COGS300

Big Ideas in Cognitive Systems

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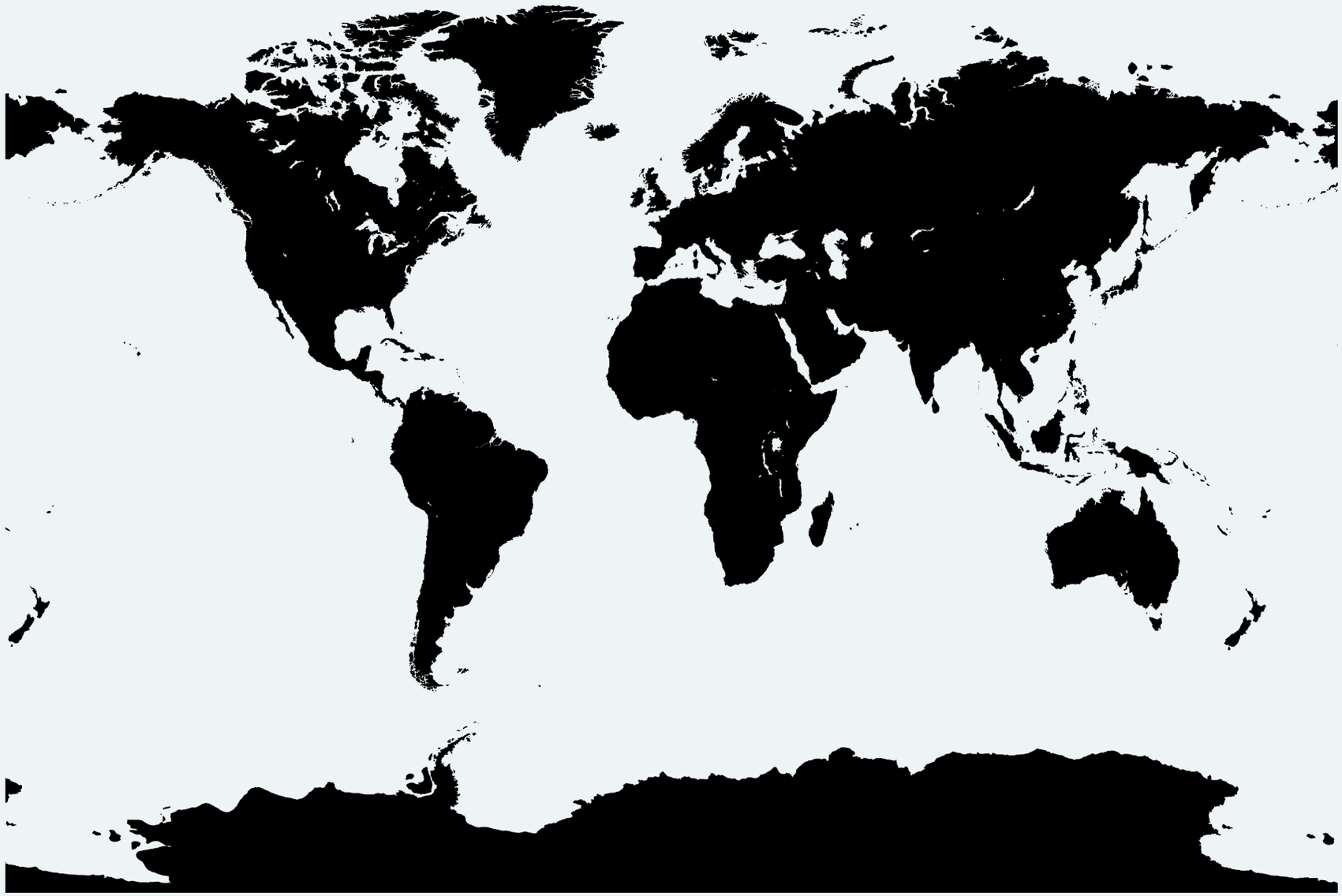
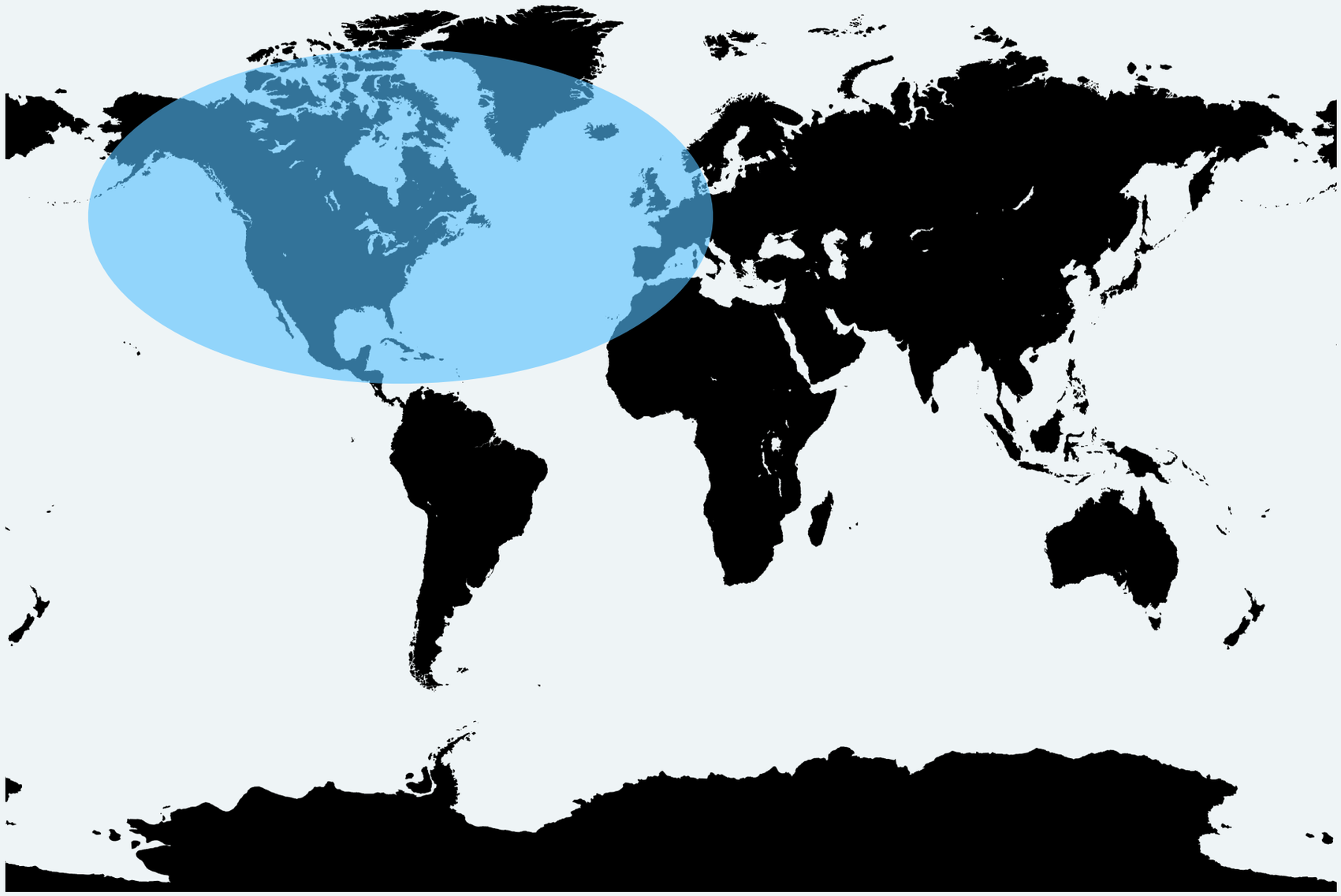
Big Ideas in Cognitive Science



