

Cognitive Science & Psychology: Mind, Brain and Behaviour

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specs-lab.com



SPECS

Synthetic, Perceptive, Emotive and Cognitive Systems group

Outline



Lecture 1 Introduction - Homo Sapiens, Robots and other Aspirations

Lecture 2 The Mind, Brain, Behaviour Cycle

The knowledge problem in the science of mind and brain

Read: Ch 1: Living Machines: An introduction

Read: Ch 2: A Living Machines approach to the sciences of mind and brain

Lecture 3 (1850-1915) Structuralism and Functionalism

Read: Ch 3: A roadmap for Living Machines research

Read: Ch 4: Life

Lecture 4 (1915-1950) Behaviorism and Cognitive Behaviorism

Read: Ch 5: Self-organization

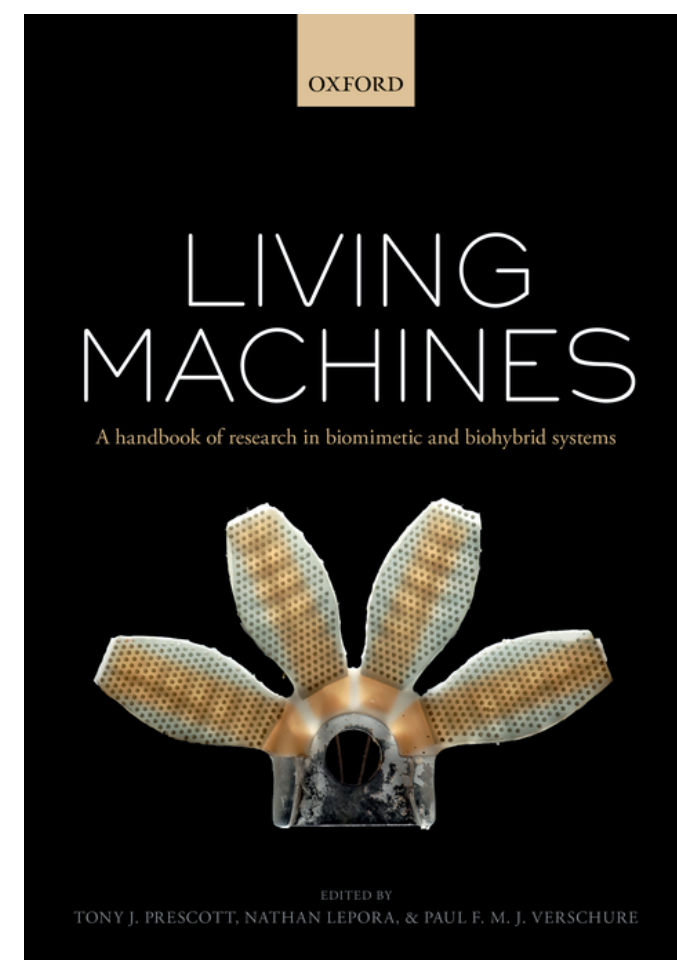
Read: Ch 8: Evo-Devo

Lecture 5 (1950-1960) The Demise of Behaviorism

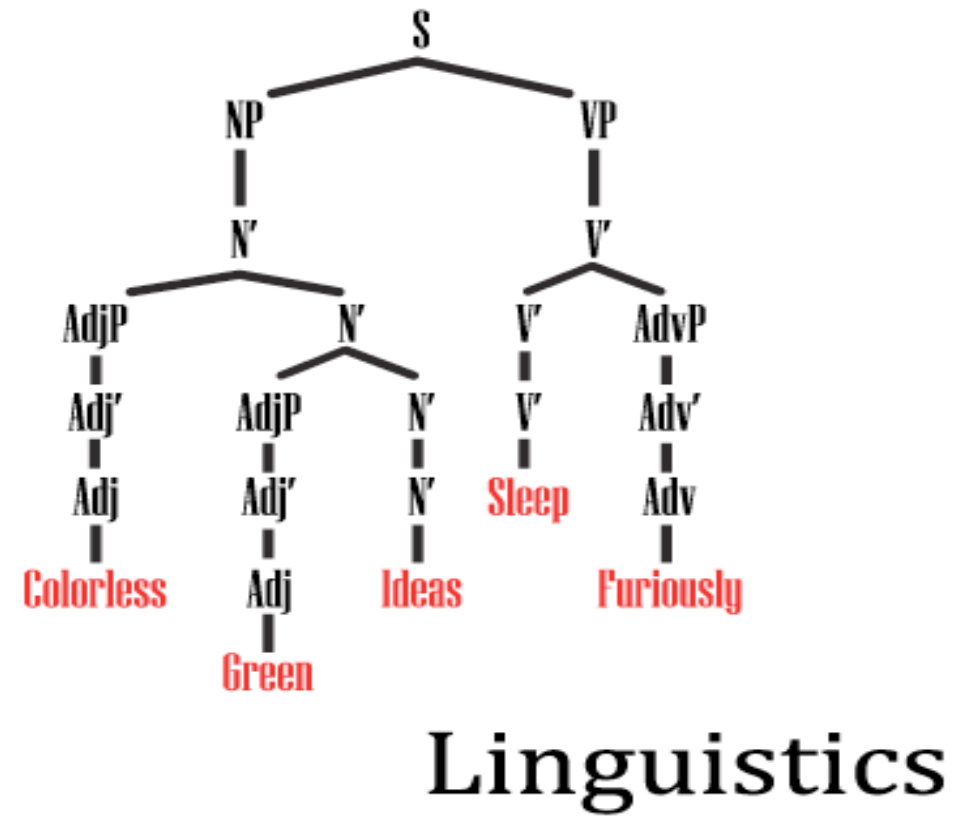
Lecture 6 (1945-1960) Cybernetics and the Cognitive Revolution

