversial view:

- Insufficiency of the scientific method and of scientific data to dictate the theory

- An essential component of scientific method is the worldview (Kuhn says *paradigm*) which includes:

1. fundamental entities
2. fundamental interactions (between entities, and with us)

- The worldview dictates:

1. what kind of problem is scientifically legitimate
2. what kind of answer is scientifically acceptable

Example: Internal qualities vs. external forces

The point here is that it is *necessary* to draw on a worldview in order to be able to make progress in scientific research.

- Normal Science: development of science *within a worldview*. Highway of research. Problems known, type of answers well delineated.

- Anomalies: where science hits a rock.

Kuhn's claim is that most of the time, anomalies are discarded as uninteresting (and there is good evidence in favor of this claim). Normal science mostly consists in force nature in well articulated conceptual boxes.

That said, if there is repetitive anomaly, which cannot be solved within the accepted worldview, then a *scientific revolution* may be on its way.

Example: end of 19th century: Lord Kelvin “minor clouds” – Michelson and Morley, Black Body radiation

- Scientific revolution: shift in paradigm, or worldview. Common characteristics:

1. resistance
2. shift to an incompatible theory
3. new legitimate problems and type of answers

Conclusion – Not everything that Kuhn says has to be taken as the ultimate truth of course, but we have know a better understanding about how science develops. This theory includes the following core notions:

- Worldviews
- Normal science
- Anomalies
- Revolutions

Now, the problem is: if this is true, that is, if the history of science is the succession of incompatible and equally scientifically acceptable views, in what sense can scientific

statement be said to be true? Dewitt seems to say that *we accept a new belief in our worldview not so much because it corresponds to the reality than because it fits into our system of beliefs*. Is that true ? :-)

3.5 What is truth?

An essential distinction – there are two questions that we need to keep clearly separated:

1. the question: “what is truth”
2. the question: “how do we know what the truth is”

The first question is a question of *definition*, the second is an *epistemological* question.

Definition 8 – Epistemology

Epistemology is the discipline which studies the ways in which we know. (episteme = knowledge, logos = theory/study/science of. So: epistemology = theory/study/science of knowledge)

The point is simply that *the way you know something does not have to do anything with what this thing is*.

Example 1:

- oak trees in the book: the forest expert’s statement is not what makes an oak tree an oak tree

Example 2:

Compare:

1. the question: “what is God”
2. the question: “how do we know what is God”

It should be clear that the two questions are quite different: What God is does not depend on our ways to know it.

Here we are interested in the question of the *definition* of truth, *not* the *epistemological* one. We are interested in finding out what it is that makes a true statement a true statement, not how we can know whether a given statement is true or not.

We will see that the second question (the epistemological question) always tends to interfere with the discussion of the first one (the question of definition).

An “obvious” theory of truth – At first, truth does not seem difficult to define: a belief is true when what the belief corresponds to the reality. This is roughly what is called the *correspondence theory of truth*

Definition 9 – Correspondence Theory of Truth

The Correspondence Theory of Truth is the view that truth is about correspondence: X is true if and only if X corresponds to a state of affairs in the real world.

Example: “Jalisco is black” is true if and only if Jalisco is, indeed, black.

There are many refinements on the theory but we don’t need them. For now, let us see why this very natural theory of truth is difficult to maintain.

Problems with the correspondence view of truth – The problem with the correspondence theory of truth is that it ultimately faces one of the oldest problems in the history of philosophy: the problem of the inaccessibility of the external world.

- **The general problem is that:**

1. If the correspondence theory of truth is right, then in order to assess the truth of a given belief, we are to check whether this belief corresponds to a state of affairs in the outside, real world.
2. To check whether there is such a correspondence, we need to access the states of affairs in the real world
3. It is not clear that this is ever possible

- **How can we check on the states of affairs in the world?** A very natural answer is: through sense observation, or perception. If I want to check whether my belief that Jalisco is black is true, I can simply look at Jalisco, and check she is, indeed, black.

Is this so simple? To see that it is not, we have to think about how our perception works. The most natural view about perception is the *representational theory of perception*.

- The representational theory of perception – This is a big word for what you probably take for granted, that is:

Definition 10 – Representational theory of perception

The representational theory of perception is the view that our perceptions are representations of the external world.

Example of vision: External objects project on the surface of the retina, this projection is processed by the brain, and we get a “picture” of external objects in our brain.

Note that there are various kinds of representation medium in general: Jalisco in my brain / Jalisco on a photograph / Jalisco in the computer.

At the end of the day, the most natural view on perception is that what we get from the real world are *representations* of external objects.

- **Now, the problem is that if the representational theory of perception is true then we are stuck in our own consciousness**

Total Recall, Matrix, the brain in a vat

Roughly:

- if you want to check on whether a picture of Jalisco is an adequate representation, you compare the picture with what Jalisco really is

- if you want to check on whether your perceptual representation of Jalisco is an adequate representation, you compare your perceptual representation of Jalisco with????

