Ancient metaphysics

- Before we can ask "what are concepts made of?" we need to ask "what is the world made of?"

  - Answers to this question have been debated for thousands of years

- Ancient Chinese thought the world was made of 5 elements: wood, fire, earth, metal, and water
- Ancient Greeks thought there were 4 (or 5) elements: earth, water, air and fire (and aether).
- Plato suggested a fundamental dichotomy between the sensible world and the [Platonic] forms
- This idea was later incorporated into Christianity as the division between the profane and the sacred

Modern metaphysics

- Descartes (1630s) expressed this as a duality between the body (made of physical material) and the mind (made of mental material)

  - This is called Cartesian Dualism

- But dualism has problems, most seriously: if mind and body are completely separate, how can they interact?

  - Most scientists eventually came to the conclusion that they can't.

- The modern alternative is monism (one-ism): the idea that everything is one type of substance:

  - Everything is physical -> materialism

  - Everything is mental -> idealism (idea-ism)

The brain is a machine

- The world is a machine

  Gallileo (1632): “The systems of the world"

  Newton (1687): Equations govern the world

- The body is a machine

  Harvey (1628) The circulatory system

  Descartes (1637): The body is a system of pipes and pumps

  de la Mettrie (1749): “L’Homme Machine”

  Darwin (1859) Biological structures are devices to aid survival

- The brain is a machine

  Leibniz (1704) Calculus of reasoning

  Boole (1854): "The Laws of Thought”

  Turing (1937): Universal computers

  McCulloch & Pitts (1943): Brains are computers

Rationalism vs. empiricism

- Historically, there are two basic attitudes towards how the mind comes to know a concept, called
- Empiricism

  - All knowledge comes from experience

  - The mind begins as a *tabula rasa* (blank slate)

  - -> Associationism -> behaviorism
- Rationalism

  - The mind derives knowledge from internal mental processes, like reasoning and innate knowledge

  - -> Nativism -> Cognitivism

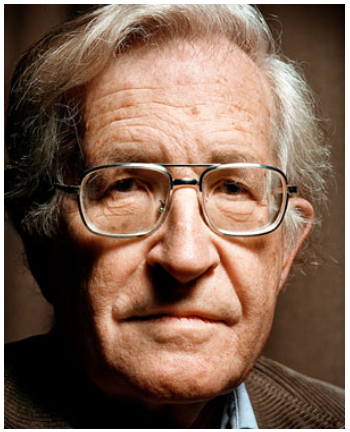
Rationalism

- René Descartes (1637)

  The brain can't interpret the world without certain ideas being "built in" (innate)

- Immanuel Kant (1781)

  Certain aspects of the world can't be learned



- Noam Chomsky (1958)

  - Language can't be learned without certain knowledge being built in (Universal Grammar)

Empiricism

- John Locke (1690)

  - Knowledge comes from experience…

  - … via sensations and associations among sensations -> Associationism

- David Hume (1739)

  - Causality, universals do not really exist; they are "habits of the mind"

- B. F. Skinner (1953)

  - Psychology is just an analysis of behavior -> Behaviorism

  - Learning is just conditioned associations between stimulus and response -> S-R psychology

Turing (1950) "Computing machinery and intelligence"

In the process of trying to imitate an adult human mind we are bound to think a good deal about the process which has brought it to the state that it is in. We may notice three components,

(*a*) The initial state of the mind, say at birth,
(*b*) The education to which it has been subjected,
(*c*) Other experience, not to be described as education, to which it has been subjected.

Instead of trying to produce a programme to simulate the adult mind, why not rather try to produce one which simulates the child's? If this were then subjected to an appropriate course of education one would obtain the adult brain. Presumably the child-brain is something like a note-book as one buys it from the stationers. Rather little mechanism, and lots of blank sheets. (Mechanism and writing are from our point of view almost synonymous.) Our hope is that there is so little mechanism in the child-brain that something like it can be easily programmed. The amount of work in the education we can assume, as a first approximation, to be much the same as for the human child.