Lecture 7 (1960-Now) Mind as Computation

Lecture 8 (1985-Now) Biology as a metaphor and Reality



COGNITIVE

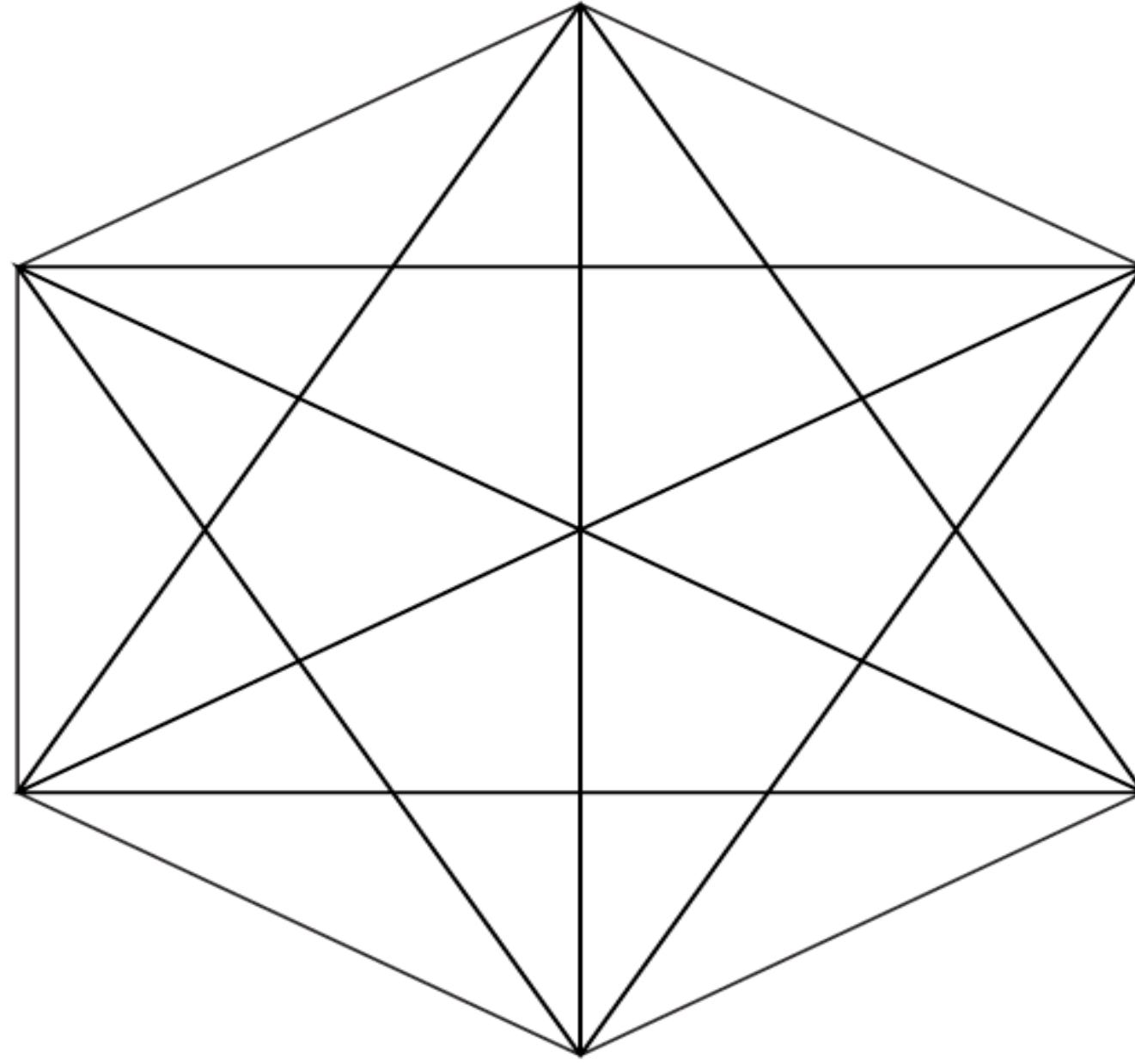


Computer Science
Artificial Intelligence



Φ

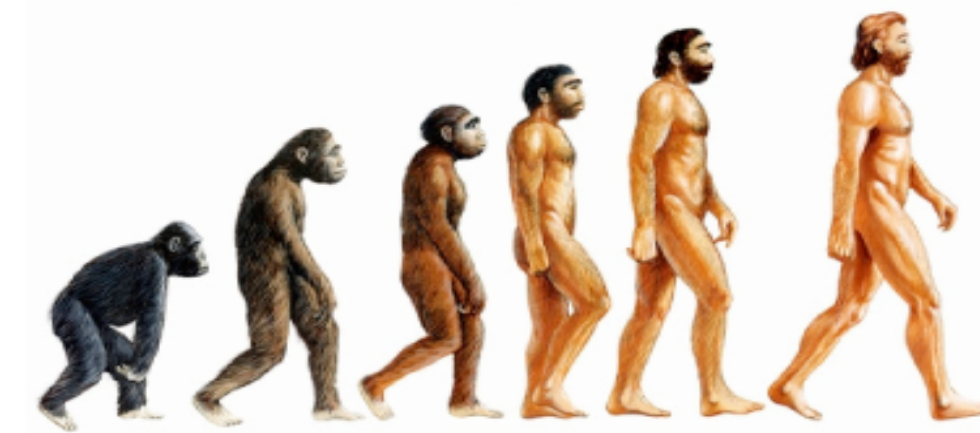
Philosophy



Ψ

Psychology

Anthropology



Neuroscience

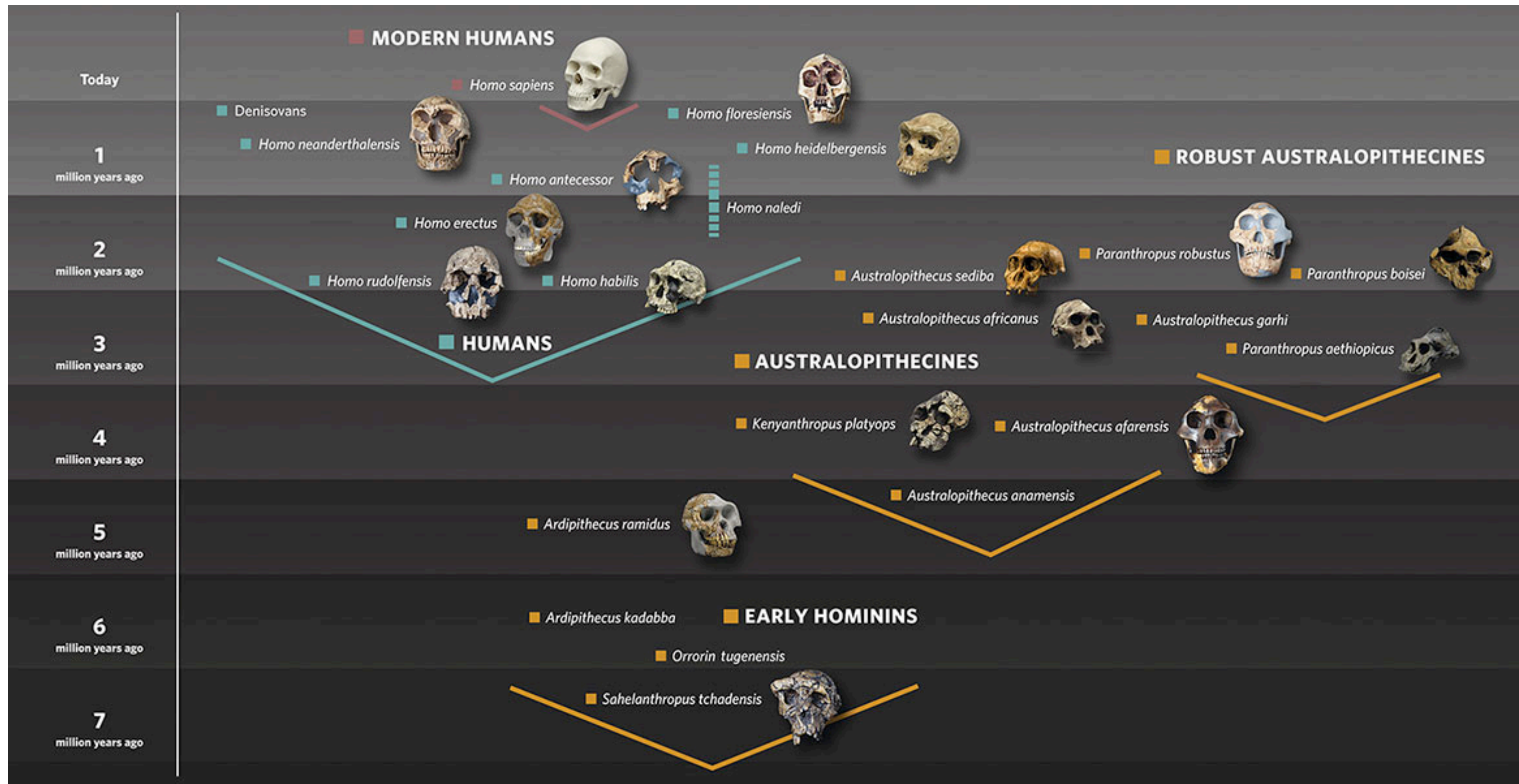


SCIENCE

Humanity's 3 BIG questions



The 6 conceptual revolutions that put humans in their place



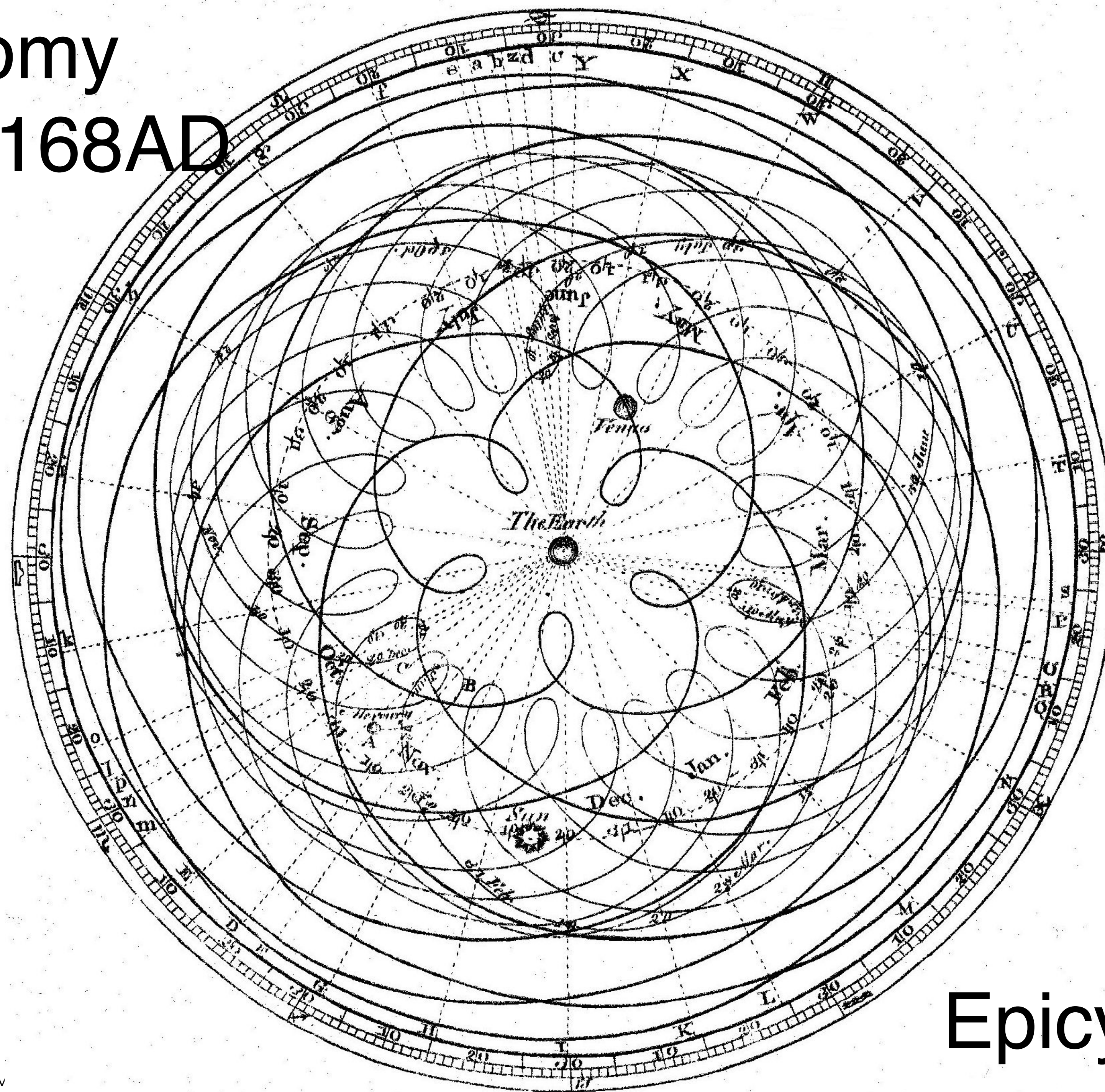
<https://www.nhm.ac.uk/>



The Universe



Ptolomy 100-168AD



Epicycles







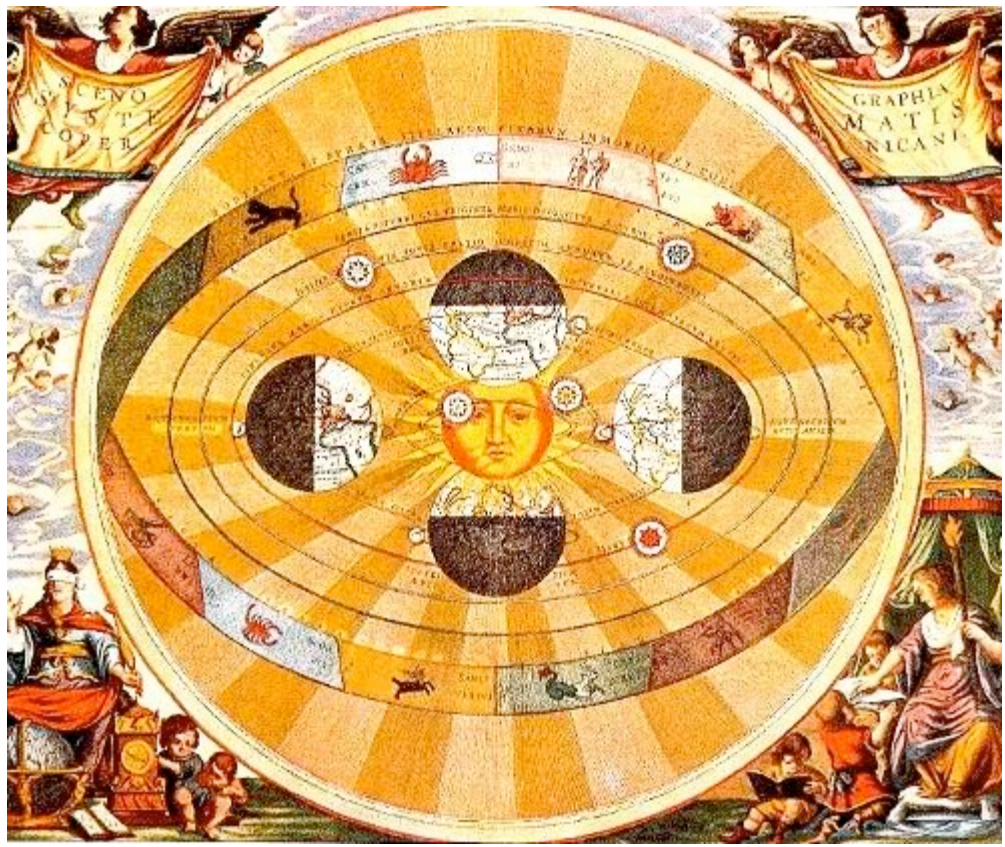
Engraving of Galileo Galilei (1564-1642) demonstrating his telescope, the first to be used for astronomical observations, to the Doge (ruler) of Venice, Italy, in August 1609

