Cognitive Neuroscience for AI Developers (CNAID)

SS 2023

Week 1, Introduction to Cognitive Science and the philosophical approach of Cognitive Science

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Multiple Choice Exercise

(Please mark the right answer with a cross. Only one answer is correct!)

Q1: Which statement on cognitive science is **not** correct?

- o   The scientific method is an iterative process where hypotheses are tested in experiments and the results are used to update the hypotheses true
- o   Cognitive science is an interdisciplinary approach with the common goal to understand the mind true
- X   Especially philosophy uses the scientific method to generate knowledge false: no experiments
- o   "The blind men and the elephant" is a metaphor for the problems of the interdisciplinary study of the mind true
- o   Cognitive Neuroscience is located at the intersection of psychology and neuroscience true

Q2: Which statement on the brain and the mind is **not** correct?

- X   The brain consists of approximately 100 Million neurons false: 100 billion neurons
- o   The central idea of cognitive science is that the brain is an information processor true
- o   Cognitive science was influenced by the development of the digital computer true
- o   There are more possible connectomes then protons in the universe true: (100**10**22 vs. 10**80)
- o   Information processor represent and transform information true

Q3: Which statement about representations and computations is true?

- o   There are 2 different forms of representations. false: 4 (concepts, propositions, rules, analogies)
- o   Concepts are statements about the world. (e.g. "It is raining outside!") false: (stands for entity)
- X   Newell and Simons proposed that physical symbol systems (formal logical systems) allow for general intelligence true
- o   David Marr proposed that computations can be understood on four different levels false: 3
- o   In David Marrs "Tri-level Hypothesis" the implementational level refers to an exact formulation of the problem a system is trying to solve false: computational refers to exact formulation of problem

Q4: Which statement of the philosophical approach in cognitive science is **not** correct?

- o   Philosophy is the oldest discipline in cognitive science. true
- o   The primary method of philosophy is reasoning. true
- X   Deductive reasoning refers to drawing conclusion from several observations of specific instances of the world. (Whiskers the cat has four legs. Scruffy the cat has four legs. All cats have four legs.) false: example for inductive reasoning
- o   2 branches of philosophy are Metaphysics and Epistemology true
- o   Dualism and Monism are two theories trying to solve the mind-body problem true

Question 5:

Which statement on Monism and Dualism is true?

- X   Idealism is one sub-theory of Monism. true
- o   Materialism considers a "world consciousness". false: in materialism everything consists of physical substance
- o   Functionalists believe that biological neurons are needed to generate mind and intelligence. false: multiple realizability
- o   Rene Descartes believed in monism. false: substance dualism
- o   The fact that brain damage changes mental states proves Dualism. false

Discussion Exercise

In his paper from 2003 Nick Bostrom proposes that we are living in a computer simulation.

Bostrom, N. (2003). Are we living in a computer simulation?. The philosophical quarterly, 53(211), 243-255.

Please discuss/answer the following question.

1) *Bostrom writes: "A common assumption in the philosophy of mind is that of substrate-independence. The idea is that mental states can supervene on any of a broad class of physical substrates" (Bostrom, 2003).*
   On which theory this argument is based on?   Philosophical functionalism

2) *"But in order to get a realistic simulation of human experience, much less is needed– only whatever is required to ensure that the simulated humans, interacting in normal human ways with their simulated environment, do not notice any irregularities. The microscopic structure of the inside of the Earth can be safely omitted. Distant astronomical objects can have highly compressed representations: verisimilitude need only extend to the narrow band of properties that we can observe from our planet or solar system spacecraft. On the surface of Earth, macroscopic objects in inhabited areas may need to be continuously simulated, but microscopic phenomena could probably be filled in ad hoc." (Bostrom, 2003).*
   Discuss if this statement makes sense. Think of examples as well as arguments for and against that idea. There is no wrong or right!

3) Does the theory described here fulfill the principles of Occam's razor? There is no wrong or right!

4) *"The basic idea of this paper can be expressed roughly as follows: if there were a substantial chance that our civilization will get to the posthumanstage and run many ancestor-simulations, then how come we are not living in such a simulation? I shall develop this idea into a rigorous argument. I need to introduce the following notation:*
   f_p*: Fraction of all human-level technological civilizations that survive to reach a posthuman stage*
   $\bar{N}$*: Average number of ancestor-simulations run by a posthuman civilization*
   $\bar{H}$*: Average number of individuals that have lived in a civilization before it reaches a posthuman stage.*
   The actual fraction of all observers with human-type experiences that live in simulations is then: $$f_{sim} = \frac{f_p \bar{N} \bar{H}}{(f_p \bar{N} \bar{H}) + \bar{H}}$$ *" (Bostrom, 2003). Discuss this estimation. Does it make sense? There is no wrong or right!*