Big Ideas in Cognitive Science

heavy skew towards North America and Western Europe!



The foundations of modern cognitive science

Behaviourism

- first half of 20th century
- psychology as an experimental science
- my generation of cognitive scientists:

Anyone knows what behaviourists actually said / did? I mean no one ever taught us anything about them…

The foundations of modern cognitive science

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- previous generation of cognitive scientists:

https://www.youtube.com/watch?v=OrQ0LfqxABM

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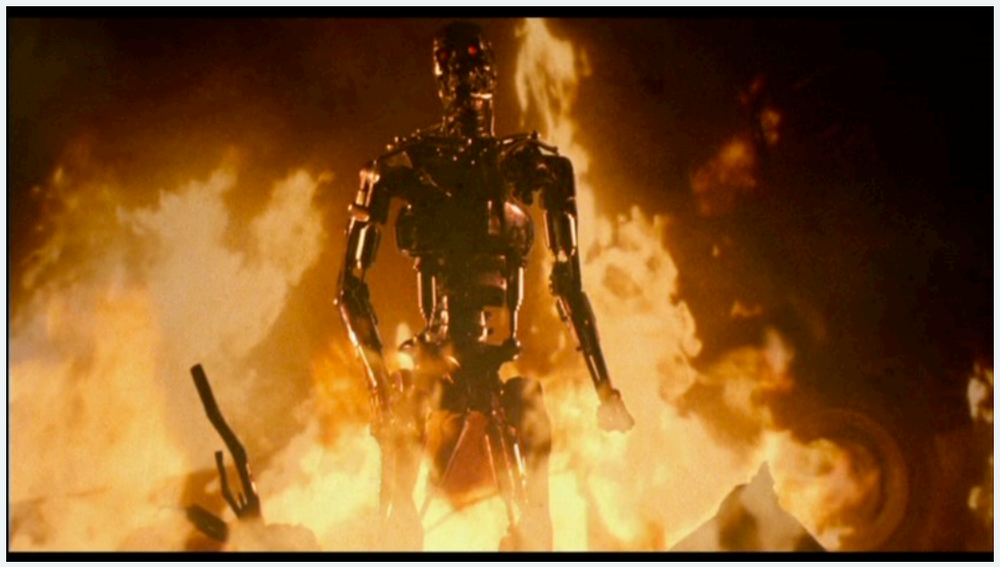