Venice, 1609

Copernicus

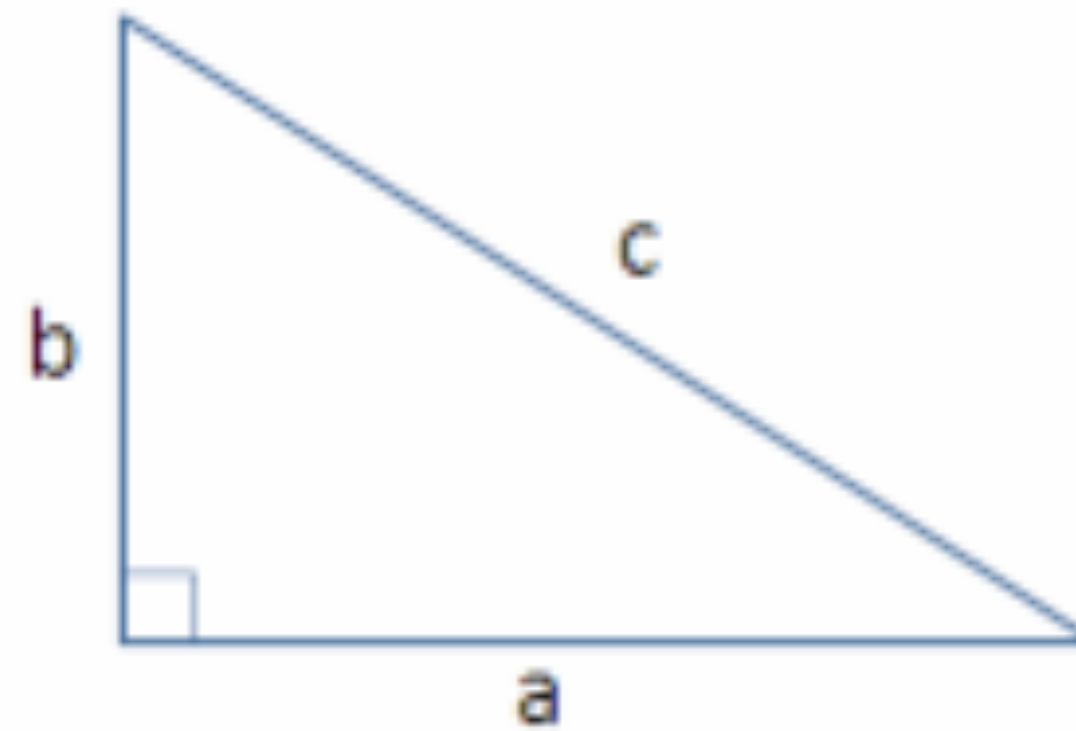
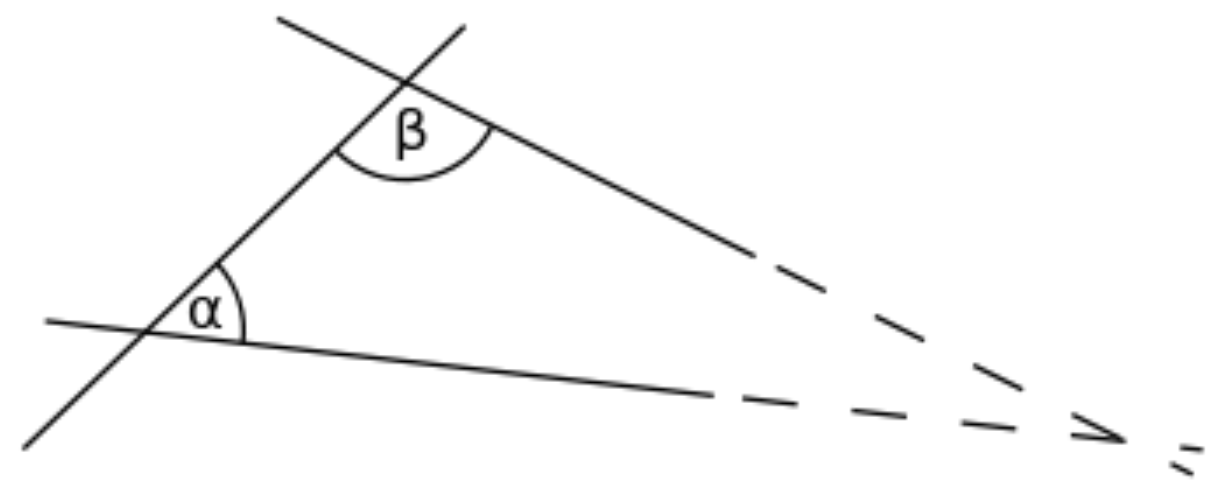


(19 February 1473 – 24 May 1543)



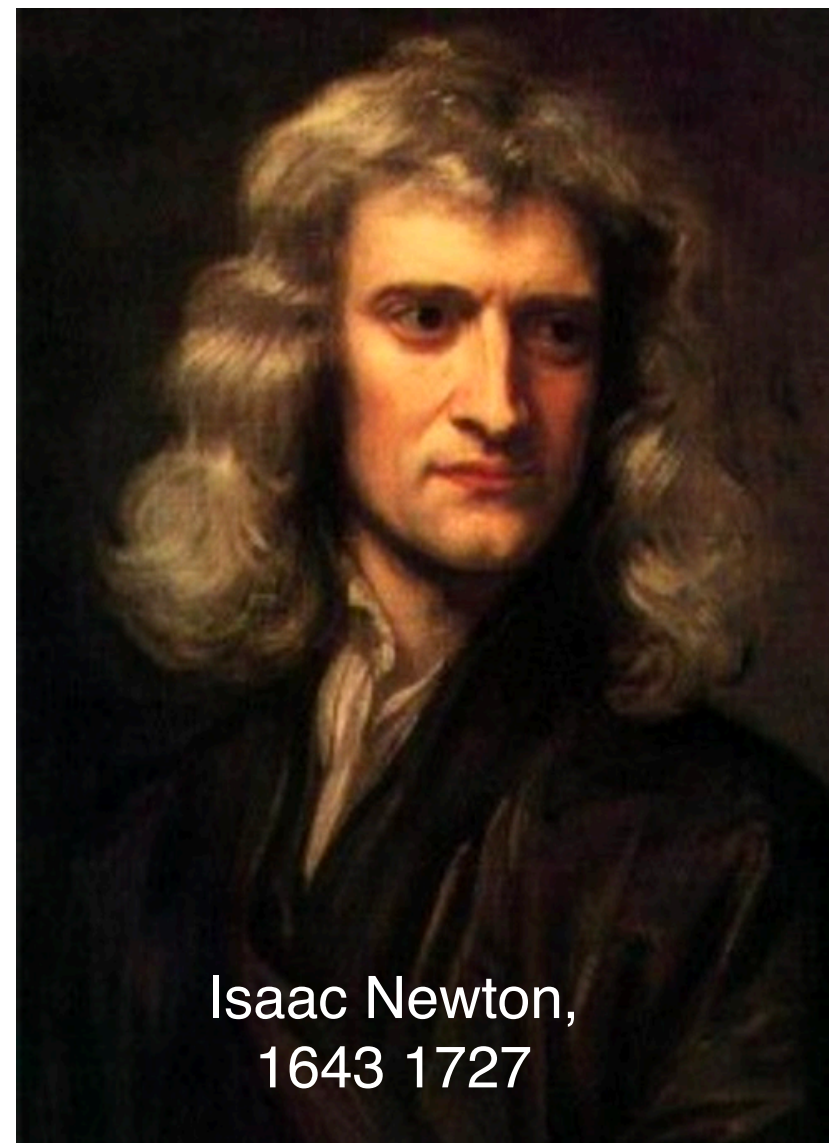
Nicolai Copernici Torinensis De revolutionibus orbium coelestium, Libri VI

(On the Revolutions of the Heavenly Spheres by Nicolaus Copernicus of Torin 6 Books), first printed in 1543 in [Nuremberg](#)



$$c^2 = a^2 + b^2$$

“Language of the universe is mathematics and logic”



Isaac Newton,
1643 1727

Newton's Laws

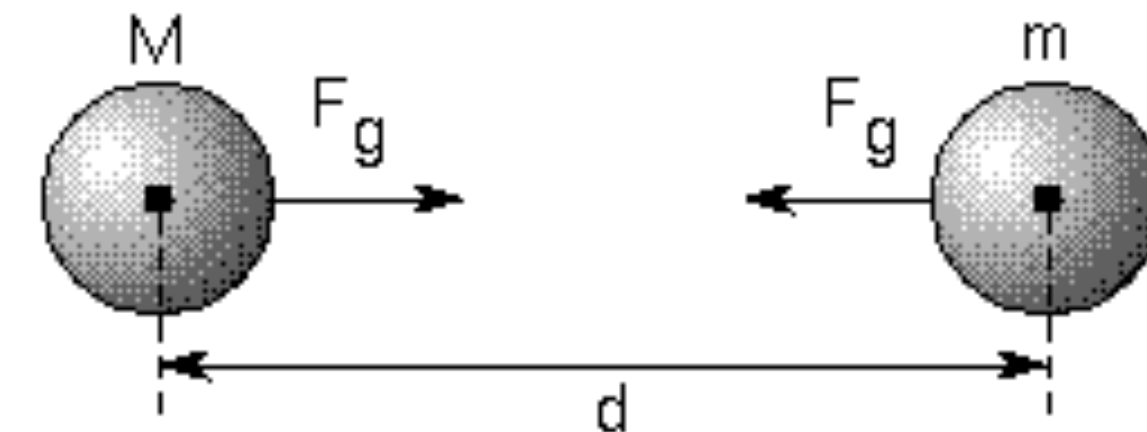
1. A body will remain at rest, or moving at a constant velocity, unless it is acted on by an unbalanced force.
2. The force experienced by an object is proportional to its mass times the acceleration it experiences:

$$\vec{F} = m\vec{a}$$

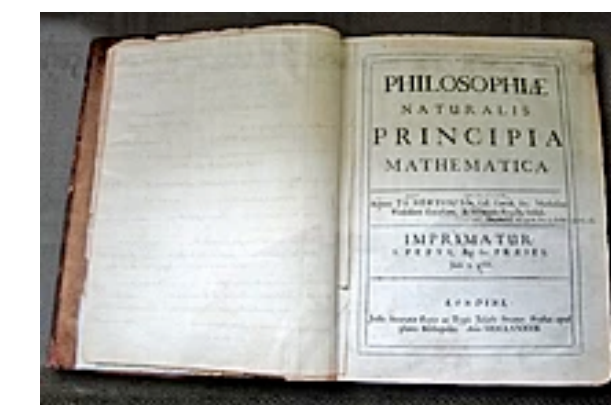
3. If two bodies exert a force on one another, the forces are equal in magnitude, but opposite in direction:

