

Chapter 4

Aristotle's worldview

4.1 Homework

Readings – DeWitt chapter 2 and 10, Lindberg, *The Beginning of Western Science*, chapter 3

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

1. What are the fundamental constituents of the world according to Aristotle?
2. What are the four causes? Explain with an example
3. What are the main aspects of Aristotle's scientific method? Should science rely on observation according to him? Does science consist in generalizing universal, mathematical laws from controlled experiment? Why / Why not?
4. In what sense is Aristotle's view on living beings hierarchical? Explain how it fits with his views on physics.
5. What is a teleological explanation? a mechanistic explanation?

4.2 Introduction

Goal of the chapter: to understand Aristotle's beliefs not as a grocery list, but as a system of consistent, interrelated beliefs: a system. For this, we need to:

1. distinguish between core and peripheral beliefs in Aristotle's worldview
2. Understand how the peripheral beliefs cohere with the core beliefs

4.3 Aristotle's Core Views: Metaphysics

What is Metaphysics – this is of course a difficult question. That said, we can content ourselves with a rough characterization:

Definition 12 – Metaphysics

Metaphysics is the part of knowledge which deals with what kinds of being exist and what kind of existence these being have.

So: what does exist? and how does it exist if it does?

The first question should not be a problem for you: for example, we already discussed the possibility of the non-existence of the external world. This is clearly a question which falls in the domain of metaphysics.

That said, you might not understand what the second question is about: what does "kind of existence mean"? What is implied by this question is that there might be different kinds of existence, that is, not everything "exists" in the same way, even if we use the same word, "existence" for all kinds.

A natural way to think about existence is in terms of *material bodies*. We are pretty sure that matter exists, and not many philosophers want to deny this. Now, *are material bodies the only kind of being there exists?*

Examples:

- the color blue
- rainbows
- from science: waves, electrons, spacetime

So, when we do metaphysics, we have to say not only what are the things that we accept in our inventory of the world, but also how these things exist.

Now that we know a little more about what metaphysics is, let us see what Aristotle has to say about it

The fundamental constituents of the Aristotle's world – Aristotle's metaphysics stands in reaction to both:

- The materialists (Epicureans : atomists): the world is made of atoms randomly moving in the void
- Plato and the theory of the forms – idealism

Aristotle is looking for a third route between materialism and idealism.

Definition 13 – Materialism

Materialism is the metaphysical view that the fundamental constituent of the world is matter.

Definition 14 – Idealism

Idealism is the metaphysical view that the only fundamental constituents of the world is ideas.

Against the materialists: Aristotle wants the world to make sense – According to him, to say that a particular tree is made of bouncing atoms does not provide a *proper explanation of how it comes that the tree is a tree and not something else*. The materialist cannot give a satisfactory account of the *order* of the world, of the world as *cosmos*.

Example: Prof. Schmidt at 11:45 pm at 3 feet from the girls' dorms door.

Plato had raised this problem before Aristotle, and gave a rather radical answer to the problem: the theory of the forms. Roughly: the sensible world has an inferior kind of being, the true existence belongs to the forms, or ideas, which are separated from the sensible world and only accessible to reason.

Example of “square”

So: Aristotle was sensible to Plato's concerns about materialism, but also wanted the sensible things to have a full existence.

His answer:

- Against the materialists: the fundamental constituents are *individual substances*. This includes the five elements of course, but also more complex individuals: Jalisco, a particular tree, you etc.

- Against Plato: Forms exist here and now, in the sensible world.

How does this work?

Individual substances are constituted of both matter and form. Their form is an essential part of their nature. *Matter and form cannot be separated* (de re/ de dicto). We cannot conceive of unformed matter, and forms cannot exist separately of some matter to inform.

The ways in which substances exist – Essential natures and change

- **Essentialism** – According to Aristotle, substances have *essential natures*
Distinction between *natures* and *artifacts*: Roughly, natural objects possess an internal principle of motion, while artifacts do not – Example: dinner and bottle of wine / the wood and the bed
The nature of a particular substance is *what makes this substances this particular substance*. It is the internal principle that make Jalisco be Jalisco, and this tree be this tree.
The nature of a particular substance also determines the behavior of the substance (its motion, growth etc.)
- for the four element: their nature defines their natural place and natural motion
- for the complex substances: their nature defines their natural behavior: a cub becomes a bear
The nature of a substance is not only the form, not only the matter, but both of them (even if the form counts more). Why not only the form? example of the

marble and the statue: the marble contains lines and you must take these lines into account when sculpting the marble.