The foundations of modern cognitive science

Behaviourism

- main issue: stimulus–behaviour with no middle man (i.e. mind!)
- (side note: similar issue in linguistic structuralism)

~~psychological processes~~

~~representations~~

~~hidden layers~~

The foundations of modern cognitive science

Computation

- the birth of computing machines: computation (≈ cognition / thought) as a physically fully specified & implemented process

- the Turing Machine (“a-machine”)
- first physically implemented electronic computers in 1940s/1950s

Representation and Computation

Representation and Computation

- viewing cognition as the operation of computational processes on representations

- 1950s onwards
- focus on the middle-man between stimulus and behaviour – the mind
- (+ a lot of pooh-poohing of behaviourism)

Representation and Computation

Representation and Computation

- viewing cognition as the operation of computational processes on representations

- parallel development of:
  - modern computers & programming Ls
  - models of cognition

mind **?** **=** **computer**

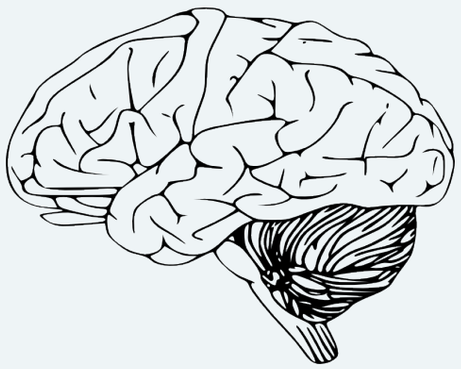
Neural networks

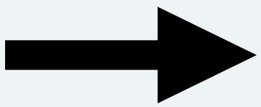
Neural networks

- fully implemented computational devices inspired by the brain

- also around the 1950s!