$$\vec{F}_{12} = -\vec{F}_{21}$$

Newton's Universal Law of Gravity



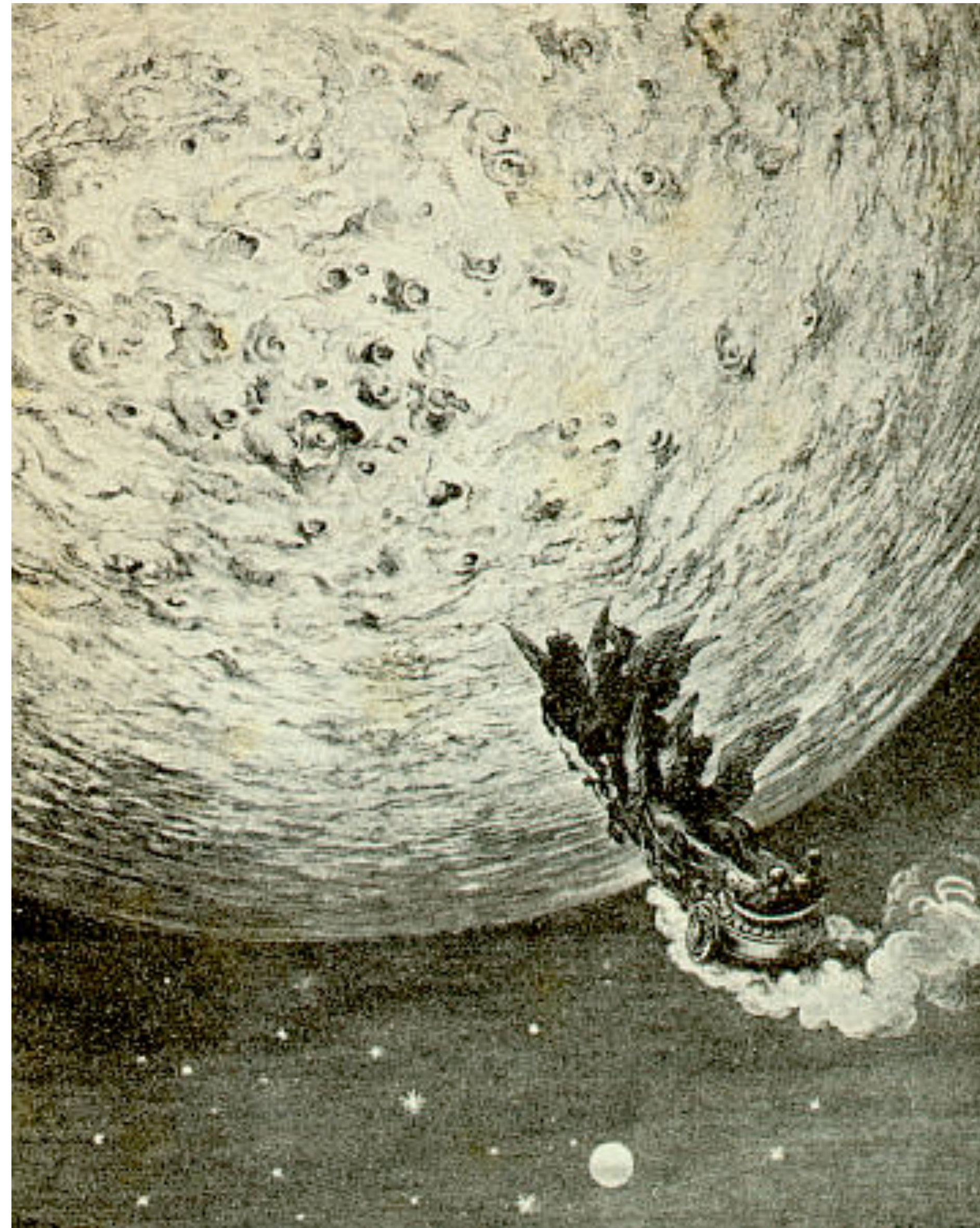
$$F_g = \frac{GMm}{d^2}$$





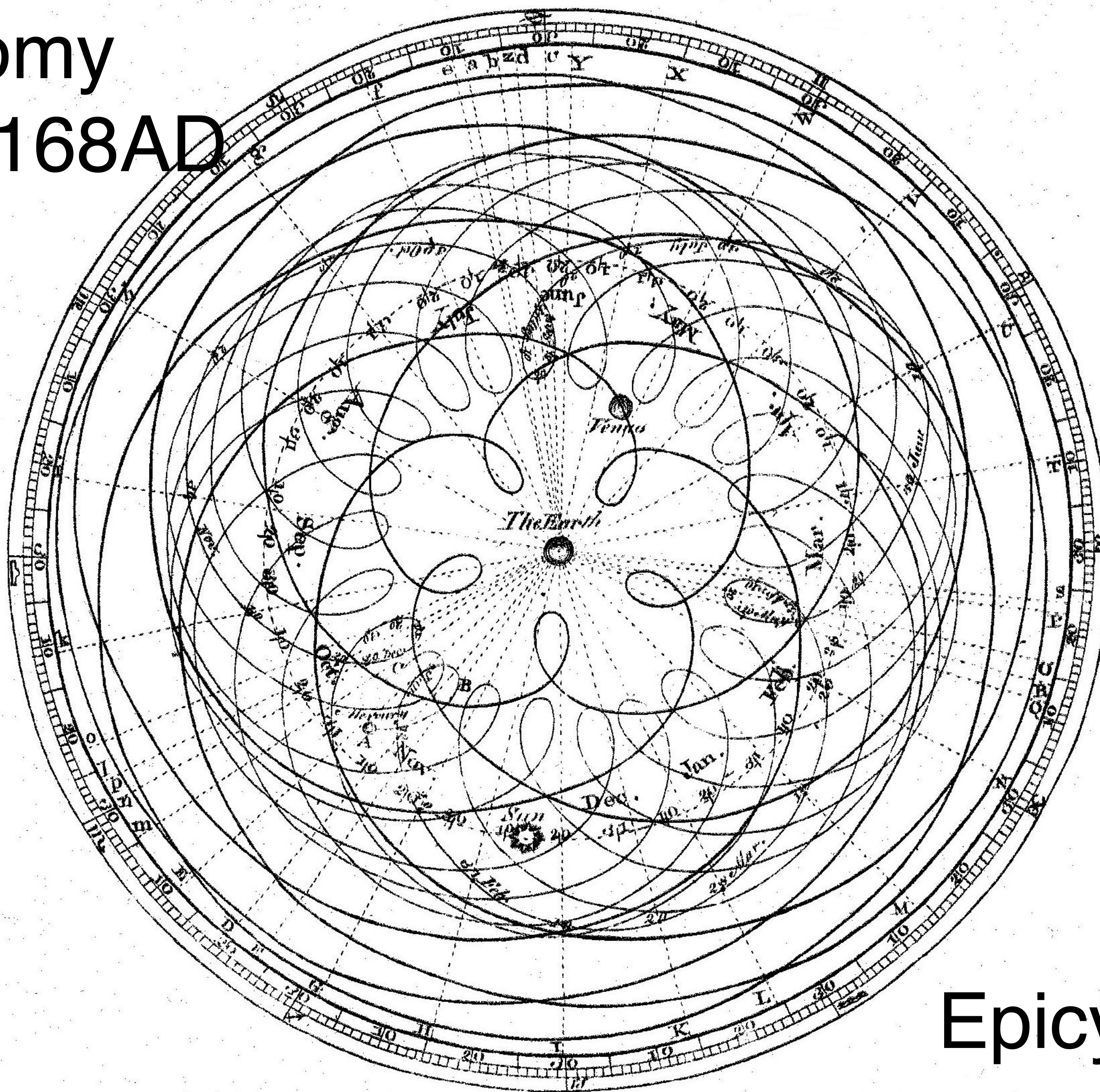
Orlando furioso ("The Frenzy of Orlando", more literally "Mad Orlando") - 1516

Ludovico Ariosto (8 September 1474 – 6 July 1533)



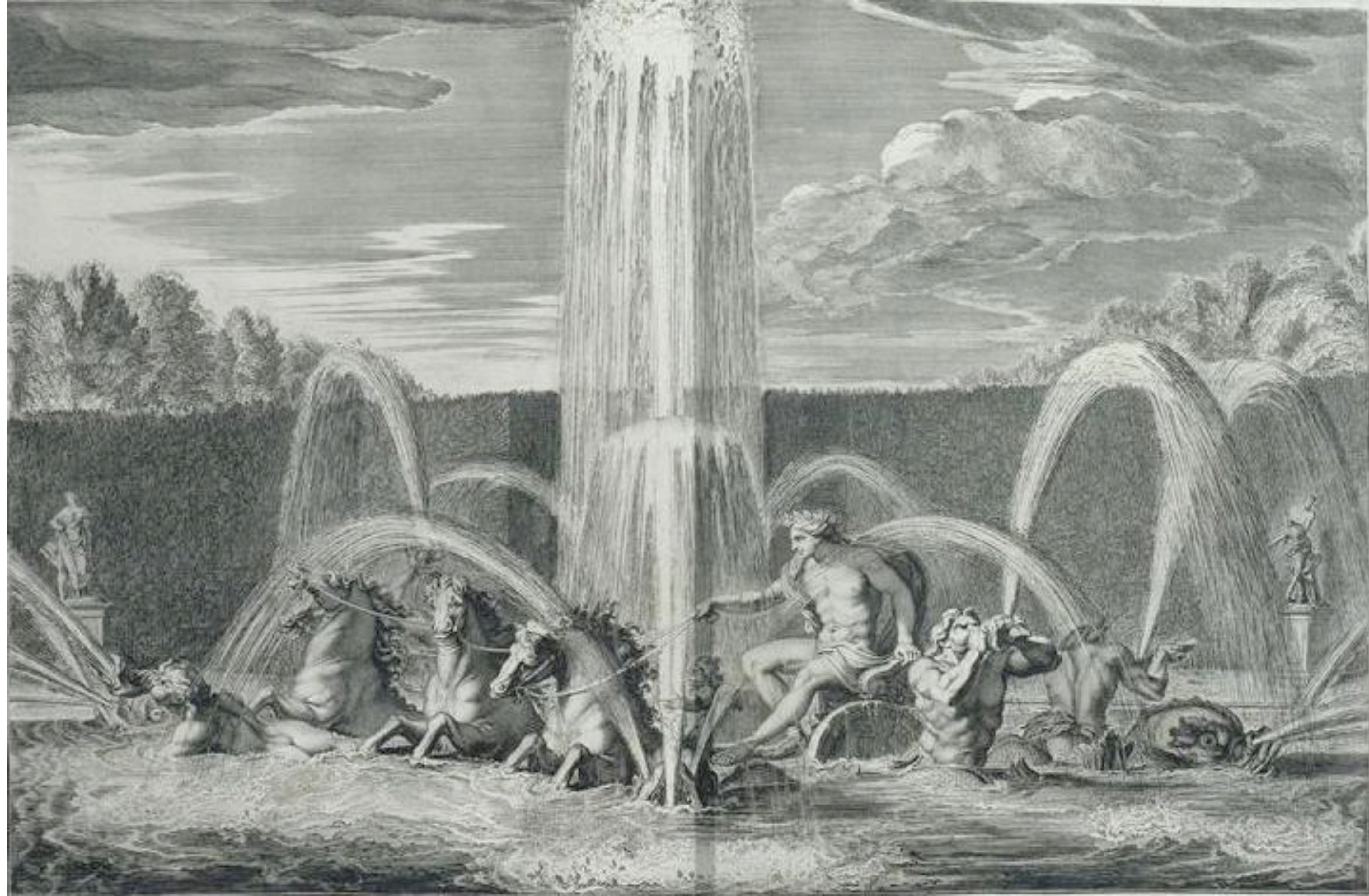
Astolfo sulla luna : illustrazione di Gustavo Doré
per l'edizione francese del 1879 dell'« *Orlando furioso* ».

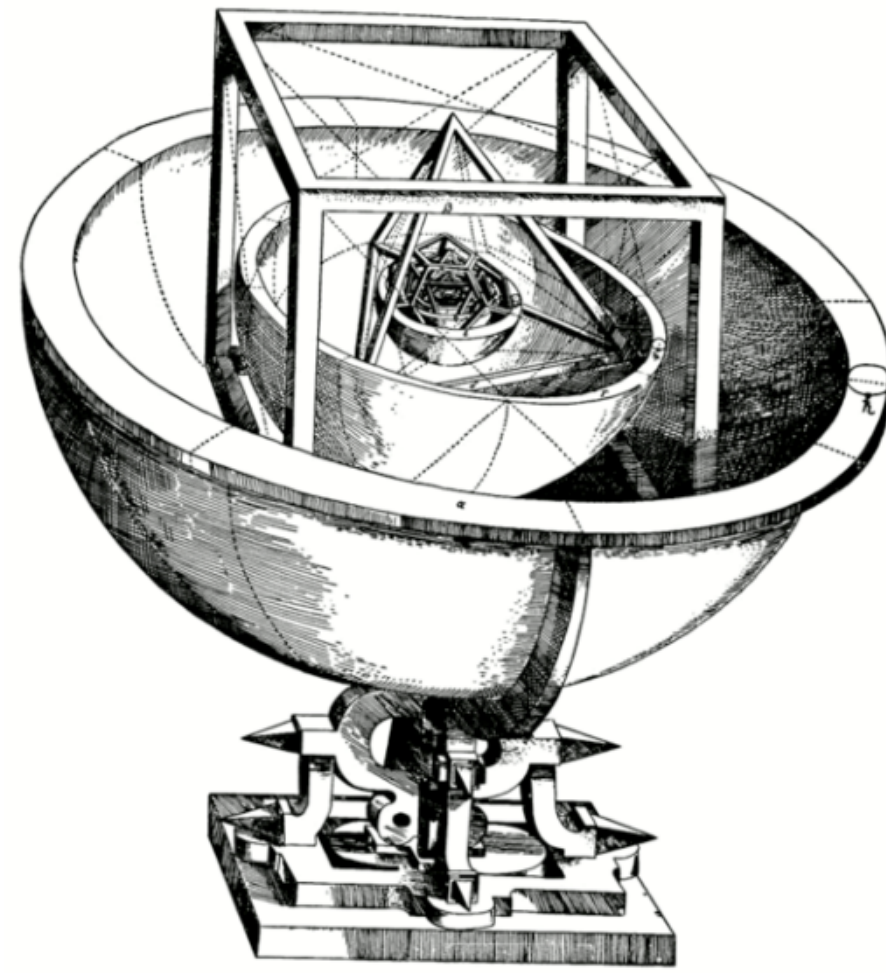
Ptolomy 100-168AD



Epicycles

1 Humans (and their Gods) do
not constitute the centre of the
universe/reality





Cartesian Dualism



R. Descartes (1596-1650),
De Homini 1633

Kepler's physical astronomy

Galileo's mechanistic physics

- power of a mechanistic view on the universe
- the end of Aristotelean teleological explanation