So: the fundamental constituents of the world are individual substances which are characterized by their essential natures. The essential nature of a substance defines what they are (essentially) and how they behave.

- **Teleology**

Aristotle's notion of *natures* is *teleological*, that is to say, has to do with the “end product”. This means that for Aristotle, everything has an end and this end is part of this thing's essential nature.

Now you can understand that Aristotle views the world as a *cosmos*, a highly ordered system of interconnected natures.

Example: the hierarchy of souls among living beings: growth and nutrition, motion, reason

CAREFUL: do not confuse “teleological” (in relation to a “telos”: goal, aim, end) with “theological” (in relation with a “theos”, the divine)

- **Change** – The problem of change was a classical problem for the Greek:

change = come to be

Parmenides' type of argument is basically the following:

1. there are only two ways in which something can come to be: either from what is, or from what is not. (This is using the Principle of Excluded Middle.)
2. But neither is possible.
3. Therefore, nothing can come to be.

The idea of this argument seems to be this: in a case of coming to be, the resulting object is clearly a being, something that **is**. From what initial object does it come to be? Parmenides offers us only two choices: either what is or what is not. But if the initial object is what is, and the resultant object is also what is, we do not really have a case of coming to be – there is no change. And if the initial object is what is not, we have another kind of impossibility, for nothing can come to be from what is not (*ex nihilo nihil fit*).

Plato's answer to this problem is to postulate the existence of two kinds of “beings” (of which only one kind really **is**):

- The forms *are* and never come to be

- The sensibles continuously come to be, and “are” not really (images)

Aristotle wants to give an analysis of coming-to-be, i.e., change, that will enable him to avoid this dilemma: How something that is can come to be? His account is designed to explain both how change in general is possible, and how coming into existence is possible.

Aristotle's account will seem really simple to you. This simply because we all came to accept his view on the topic. 20 centuries later, it is easy to understand that it is now “obvious” to us.

The idea is to distinguish between a *subject*, which does not change, and *accidental properties*, which change.

Example: Tiffany learns to play the guitar

4.4 Aristotle's Core Views: Epistemology and the Scientific Method

What is epistemology – As the etymology indicates, epistemo-logy is the study/science of knowledge. So, an epistemological view is a view on how and what we can know.

Definition 15 – *Epistemology*

Epistemology is the part of knowledge which deals with the nature of and the means to knowledge.

So: what is knowledge and how do we attain it?

1. What is knowledge?

The question is about the nature of knowledge – we need criteria to be able to recognize true knowledge

2. How do we know? through the senses? through reason? through a mix of both?

These are the fundamental question of epistemology

From experience to knowledge – In the first book of his *Metaphysics*, Aristotle makes a strong case in favor of the view that knowledge come from experience. In this way, he is one of the first *empiricists*.

Definition 16 – *Empiricism*

Empiricism is the epistemological view that all knowledge comes from experience.

For Aristotle, there is a *continuity* from the senses to memory, from memory to craft, from craft to science and from science to wisdom:

[...]human beings attain science and craft through experience.(981a2-3)

All animals	Senses
Some animals	Memory
Human beings	Experience
Knowledge:	Craft Science Wisdom

Within the hierarchy:

- many memories of the *same* thing result in an experience.

- many experiences result in an *universal judgment* about *similar* things, which constitutes a craft.

- from craft, one gets interested in the cause, and that's how a mere craft becomes science

- wisdom is the science of the first principles and cause

What is important: *science is the investigation of causes*: scientific knowledge is in continuity with experience but requires more than the simple recording of repeated observation. Just as it takes a special faculty to go from repeated observation to a general law, it takes another special skill to discover the *true causes* that lie behind and explain the behavior described by a general law.

Thus, true knowledge is knowledge of the causes. One criterion that Aristotle gives in order to check whether someone has true knowledge of something or not is to ask this person to teach it: *only he or she who is able to teach a subject matter can be considered to know this subject matter.*

Scientific demonstration – Aristotle was the first to give an account of proper methodology of science.