The upshot is that we have no idea of what the world is “really” like!

- **Objections and Answer** – Isn’t it the case that this is just a “philosophical question” (in the derogatory sense). Isn’t it just the case that our perceptions are reliable.

In fact, not really:

- sense can be deceptive – temperature wood and metal/glass (specific heat capacities)

- optical illusions – no way around it

- the dream argument – there is infallible means to say that you are dreaming – therefore, we may well be dreaming now !

- electrical impulse and the brain in a vat

Total Recall, Matrix

- **Conclusion for the correspondence theory of truth**

If the correspondence theory of truth is right, and assuming that our perceptions are representation of the external world, then, we have no way to say whether our beliefs are true or not.

- **IMPORTANT NOTES:**

1. The problem is *not* about whether the external world *exists* or not, but about *what it is like*. The view that the external world is merely a product of my own mind (*solipsism*) is not taken seriously by any serious philosopher. That there *is* an external world is fine, what it is like is another, much more problematic, issue.

2. The problem is *epistemological*. The problem is *not* that the correspondence theory of truth is flawed in itself, but rather that it implies a serious problem: we can never check the truth and falsity of any of our beliefs.

The problem is serious, and some have tried to get around it.

Descartes and the foundation of knowledge –

Descartes took the problems above very seriously. He considered that it constitutes a real threat for the very possibility of knowledge. Consequently, he took on the project the re-build the entire body of knowledge starting the foundations:

- Put into doubt everything that is not certain – Dream, Evil Genius
- Try to find one single thing that we cannot doubt: an absolute truth
- Try to re-build the entire body of knowledge on the basis of this truth
- Then we would end up with a well warranted body of true knowledge

The problem is that Descartes failed to rebuild: roughly, he needed to suppose that God is truthful in order to get out of his own consciousness. So, he left us with a huge problem, the so-called “problem of the external world” and an unsatisfactory answer !

The coherence theory of truth – If we think that the problem above is a serious problem for the correspondence theory of truth, then we can consider alternative theories. The coherence theory of truth is one of the possible alternatives on the “philosophical market”

Definition 11 – *Coherence theory of truth*

The coherence theory of truth is the view that truth is about consistency: X is true if and only if X is consistent with other “truths”, Y, Z etc.

Why would we ever consider that this is the right way to think about truth?

1. Note that the epistemological question is not a problem anymore: we can check on the logical compatibility of one belief with other beliefs without any need to access the external world. Reason and a good training in logic is all it takes.

2. There a domain in which this view is quite natural

Example: Mathematics, in particular geometry.

Variations on and Problems for the coherence theory of truth – there are some clarifications that are needed to make the view precise:

- the view says that a belief is true if it coheres with other beliefs... but whose beliefs?
 1. individual coherence theory of truth
 2. group coherence theory of truth

The individual theory is clearly unacceptable (we are back to the “anything goes” problem, which was what we wanted to avoid in the first place)

The group theory faces the problem of the precise definitions of a group: our family, nation, experts?

Example: should we accept blind people in the group chosen for knowledge about colors?
- A more serious problem is that it does not seem to satisfy our requirements for a theory of truth:

Example of geometries: all of them are (coherence) true, but which one is the (correspondence) true one??

Conclusion – What to take home concerning scientific theories ?

- Two possible theories of truth : correspondence / coherence
- The correspondence theory of truth:
 - fits with our intuition about what truth is (the answer given to the definition question is satisfactory) – a scientific statement would be true if what it says about what the world is like indeed corresponds to what the world is like
 - but it creates a serious problem concerning how we know what the truth is (the answer given to the definition question is unsatisfactory) – we would never be able to assess whether a theory is true or not
- The coherence theory of truth:
 - solves the epistemological problem in that we can check on the logical compatibility of various beliefs without needing to access the external world – a scientific statement would be true if it is compatible with all the previously accepted scientific statements
 - but does not fit with our intuition that scientific truth is about the world, and not about what we believe it is !
- That said, a closer look at the history of science and at the actual practice of science seems to speak in favor of the coherence theory of truth:

Kuhn's view of the development of normal science: scientific hypotheses have to fit into a worldview.

The problem of accessibility of the external world is a crucial problem – instruments and experimentation (remember Aristotle). All we compare are “representations” of the external world, we never have direct access to “data”.

So, despite our reluctance, there must be something true about DeWitt's idea that the coherence theory of truth is more appropriate when discussing the truth of scientific statement.

It cannot be the final world though. for a simple reason: there are some facts that do not fit with our worldviews and that are *not* rejected. These are these anomalies that lead to scientific revolution. Sometimes, we just hit the reality (whatever this reality is like), and we are compelled to change our beliefs. This absolute fact of the possibility of belief revision in the face of anomalies speaks against a radical coherentist view (a view which would say that all there is to scientific truth is coherence).

Our goal is to find a middle ground !



Figure 3.1: A brain in a vat (Steven Ansell)