Harvey: the heart is a pump

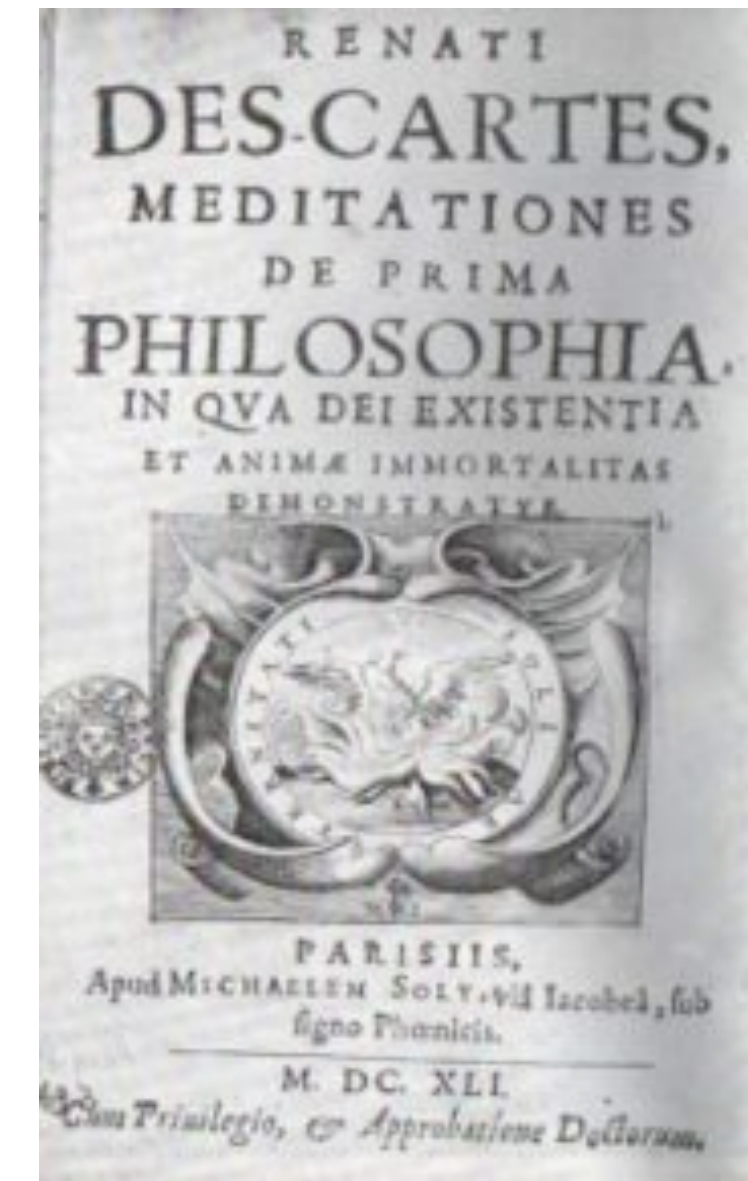
Descartes: Also physiology can be described in mechanistic terms

Fountains of Versaille
Hydrolic machines

“View of the Bassin d'Apollon” engraving by Louis de Chastillon, 1683

Descartes Meditations:

- “..never to accept anything as true that I did not know to be evidently so: that is to say, carefully to avoid precipitancy and prejudice, and to include in my judgments nothing more than what presented itself so clearly and so distinctly to my mind that I might have no occasion to place it in doubt.”
 - **Truth is derived from the mind**
- “..to divide each of the difficulties that I was examining into as many parts as might be possible and necessary in order to best solve it.”
 - **Rule of analysis: compose larger problems in smaller problems**
- “..to conduct my thoughts in an orderly way, beginning with the simplest objects and the easiest to know, in order to climb gradually, as by degrees, as far as the knowledge of the most complex, and even supposing some order among those objects which do not precede each other naturally.”
 - **Rule of synthesis**
- “..everywhere to make such complete enumerations and such general reviews that I would be sure to have omitted nothing.”
 - **Deductive logic: Cēterīs paribus**

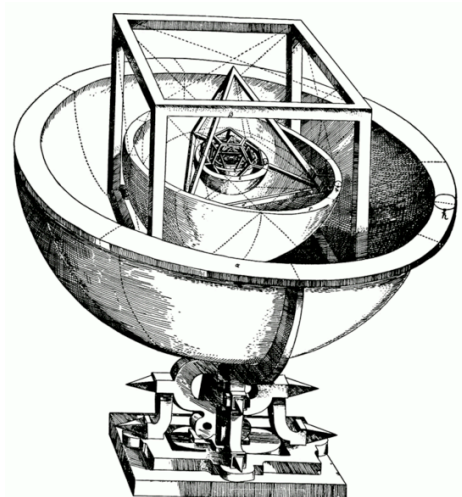


(1641) Meditations on First Philosophy: In which the existence of God and the immortality of the soul are demonstrated

How to ascertain truth?
Everything can be doubted except doubt itself
Cogito ergo Sum

Cartesian revolution

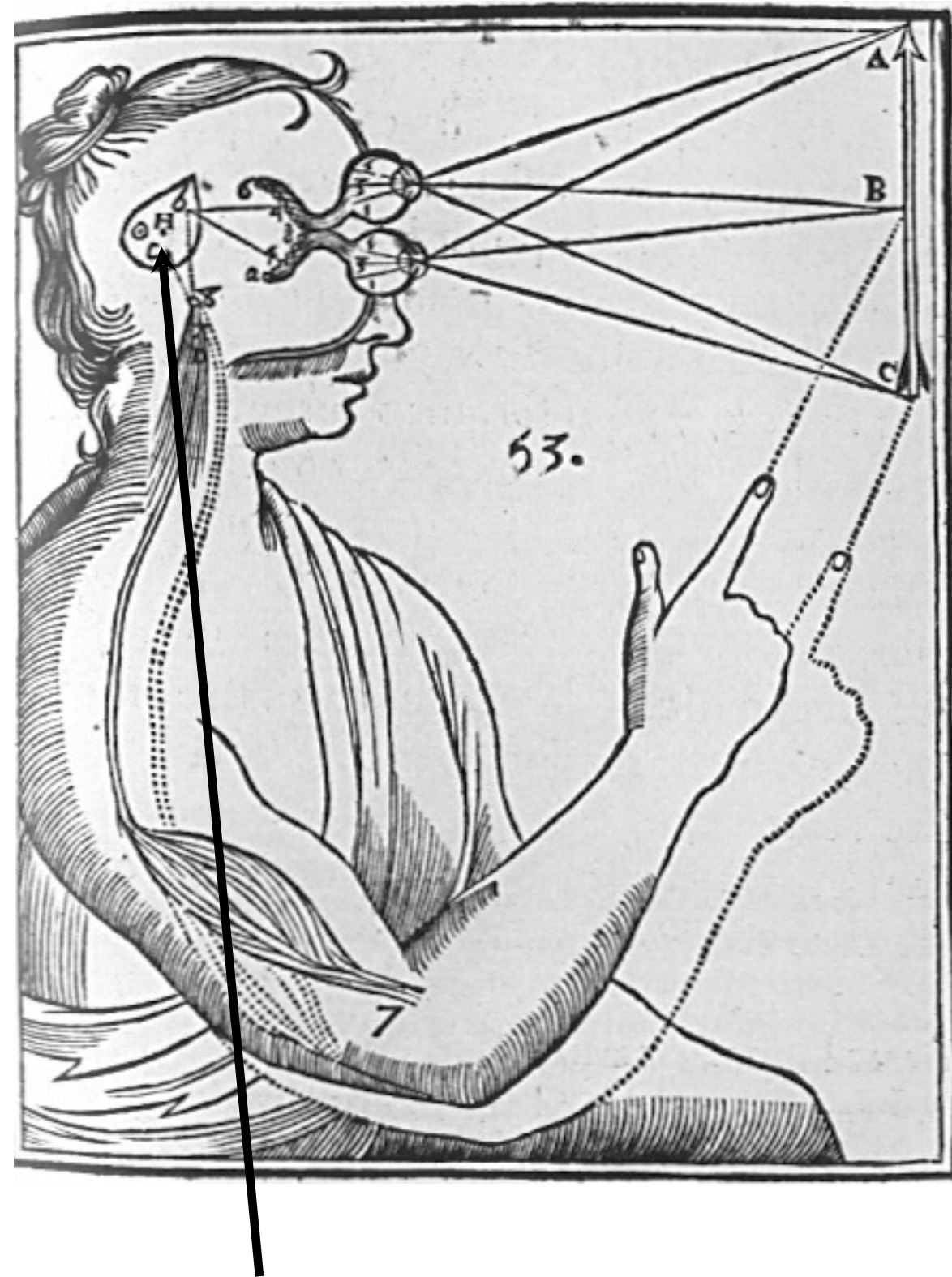
- The mind is the whole soul:
 - soul is principle of thought and consciousness (not of life)
 - the rest is physiology -> mechanics
- A person is *res cogitans*: a thinking being
 - what we are/can be aware of
 - thought and consciousness are one
- Mind and Body are a unity of two different substances
- Matter has extension: *res extensa*



R. Descartes (1596-1650), De22

Paul Verschure

Cartesian dualism



Perception is not based on resemblance of the pineal image to its cause but on the “movements” it induces:

- the homunculus problem
- pineal gland solves the binding problem
- PG is locus of all psychological functions (the end of the ventricular doctrine)

Pineal gland interface between mind and body:
good candidate because of its location between the two hemispheres

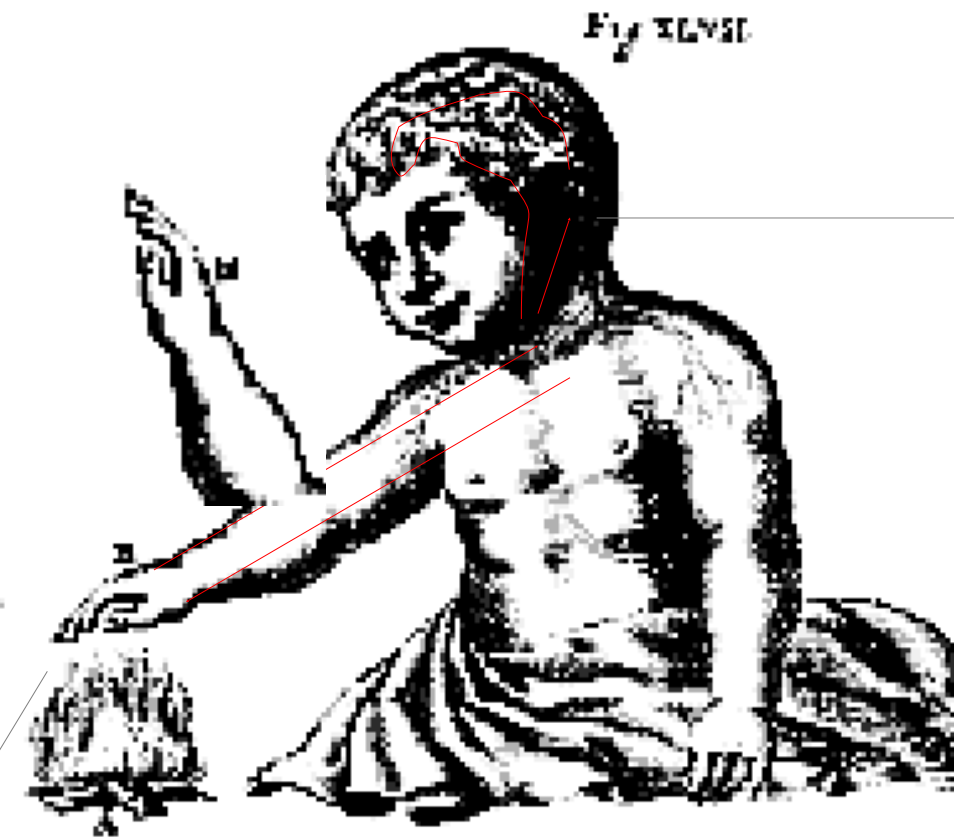
Descartes (1644) Principles of Philosophy



R. Descartes, De Homini 1633

Descartes' mechanistic explanation of the reflex

The ventricles are the source of animal spirits
"fine winds"
"very lively pure flame"



Animal spirits

Valves

Experience

Δ valves

Δ flow animal spirits

- animals are reflex driven automata
- excitatory and inhibitory reflexes

External stimulus is the driving force of action

Antecedents to substance dualism: Avicenna (980-1037, Persia)

Ibn Sina, Abu Ali Sina, Pour Sina, or Avicenna, was a Persian polymath. One of the most significant physicians, astronomers, thinkers and writers of the Islamic Golden Age, and the father of early modern medicine.

