

CONTRARIÆ		VEL INCONGRUÆ	
S V B A L	UNIVER. AFFIRM.		UNIVER. NEGAT.
	OMNIS VOLUNTAS BONÆ.	ALTERUTRÆ	OMNIS VOLUNTAS BONÆ.

Aristotle: Theory of Science

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	SUBCOTRARIÆ. SUPPARES. VEL SUBNEUT.		

Overview

Reminder

General theory of science

First principles

Meno paradox

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Reminder

- science starts with wonder; seeking explanation
- a full explanation consists in identifying the 4 causes: material, formal, efficient, final
- we need these to account for things; to account for regularity (we are explaining things, not events)

Remaining questions:

- does anything count as science?
- can science have any object?
- Meno's paradox

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General Theory of Science

What science does:

- 1 displays the essences of the members of its domain
- 2 makes clear how these essences are explanatorily prior to other properties that these members have
- 3 logical structure

E.g.: “whales have lungs.” – if you are scientific, you should explain why, by pointing to various characters in the essence of whales.



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Knowledge of the fact vs. knowledge of the *reasoned fact*:

- knowing that X is the case is not the same as knowing why it is the case.
- Knowledge in the strict sense cannot be coincidental or a result of luck.
- Whatever we know, must be necessarily the case, and we need to understand why it is so!

E.g., I can know that whales happen to have lungs. But I don't know why.
(Or: knowing that $a^2 + b^2 = c^2$ or being able to demonstrate it.)

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Here is an better piece of knowledge:

- ① Necessarily, all whales are mammals.
- ② Necessarily, all mammals have lungs.
- ③ Therefore, necessarily, all whales have lungs.

This is good, because it gives an *explanation*.

As Aristotle would put it, the middle term of the syllogism (“mammals”) is causally relevant.

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The Logical Structure of a Science

- science consists of these explanations, arrangeable into syllogisms
- if it's a genuine explanation, the starting point needs to be better known than the end-point
- example: geometry. We demonstrate every proposition from the ones we already know.
- but how far can we go back???

Claim: There must be first principles.

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The Argument for First Principles

- ① If there is demonstrative knowledge, then it relies on a demonstration whose premises are better known than its conclusion.
- ② There is demonstrative knowledge.
- ③ There are demonstrations whose premises are better known than their conclusions [from 1 & 2]
- ④ These prior premises are either (a) known because demonstrated or (b) known but not demonstrated.
- ⑤ If 4a, then (aa) the process of demonstration will carry on into infinity, or (ab) it will be circular.
- ⑥ It is not the case that (aa), neither that (ab).
- ⑦ Therefore: (b); the first principles of demonstrations are known but not demonstrated. [from 4 & 5 & 6]

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The Argument for First Principles

- P1: it is just what a demonstration is. If the premises are not better known, then there is no point!
- P2: Aristotle is not a sceptic, and does not engage with scepticism seriously.
- P6: demonstrations cannot be circular, since the 'demonstrates' relation is transitive, and something cannot demonstrate itself.
- P6: they cannot carry on into infinity, since in that case there would be no knowledge whatsoever.

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First Principles

First principles are field-specific:

- it is a first principle of optics that the shortest path between two points is a straight line.
- it is not a first principle of geometry! (you can demonstrate it)
- Some sciences are more fundamental than others in the sense that they provide the first principles of the latter. Examples: optics receives its principles from geometry; music from arithmetics.
- most universal first principles: the principles of all knowledge. (Such as the law of non-contradiction.)

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Knowledge of First Principles

If the most universal first principles are not demonstrated, how do we know them?

How can we learn, if we don't know what we are looking for? (And if we do know, then also: how can we learn?)

Post. Anal. I.1, 71a1–7

“All teaching and all intellectual learning come about from already existing knowledge. Both deductive and inductive arguments proceed in this way; for both produce their teaching through what we are already aware of.”

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Knowledge of First Principles

Aristotle's solution:

Post. Anal. I.1, 71a25

“You should perhaps be said to understand in a way – but in another way not. . . . You understand it universally – but you do not understand it *simpliciter*.”

- If I know that the area of a circle cannot equal the area of a square, I already implicitly know about irrational numbers.
- When we grasp a particular, we may already implicitly grasp some universals to which it belongs.
- Universals apply to all members of a class, not simply to known members. Hence, when we arrive at a universal, we acquire considerable insight!
- Consequently, I can “know” something before I know it, strictly speaking

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Knowledge of First Principles

Post. Anal. 100a3–8

“So from perception there comes memory... and from memory... experience; for memories that are many in number form a single experience. And from experience, or from the whole universal that has come to rest in the soul... there comes a principle of skill and of understanding.”

- contra Plato: first principles are not innate
- repeated perception → memory → experience (= a single universal in the soul as the result of repeated instances of perception)
- soldier analogy; a theory of induction! (*epagoge*)
- the universal emerging from experience in the soul is the starting point for a demonstration; a state of understanding (*nous*)

The “argument”: it’s either scepticism, innate ideas, or *nous*; but not the former 2; therefore it’s *nous*.

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