brain



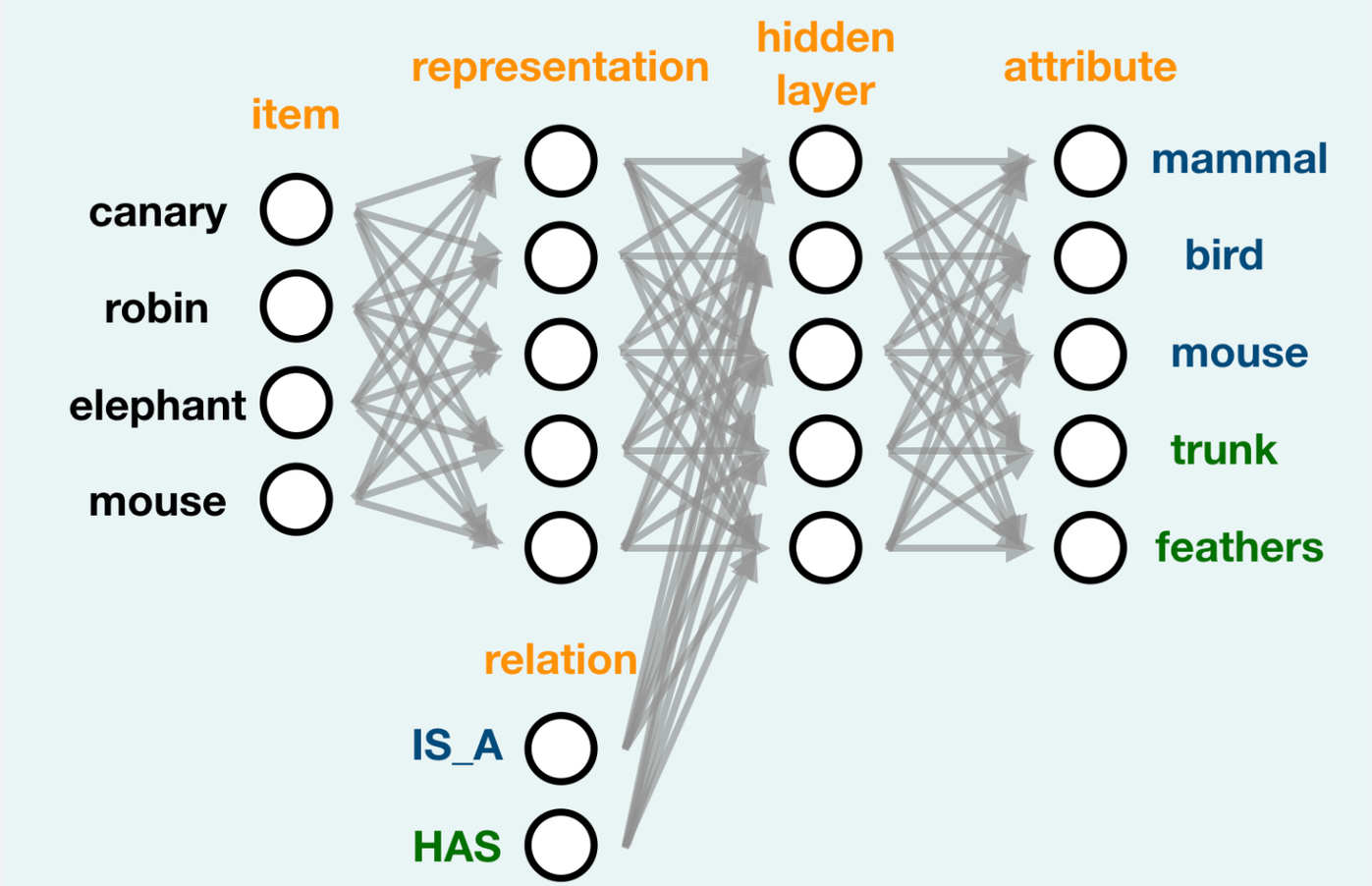


computer

Neural networks

Neural networks

- fully implemented computational devices inspired by the brain



Neural networks

Neural networks

- fully implemented computational devices inspired by the brain

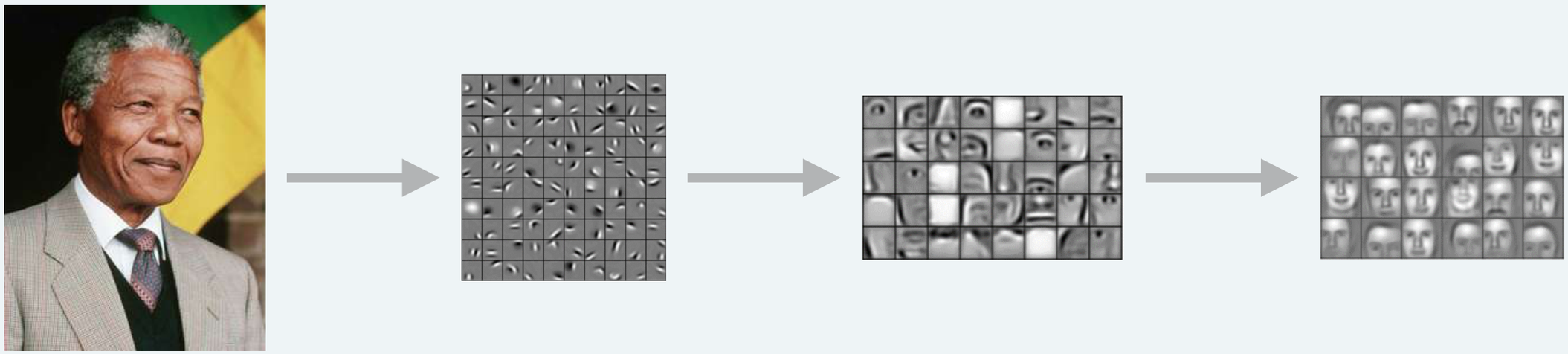
- two prominent false(ish) starts
  - 1950s (the so-called perceptron)
  - 1980s (parallel distributed processing)

Neural networks

Deep Neural Networks

- cleverly designed neural networks with multiple hidden layers can discover patterns in data without explicit guidance

- starting around the 2000s



Neural networks

Deep Neural Networks

- cleverly designed neural networks with multiple hidden layers can discover patterns in data without explicit guidance

- many practical applications (cf. AI)
  - Siri on iPhones
  - Google Translate
  - self-driving cars
  - ChatGPT, Dall-E

Neural networks

Deep Neural Networks

- cleverly designed neural networks with multiple hidden layers can discover patterns in data without explicit guidance

- strong applied skew, but beginning to inform theoretical research in cognitive science more and more

Mind ≠ Brain

Extended Mind

- cognition is not limited to the human brain and relies on many different external (or sometimes internal) cognitive tools

- physical: calculator, pen & paper, filing systems, computers, mobile devices
- behavioural: language, making drafts/ sketches, visualisation, etc.

Mind ≠ Brain

Cultural evolution

- cognitive tools and culture are the products of a long process of cultural evolution

- features of cultural evolution may explain many properties of cognition that were previously attributed directly to the brain