HISTORY OF PHILOSOPHY WITHOUT ANY GAPS

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138 - THE SELF-MADE MAN: AVICENNA'S LIFE AND WORKS

Posted on 21 July 2013

Despite war, the demands of patronage, and intellectual rivalry, Avicenna (Ibn Sīnā) manages to become the most influential of all medieval philosophers.

00:00 22:51

↓

« Previous

Next »

137 - God Willing: the Ash'arites

139 - By the Time I Get to Phoenix: Avicenna on Existence

Episodes 120 - 145: Formative Period

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Floating man argument



Floating Man

“One of us must suppose that he was just created at a stroke, fully developed and perfectly formed but with his vision shrouded from perceiving all external objects – created floating in the air or in the space, not buffeted by any perceptible current of the air that supports him, his limbs separated and kept out of contact with one another, so that they do not feel each other. Then let the subject consider whether he would affirm the existence of his self. There is no doubt that he would affirm his own existence, although not affirming the reality of any of his limbs or inner organs, his bowels, or heart or brain or any external thing. Indeed he would affirm the existence of this self of his while not affirming that it had any length, breadth or depth. And if it were possible for him in such a state to imagine a hand or any other organ, he would not imagine it to be a part of himself or a condition of his existence.”

—Avicenna, “De Anima, the book of Healing' Na”, Avicenna, L E Goodman

Soul: unmediated & reflexive consideration of self

Dualism without interaction

- Psychophysical parallelism
 - interaction is an illusion
 - “God” is behind it
- Occasionalism
 - God supplies the link between body and mind
- Epiphenomenalism
 - Physical events cause mental states
 - mental events can NOT cause physical states

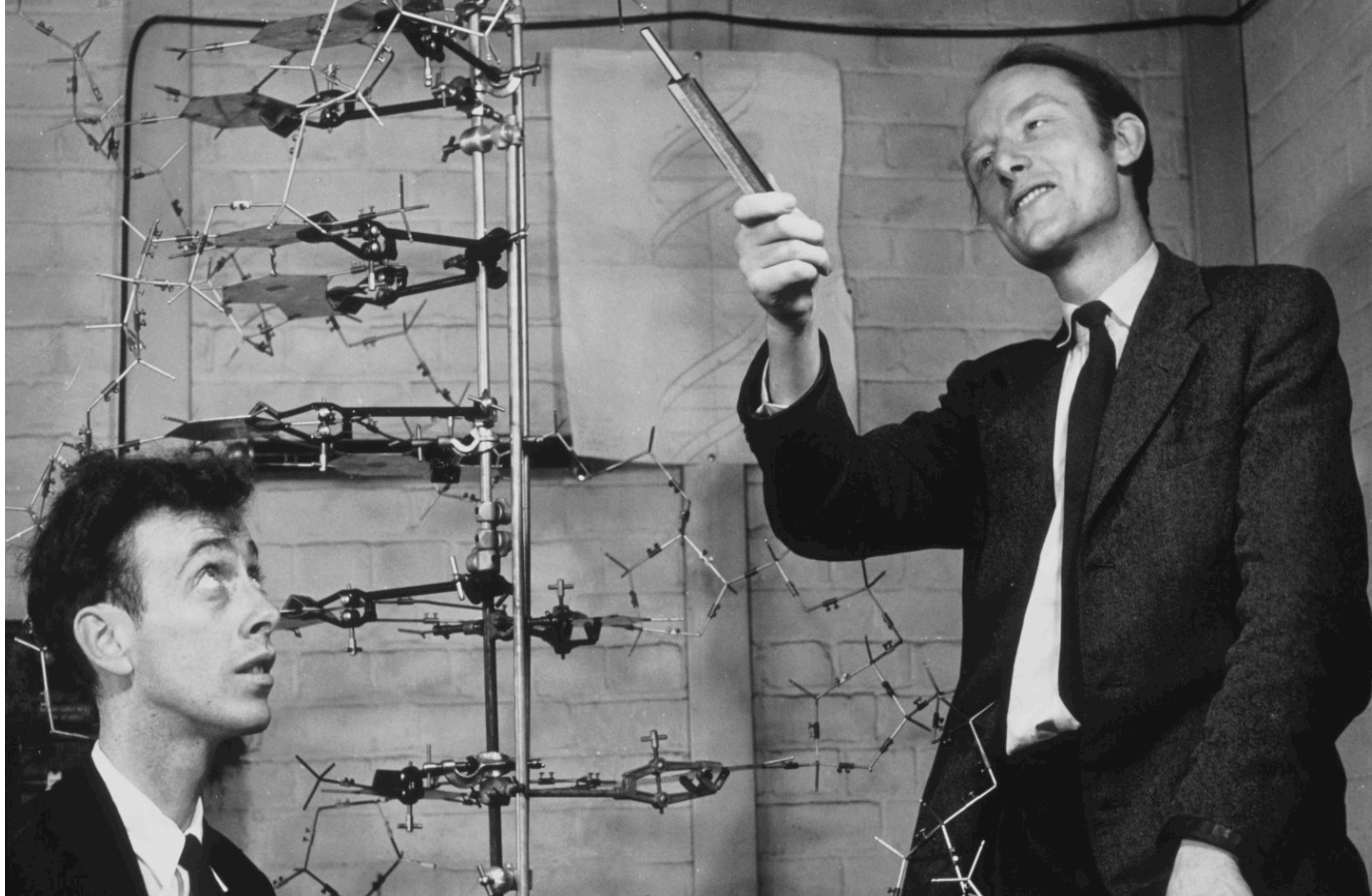
Physicalism

- Mental events can be explained by physical events
- Monism: only one substance
- Certainly makes a scientific program to study mind feasible
- Type-Identity theory
 - Mental events = physical events
 - The thought “blue camels” = a unique neuronal state of the brain



Life





MOLECULAR STRUCTURE OF NUCLEIC ACIDS

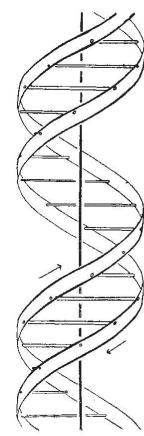
A Structure for Deoxyribose Nucleic Acid

WE wish to suggest a structure for the salt of deoxyribose nucleic acid (D.N.A.). This structure has novel features which are of considerable biological interest.

A structure for nucleic acid has already been proposed by Pauling and Corey¹. They kindly made their manuscript available to us in advance of publication. Their model consists of three intertwined chains, with the phosphates near the fibre axis, and the bases on the outside. In our opinion, this structure is unsatisfactory for two reasons: (1) We believe that the material which gives the X-ray diagrams is the salt, not the free acid. Without the acidic hydrogen atoms it is not clear what forces would hold the structure together, especially as the negatively charged phosphates near the axis will repel each other. (2) Some of the van der Waals distances appear to be too small.

Another three-chain structure has also been suggested by Fraser (in the press). In his model the phosphates are on the outside and the bases on the inside, linked together by hydrogen bonds. This structure as described is rather ill-defined, and for this reason we shall not comment on it.

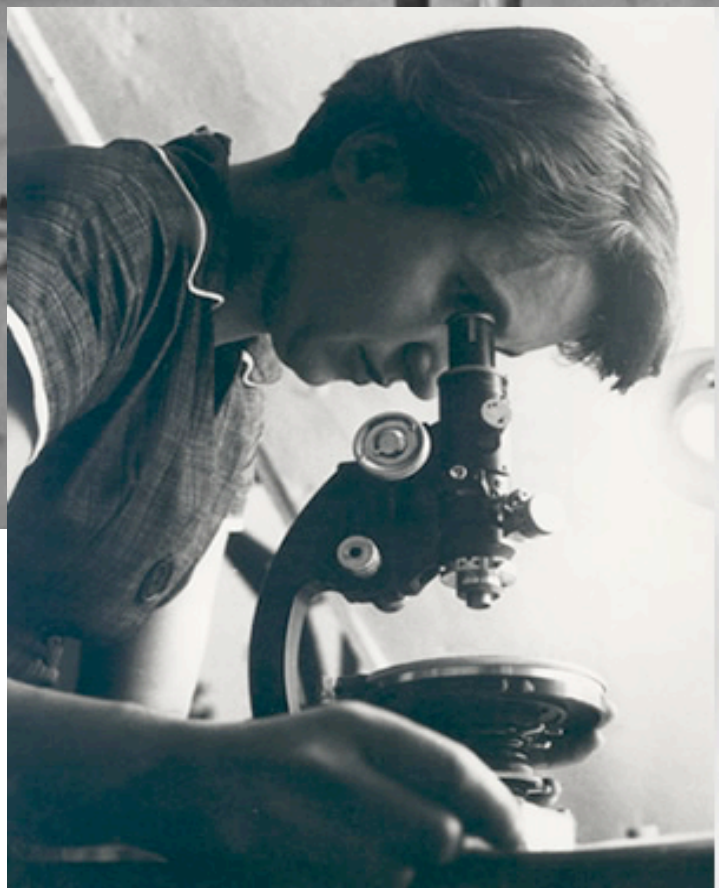
We wish to put forward a radically different structure for the salt of deoxyribose nucleic acid. This structure has two helical chains each coiled round the same axis (see diagram). We have made the usual chemical assumptions, namely, that each chain consists of phosphate diester groups joining β -D-deoxyribofuranose residues with 3',5' linkages. The two chains (but not their bases) are related by a dyad perpendicular to the fibre axis. Both chains follow right-handed helices, but owing to the dyad the sequences of the atoms in the two chains run in opposite directions. Each chain loosely resembles Furberg's² model No. 1; that is, the bases are on the inside of the helix and the phosphates on the outside. The configuration of the sugar and the atoms near it is close to Furberg's 'standard configuration', the sugar being roughly perpendicular to the attached base. There



