علوم شناختی

جلسه ۲۹

نگاه به پیش رو: چالش‌ها و فرصت‌ها

Looking Ahead: Challenges and Opportunities

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Chapter 17:
Looking Ahead: Challenges and Opportunities

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The Human Connectome Project

- July 2009, 5 years, $40 million
- Purpose: to develop and share knowledge about the structural and functional connectivity of the human brain.
- A new paradigm for neuroimaging research

Key elements of the new paradigm (1)

- Acquiring large amounts of high-quality data on as many subjects as feasible, combining different experimental techniques
- Focusing on data with high spatial and temporal resolution, and removing distortions, noise and temporal artifacts
- Representing cortical and subcortical neuroimaging data in a common geometrical framework (*brainordinates*), represented in a distinctive file format (CIFTI)

Key elements of the new paradigm (2)

- Developing a *parcellation* of the brain into distinct regions, based on connectivity and neuroanatomy

- Routinely sharing extensively analyzed results such as statistical maps (plus raw and preprocessed data when feasible) together with the code used for the analysis, so that other neuroscientists can make precise comparisons across studies, along with replicating and extending findings.

Challenges

- Incorporating standardizing framework across neuroimaging research

- Developing databases on specific disorders within the framework

Default mode network (DMN)

- There is a huge amount of activity going on in the brain even when subjects are resting.
- DMN can be studied in pure resting state experiments.
- Some cognitive disorders and diseases may be correlated with impaired functioning of the DMN.

Neural prosthetics

- **The computational model of mind:**
  cognitive systems are computational devices, whose job is transforming a certain type of input into a certain type of output.

- It is possible to build mechanical devices that could replace a damaged system in the brain.

Examples of neural prosthetics

- Cochlear implants in improving hearing
- Hippocampal prosthetic in improving episodic memory in epilepsy patients
- Exoskeletons in improving movement in paralyzed patients

Cognitive science and the law

- Eyewitness testimony

- Eyewitness testimony is both unreliable and easily manipulatable (Busey and Loftus 2007), leading to serious miscarriages of justice (subsequently discovered, for example, through DNA evidence).

Questions in neurolaw

- How can courts use neuroscientific findings to adjudicate questions about competence and capability that may arise, for example, in end of life issues?
- Are there prospects for developing brain-based techniques of lie detection?
- How should neuroscientific evidence be used as part of an insanity defence, or as evidence of mitigating circumstances?

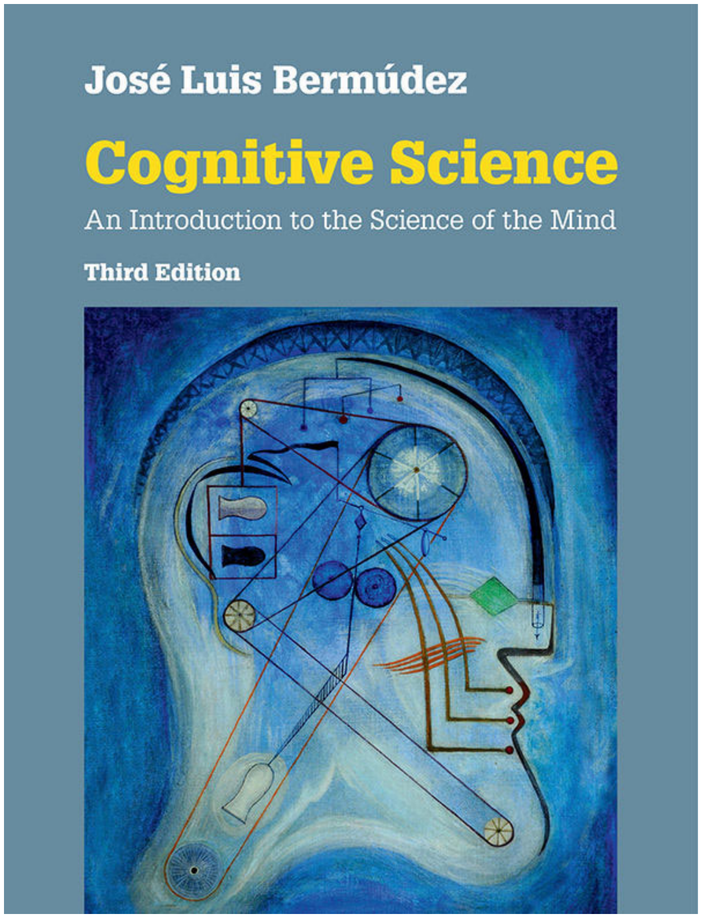
Questions in neurolaw

- Does the use of neuroscientific evidence in courtrooms pose potential challenges to privacy rights?
- Can neuroscience be used to predict recidivism in offenders?
- Are there possibilities for neuroscience-based interventions that will diminish the risk of an offender re-offending (e.g. deep brain stimulation as a way of reducing sexual drive)?

Autonomous vehicles

- They need more than sensitivity to patterns and the ability to learn from experience.
- They need to be able to deal with the unexpected behaviors from other drivers, pedestrians, cyclists, animals, livestock, etc.
- **A key challenge:** equip the autonomous vehicles with the intuitive knowledge/common sense.

منبع اصلی



José Luis Bermúdez,
Cognitive Science:
An Introduction to the Science of the Mind,
3rd ed., Cambridge University Press, 2020.
Chapter 17

CHAPTER SEVENTEEN

Looking Ahead: Challenges and Opportunities

Overview

Cognitive science has provided massive and important insights into the human mind. We have explored a good number of these in this book. These insights all stem from the single basic idea governing cognitive science as the interdisciplinary science of the mind. This is the idea that mental operations are information-processing operations.

This book began by looking at how this way of thinking about the mind first emerged out of developments in seemingly disparate subjects, such as mathematical logic, linguistics, psychology, and information theory. Most of the significant early developments in cognitive science explored the parallel between information processing in the mind and information processing in a digital computer. As cognitive scientists and cognitive neuroscientists developed more sophisticated tools for studying and modeling the brain, the information-processing principle was extended in new directions and applied in new ways.

The interdisciplinary enterprise of cognitive science is now in excellent health. There are more contributing disciplines than ever before. Cognitive scientists have an ever-expanding range of theoretical models to work with. And there is a constant stream of technological advances in the machinery that cognitive scientists can use to study the brain. It is hard not to have a sense of optimism – a sense that cognitive science is getting close to a fundamental breakthrough in understanding cognition and the mind.

437