Even if experience is extremely important for Aristotle (as the origin of knowledge and wisdom), *proper science must be demonstrative.*

The idea form of a science for a particular domain:

- first principles, axioms, or postulates, obtained by induction from experience, which are to be accepted) (postulare = to request)

- body of knowledge – obtained by logical deduction

Aristotle himself never put into application his own prescription. That said, Euclid did, and successfully enough it appears, since we still learn Euclidean geometry at school !

The doctrine of the four causes – A classic. Let us try to understand

Problem of translation of *aition*: here is a way to understand the traditional vocabulary:

1. Material cause: what *X* is made out of – static
2. Formal cause: what makes *X* to be *X* and nothing else –static
3. Efficient cause: what makes (produces) *X* – dynamic
4. Final cause: what *X* is for

Example: What is a string instrument?

1. Material cause: a string instrument is made of wood (most often)
2. Formal cause: tight strings over a resonance box is what makes a string instrument a string instrument
3. Efficient cause: luthiers make string instruments
4. Final cause: string instruments are made to play music (in a certain way)

What is important to understand here is that for Aristotle, an account of a given substance, say the string instrument, is **not** satisfactory unless the four causes are provided. *Providing the four causes is the only way to provide a complete and satisfactory scientific account of a given object of study. In particular, any object of scientific study must be accounted for in terms of a final cause.*

This is easy to understand in the case of the string instrument, and in the case of all *artifacts*. It is hard to see how we could explain to someone what a string instrument is without telling him or her that it is made *for* playing string music.

But what in the case of natural objects??? Aristotle is famous for claiming that *natural objects possess final causes* just as artifacts do.

Final Causes – internal and not external

What could be the final cause of a cat or a tree?

It is easier to begin with what Aristotle's final causes are **not**:

1. The final causes of natural objects are **not** what human can do with them. So, the final cause of a tree is not to provide us with shade. Aristotle is not guilty of a simplistic kind of anthropocentrism (= a way of explaining the world as centered around human beings)
2. The final cause of natural objects are **not** the Divine's purposes. So the final cause of a tree is not to provide oxygen/beauty/refuge for birds as part of the Divine's plan

It is important in general to understand that *final causes are not external but internal*. Both candidates above fail to be acceptable final causes because they are external.

The final cause of a natural organism is the end to which the proper biological development of the organism tend. The final cause is not an external purpose that some mind assigns to the natural object, rather, it is whatever is the end product of the series of changes which naturally occur during natural growth.

Example: the final cause of a cub is the bear !

Thus, in nature, the final cause is typically identical to the formal cause.

Mechanistic / Teleological explanations – Physics and Biology

What do we currently think of final causes? Is there a domain of science in which there are still used?

Since the Scientific Revolution, *mechanistic causes* are favored. The model for science is taken to be physics, and the model of explanation in physics is in terms of trajectories in spacetime: a given phenomenon is properly explained if the phenomenon is showed to be the result of the mechanical interaction between massive bodies.

Examples: Prof.Schmidt again / temperature and pressure of a gaz

That said, mechanistic explanations are not all there is. Biological phenomena are often not satisfactorily explained in terms of mechanistic explanations. Most often, *biological explanations are in terms of functions*.

For Aristotle, it is biology, not physics, which constitutes the “model science”: physics does not provide the most satisfactory kind of explanation, biology does.

IMPORTANT NOTE on purposes vs. function: function are **not** necessarily purposes: Tortoise's flipper have a digging function, not the purpose of digging.

So, Aristotle's views of what constitutes a scientifically acceptable explanation is certainly at odds with our current views, but it is important to understand that it is not naive or ridiculous as is sometimes supposed. Aristotle

Aristotle and us – two majors elements of what we take to be proper scientific method since the Scientific Revolution are totally absent in Aristotle's method.

- no controlled experiment – interfering with nature is obviously not the best way to discover the true natures in the world

- no mathematical laws – mathematical laws are universal: they apply to all physical systems. This conflicts with Aristotle's view that the world is made of radically different kinds of beings: different beings do not follow the same laws

4.5 Conclusion: Aristotle's physics and biology as parts of his worldview

Now we can understand Aristotle's particular views on what the world is like as connected to his more fundamental views on metaphysics and epistemology.

Cosmology – the hierarchy between elements, spheres etc. the world is a cosmos

Dynamics – natural motion and natural places – all due to the essences of natures

Biology – hierarchy again, and teleological explanations (the heart is made for... the lungs are made for ...)