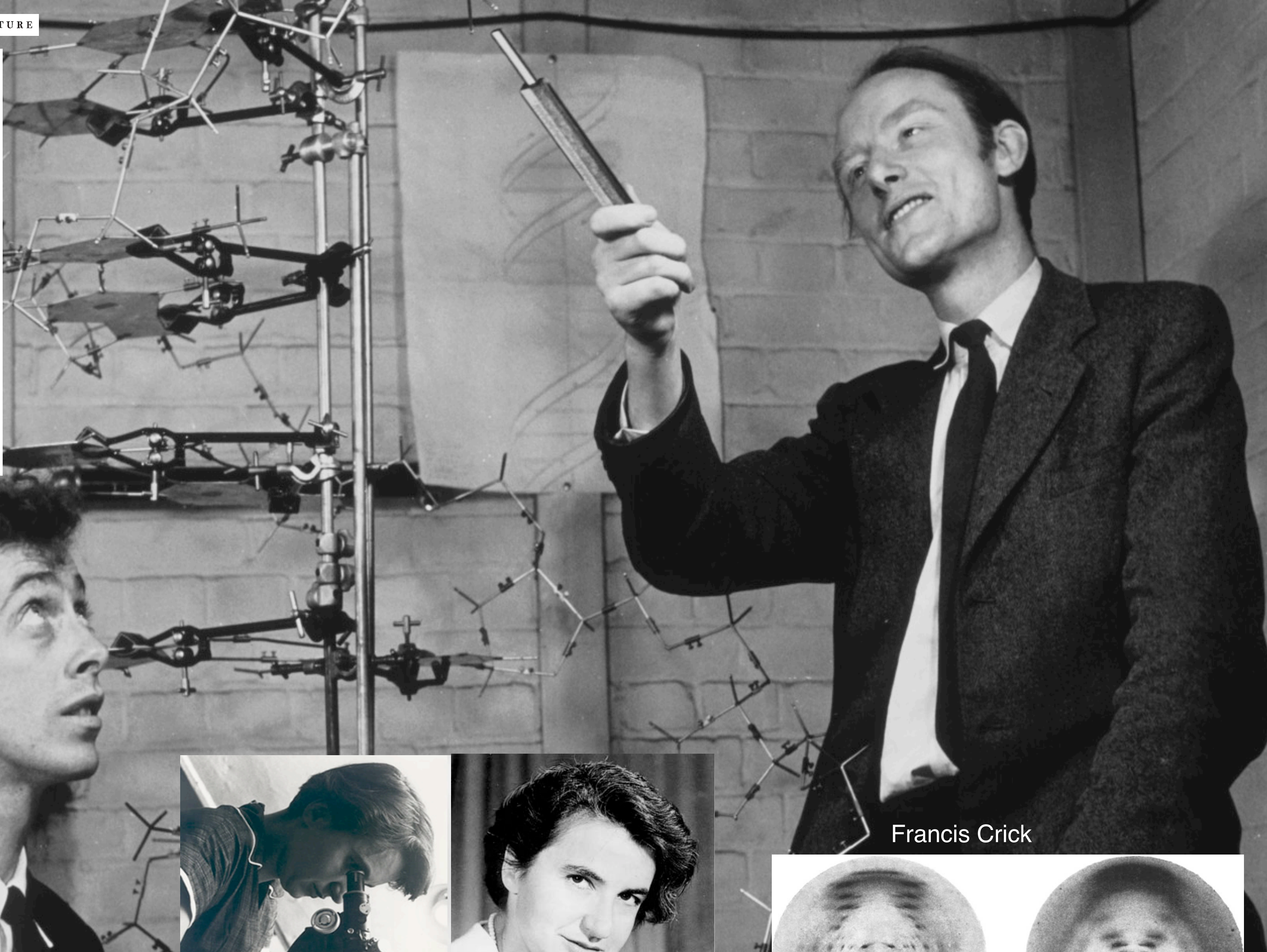
This figure is purely diagrammatic. The two ribbons symbolize the two phosphate-sugar chains, and the horizontal rods the pairs of bases holding the chains together. The vertical line marks the fibre axis.



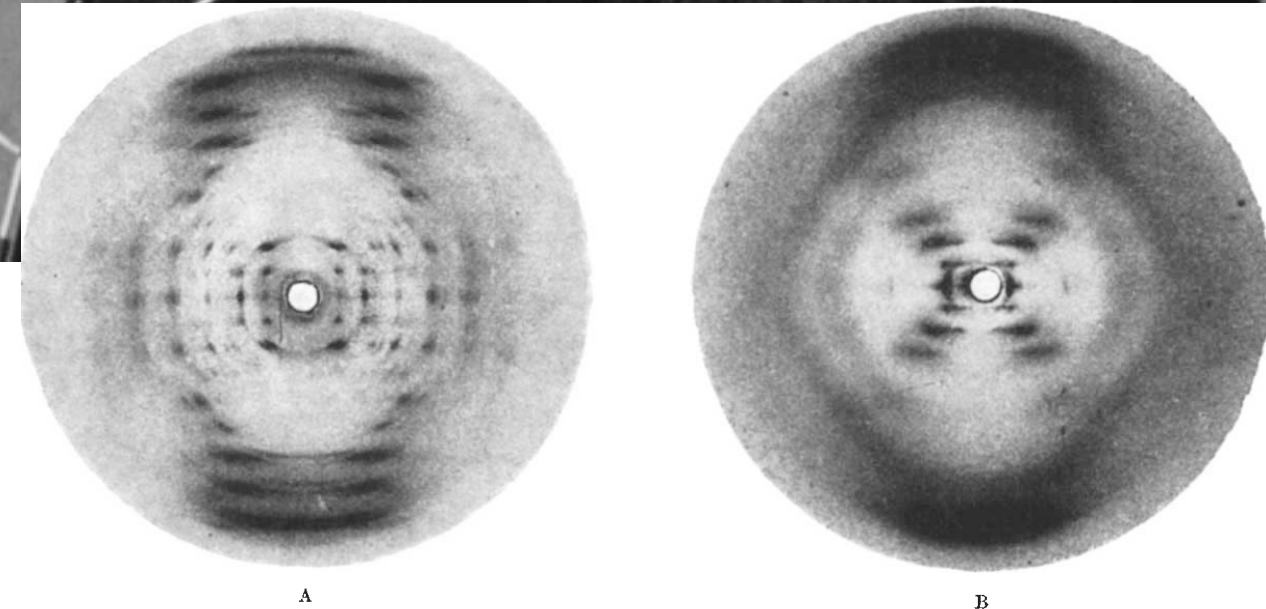
James Watson



Rosalind Franklin



Francis Crick



A

B

Humanity's 3 BIG questions

The Universe

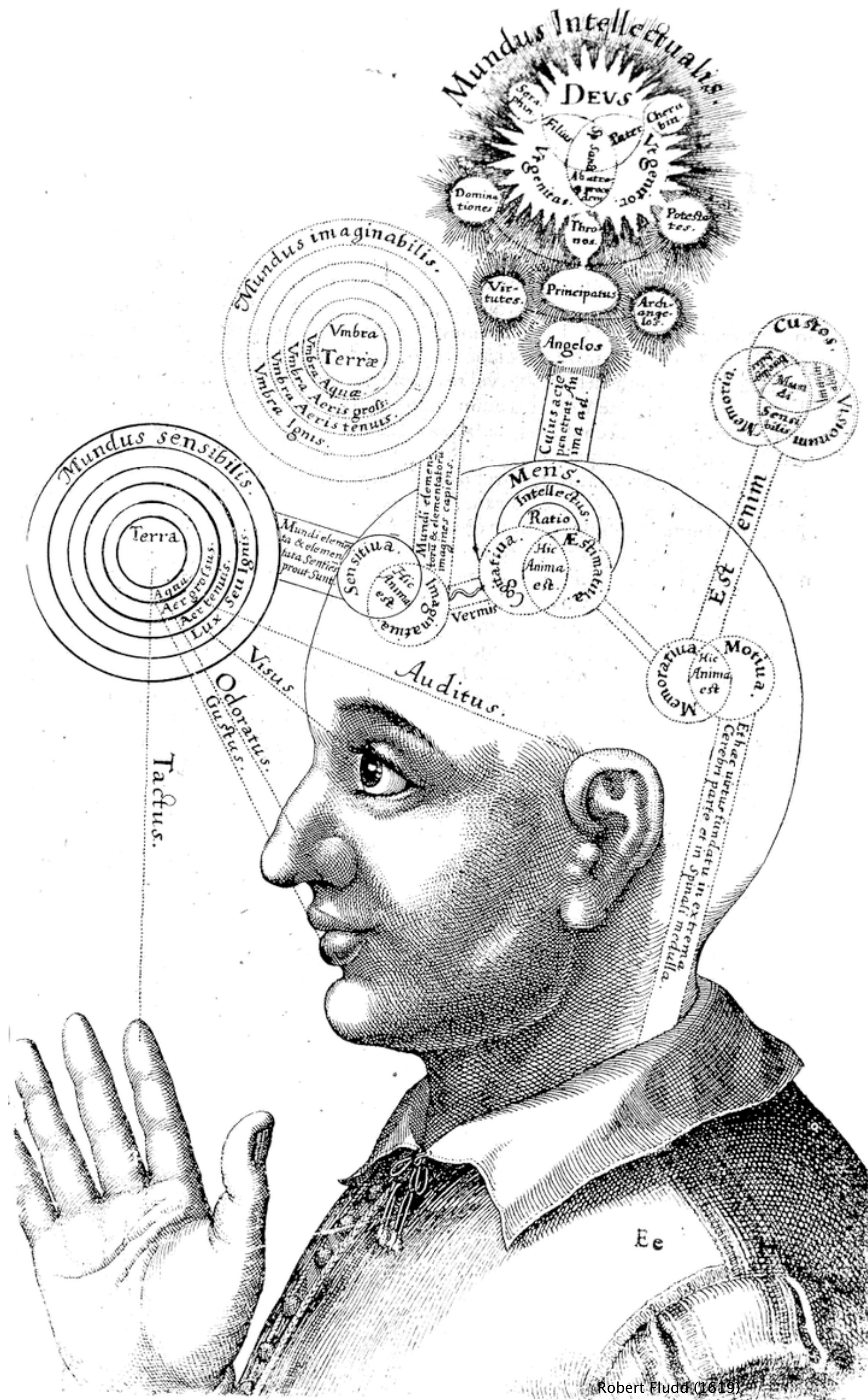
Life



Consciousness



the
he



Consciousness

Theory

Observation

Deduction
→

Theory

Observation

←
Induction



Explain

Theory

Predict

Observation

Control



**How to observe that
which is not
observable?**



JULIAN JAYNES

THE ORIGIN OF
CONSCIOUSNESS
IN THE BREAK
DOWN OF THE
BICAMERAL MIND



Julian Jaynes

1920-1997

Paul Verschure

MARINER BOOKS

origins of “Mind” in the Iliad

The Iliad, the product of the elusive poet Homer, is most probably the result of an oral tradition that developed this epic of war and the behavior of humans and gods between 1230 and 850 BC, after which it got written down. (Remember Achilles and Hector)

Mind emerges out of the amalgamation of a number of precursor concepts:

noos (noein): or 'to see'

psyche (psychein): 'to breath'

thumos: overt activity

phrenes (lungs) possibly related to pharis or speech

kradie: the heart

etor (etron): the belly.

And is used in 600BC as a material references to “mind” as a cause of human action by Solon of Athens using the word **noos**.

