

Lecture 15

Aristotle on Elements

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The nature of heavenly bodies (*On the heavens* I 2)

Aristotle's argument (in my words)

- ① The motion of the heavenly bodies is continuous and eternal, whereas unnatural motion is the quickest to stop. Therefore, the motion of heavenly bodies is natural.
- ② The motion of the heavenly bodies is circular, whereas the natural motion of all bodies on Earth is straight (down or up). Therefore, heavenly bodies are composed of something different to anything on Earth.

Quotation

If . . . the movement of the rotating bodies about the centre is unnatural, it would be remarkable and indeed quite inconceivable that this movement alone should be continuous and eternal, given that it is unnatural. At any rate the evidence of all other cases goes to show that it is the unnatural which quickest passes away . . . Therefore, we may infer with confidence that there is something beyond the bodies that are about us on this earth, different and separate from them; and that the superior glory of its nature is proportionate to its distance from this world of ours. [269b6]

Contrast with Anaxagoras

- Anaxagoras believed that everything was originally mixed, Mind started the mixture rotating, this caused the ingredients to separate, and we see this rotation still in the heavens.
- So Anaxagoras thought the circular motion of the heavenly bodies was caused by Mind, not natural to them.
- How a follower of Anaxagoras might criticize Aristotle's argument:
 - The heavenly bodies don't move continuously and eternally; initially they didn't move.
 - Unnatural motion isn't the quickest to stop. If you stir water in a large pot, it keeps rotating for a long time (forever if you keep stirring it), whereas falling stones don't fall for long.

The existence of elements (*On the heavens* III 3)

Definition

An element . . . is a body into which other bodies may be analysed, present in them potentially or in actuality . . . , and not itself divisible into bodies different in form. [302a15]

Modern example

- Compounds, e.g., water, can be analyzed into their elements, e.g., hydrogen and oxygen.
- Hydrogen and oxygen are gases, but we don't think of water molecules as containing gases. Aristotle would say that on our view, water contains hydrogen and oxygen "potentially."
- No other substance can be got by dividing hydrogen or oxygen. You can get water by combining hydrogen and oxygen, but that isn't division.

Aristotle's argument

Now if what we have described is an element, clearly there must be such bodies. For flesh and wood and all other similar bodies contain potentially fire and earth, since one sees these elements exuded from them; and, on the other hand, neither in potentiality nor in actuality does fire contain flesh or wood, or it would exude them. [302a20]

- Burning flesh or wood gives off fire; what is left is ash, which is earth. Aristotle interprets this as fire and earth being “exuded” from flesh and wood.
- Although wood can be got from earth, water, etc., Aristotle believes it is formed by composition, not by being “exuded” from any of them.

Contrast with Anaxagoras

- Anaxagoras believed that all substances (earth, air, water, wood, flesh, etc.) are elements. They are never completely separated from each other, e.g., what we call wood is really a mixture in which wood predominates.
- So Anaxagoras agrees that elements exist, but wouldn't agree with Aristotle's argument.
- How a follower of Anaxagoras might object to the argument: Fire and earth do contain flesh and wood, and exude them. E.g., when a tree grows, that occurs because wood is exuded from fire and earth. Aristotle denies this but gives no reason to support his view.

Simple motions (*On the heavens* I 2)

All natural bodies and magnitudes we hold to be, as such, capable of locomotion; for nature, we say, is their principle of movement. But all movement that is in place, all locomotion, as we term it, is either straight or circular or a combination of these two which are the only simple movements. And the reason is that these two, the straight and the circular line, are the only simple magnitudes. Now revolution about the centre is circular motion, while the upward and downward movements are in a straight line, 'upward' meaning motion away from the centre, and 'downward' motion towards it. All simple motion, then, must be motion either away from or towards or about the centre. [268b15]

Aristotle's argument (*On the heavens* III 4)

Aristotle gives many arguments that there aren't infinitely many elements. My formulation of his last one:

- ① Every element has a natural motion that is simple.
- ② There are only a finite number of simple motions.
- ③ Therefore, there are only a finite number of elements.

Aristotle's formulation:

If every element has its proper movement, and a simple body has a simple movement, and the number of simple motions is not infinite, because the simple motions are only two and the number of places is not infinite, on these grounds also we should have to deny that the number of elements is infinite. [303b3]

Contrast with Anaxagoras

- Aristotle claimed that for Anaxagoras the elements are infinite [187a25]. Certainly Anaxagoras had very many elements, whereas Aristotle thinks there are only a few simple motions.
- How a follower of Anaxagoras might criticize Aristotle's argument:
 - Aristotle's conclusion doesn't follow from his premises, since infinitely many elements could have the same simple natural motion.
 - Aristotle may be assuming that different elements must have different natural motions. But that is inconsistent with his own view, since he believes earth and water have the same natural motion (straight down).

The elements aren't eternal (*On the heavens* III 6)

Aristotle's argument

The elements . . . cannot be eternal. It is a matter of observation that fire, water, and every simple body undergo a process of analysis [i.e., destruction]. [304b23]

Examples

- Fire is destroyed by throwing water on it.
- Water when heated turns into air.

Transformation of elements

Aristotle believed the elements earth, air, fire, and water are matter with certain qualities.

	<i>dry</i>	<i>wet</i>
<i>hot</i>	fire	air
<i>cold</i>	earth	water

The elements transform into each other when one contrary is replaced by another. This is consistent with the definition of an element because the transformation doesn't involve division into constituents.

Contrast with Anaxagoras

- Anaxagoras believed all substances (his elements) are eternal; change is only by separation and mixing.
- How a follower of Anaxagoras might criticize Aristotle's argument:
 - Aristotle says we observe elements to be destroyed. But what we observe is only that they vanish and this is due to mixing, not destruction.
 - E.g., when we see water evaporate, we don't see water turn into air; we just see the water vanish. This is due to water mixing into the air and becoming invisible because the mixture is mostly air.
 - So Aristotle's premise is false; we don't observe elements to be destroyed.

Questions

- ① State Aristotle's definition of an element.
- ② For each of the following propositions, state an argument that Aristotle gives for it and explain how a follower of Anaxagoras might have objected to the argument.
 - (a) Heavenly bodies are composed of something different to anything on Earth.
 - (b) There are elements.
 - (c) There are not infinitely many elements.
 - (d) The elements are not eternal.

Reference



Jonathan Barnes, editor.

The Complete Works of Aristotle.

Princeton University Press, 1984.

Online in Past Masters.

Numbers in brackets are standard page numbers given in many editions of Aristotle.