*“Each one of you walks with the steps of a fox; the **noos** of all of you is **chaunos** [porous, spongy, or loose-grained as in wood]: for you look to a man's tongue and rapidly shifting speech, and never to the deed he does.”*

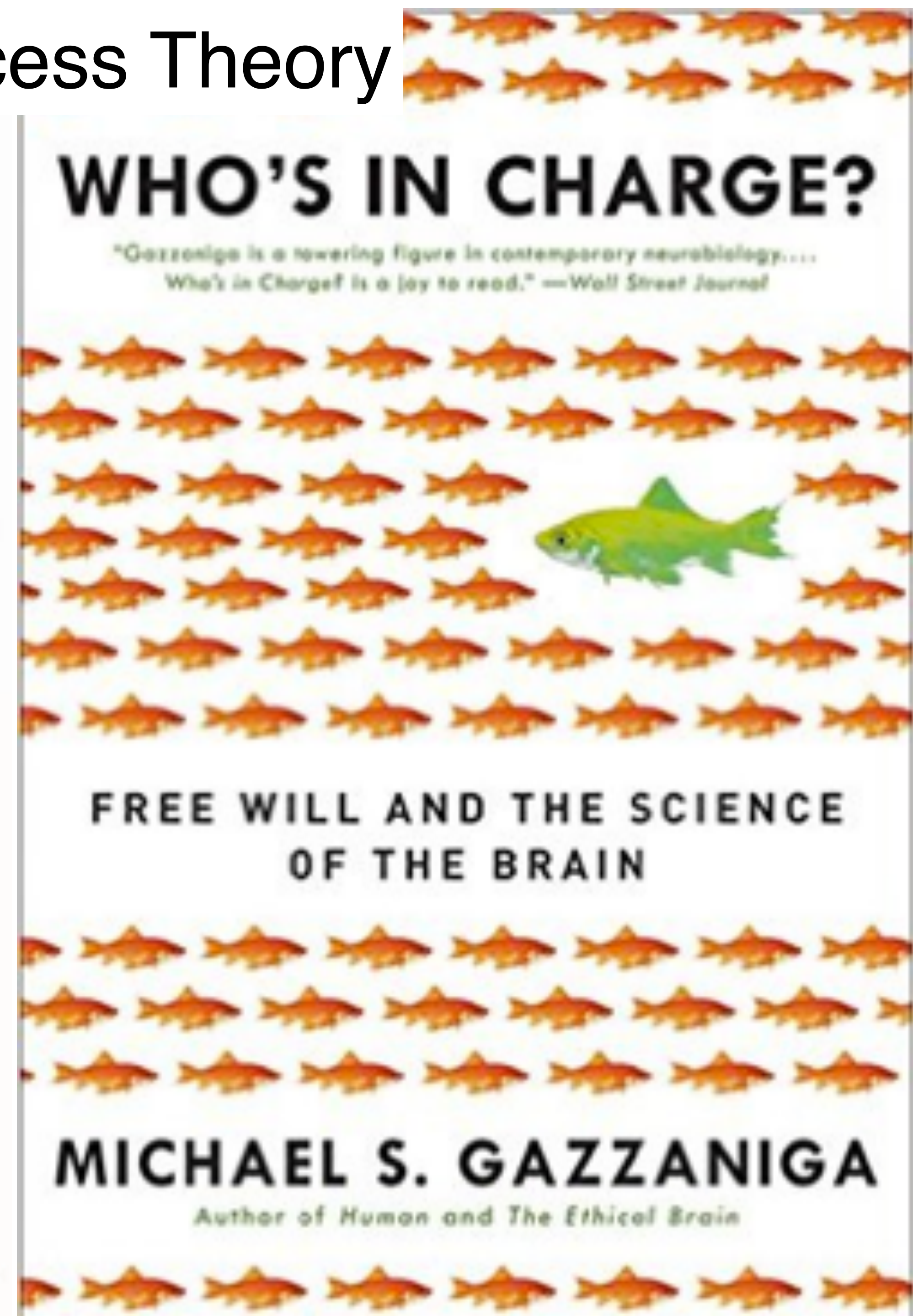
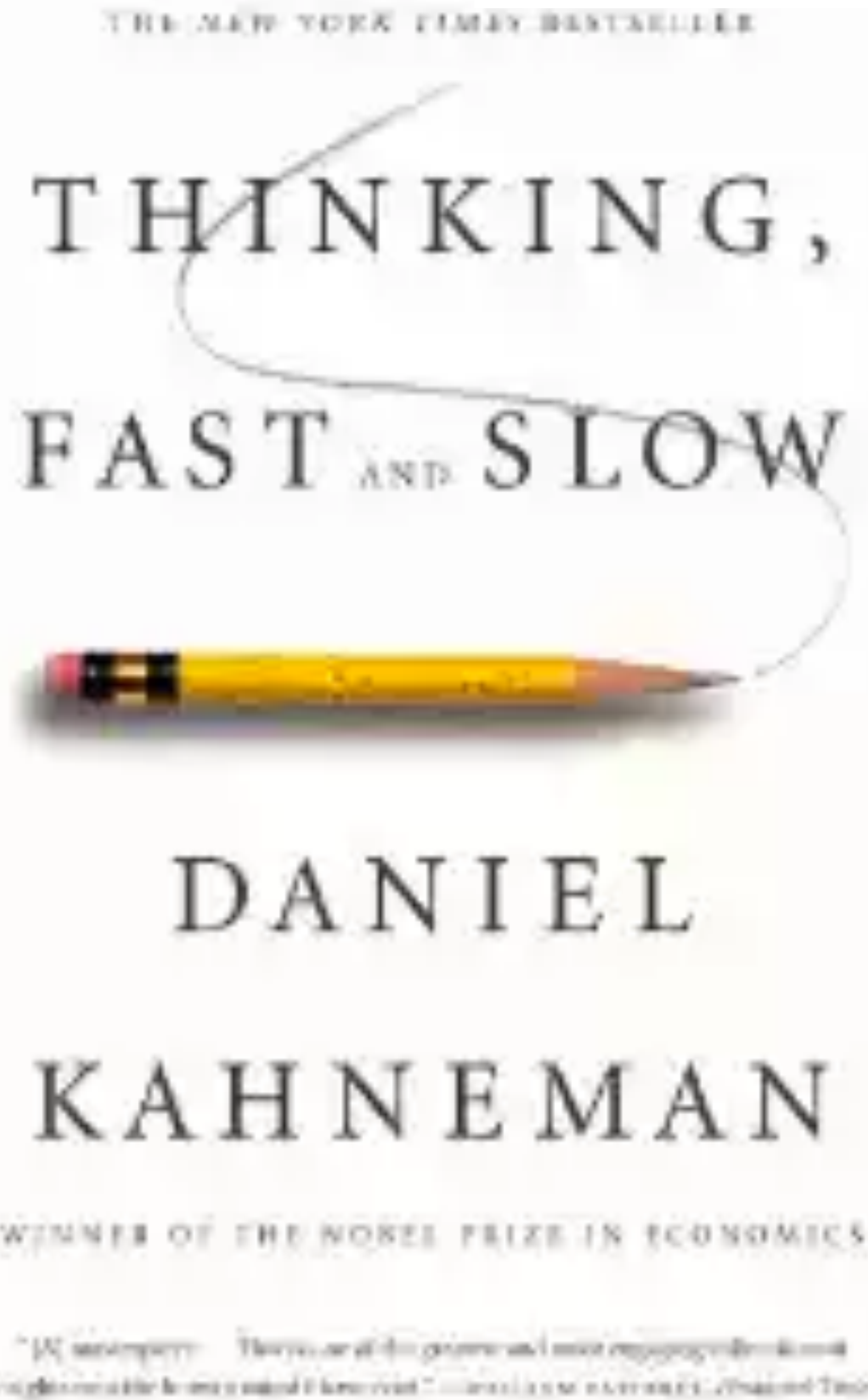
Jaynes, J. (1977) The origins of consciousness in the breakdown of the bicameral mind.

The bicameral mind hypothesis of Jaynes

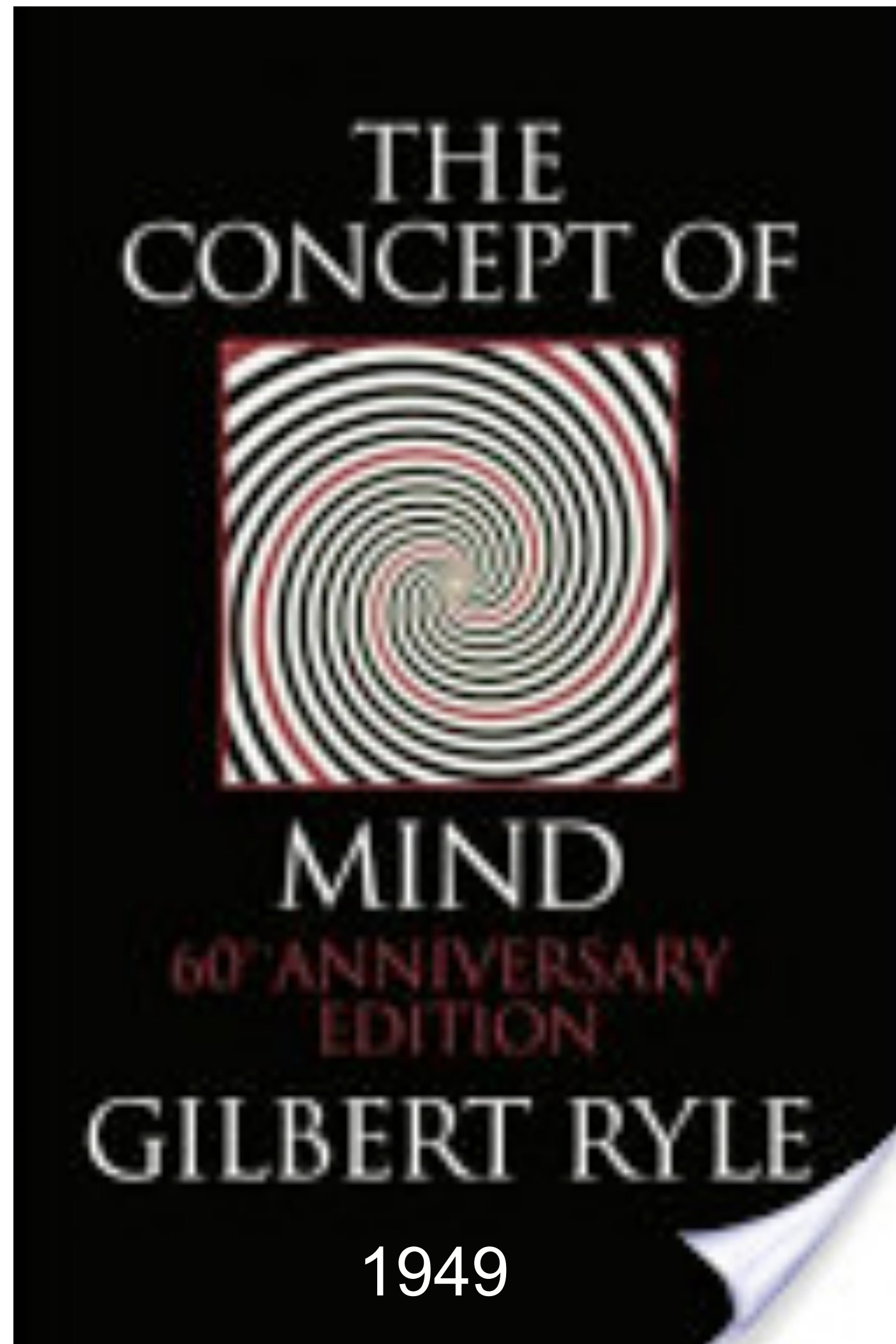
- Until 3000 years ago humans lived in a schizophrenic state:
 - Schizophrenia (schizein (σχίζειν, "to split") and phrēn, phren- (φρήν, φρεν-, "mind")) is a mental disorder affecting the experience or expression of reality such as in hallucinations, paranoid or bizarre delusions or disorganized cognition.
- Behavior resulted from instructions by external voices (“gods” / “muses”)
- Humans had a split **command & follow** brain (right-left hemisphere)
- <1000 BC no reference to cognitive processes nor evidence for self-awareness
- > 1000 BC we rely on introspection and consciousness

Jaynes, J. (1977), The origins of consciousness in the breakdown of the bicameral mind.

Dual Process Theory



What is “Mind”?



- Causal role of mind
- Phenomenology
- Natural Categories
- Folk Psychology
- Philosophical behaviorism
- Absorbed in “Functionalism”

*The book focuses on the “type-errors” or “**category mistakes**” which philosophers of mind are prone to make when they consider the logical form of “mental conduct verbs”, especially if they use as their starting-point the “Janus-faced account of human life” suggested by a Cartesian conception of the mind. Ryle (1962)*