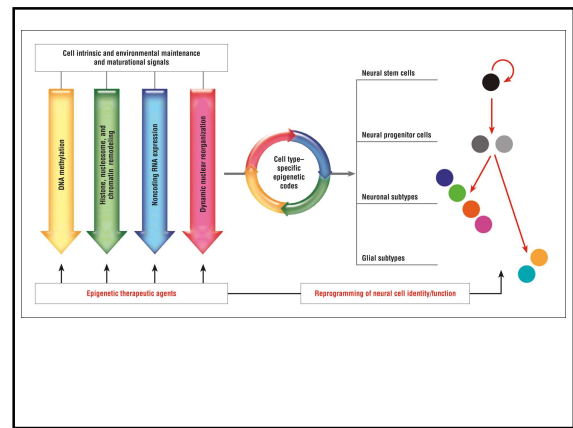
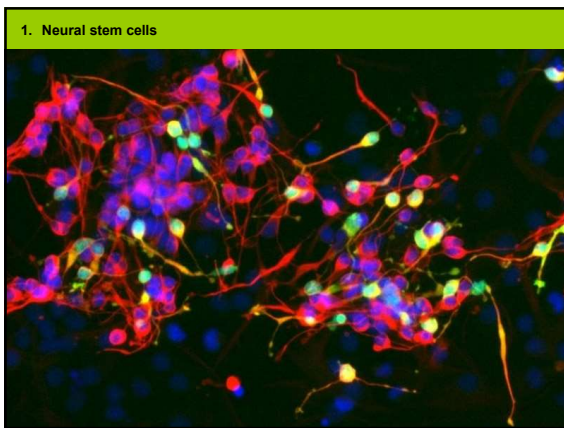
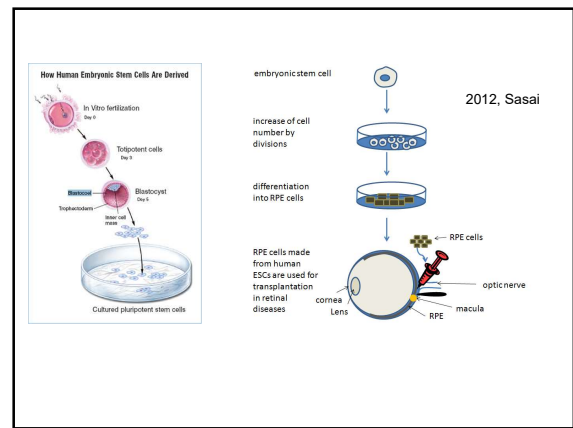


Index

1. Neural stem cells
2. Brain stimulation
3. Cognitive enhancement
4. Brain scanning
5. Decoding
6. Brain-computer interfacing
7. Neuroscience and the law
8. Neuroethics



Potential uses of Stem cells

- Stroke
- Traumatic brain injury
- Learning defects
- Alzheimer's disease
- Parkinson's disease
- Missing teeth
- Wound healing
- Bone marrow transplantation (currently established)
- Spinal cord injury
- Osteoarthritis
- Rheumatoid arthritis
- Baldness
- Blindness
- Death
- Amputations
- Myocardial infarction
- Muscular dystrophy
- Diabetes
- Multiple sites: Crohn's disease, Cancers

ALS cell based therapy

- Doctors remove part of vertebrae to reveal the spinal cord.
- A custom-built apparatus is attached to the spine and the vertebrae on either side so that the device moves with the patient as he breathes.
- A needle is inserted into the spinal cord.
- A repeated event is repeated every 4 millimeters across the opening, injecting about 100,000 stem cells each time.

ALS untangled

Researchers hope the stem cells keep the deteriorating cells healthy, stopping or slowing degeneration.

Labels: Spinal cord, Stem cells, Bone grafting, Muscle, Vertebrae, Cervical vertebrae.

- Gustav Fritsch and Eduard Hitzig
- 1870: electrical stimulation method
- Set out to electrically stimulate the cortex of a dog.
- Exposed the surface of the dog's cerebral cortex and applied galvanic stimulation.
- stimulation of certain cortical areas results in motor responses

Labels: STIMULATION SPOTS WHERE BODY MEMBERS OCCURRED, FRONT OF DOG BRAIN, BACK OF DOG BRAIN.

Labels: Motor cortex, Electrical impulses sent down spine, Motor neurons receive impulses, Motor cortex.

1. Neural stem cells

**TAKE HOME MESSAGE:
– STEM CELLS COULD REPAIR THE DAMAGED BRAIN –**

2. Brain stimulation

'Passing currents through the head, one could easily produce movements of the eyes.'

Hitzig and Fritsch, 1870

DIY brain stimulation: ...With a jolt of electricity, you might be able to enter a flow state that allows you to learn a new skill twice as fast, solve problems that have mystified you for hours, or even win a sharpshooting competition...

ANODE
The anode, or positively charged electrode, can stimulate neuronal activity in different parts of the brain.

CATHODE
The cathode, or negatively charged electrode, can inhibit brain-cell activity.

WIRES
Two electrodes can provide different types of stimulation, depending on where they are placed. Together, they make a complete circuit.

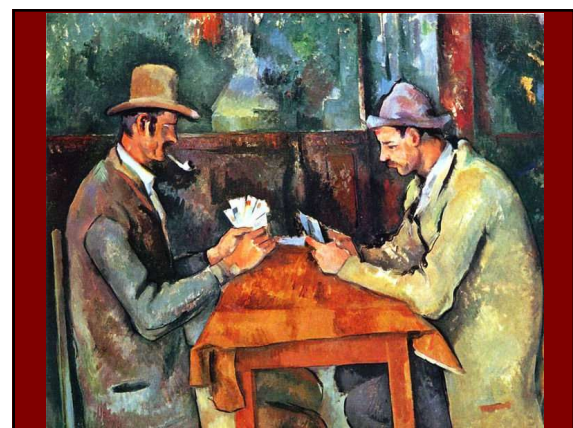
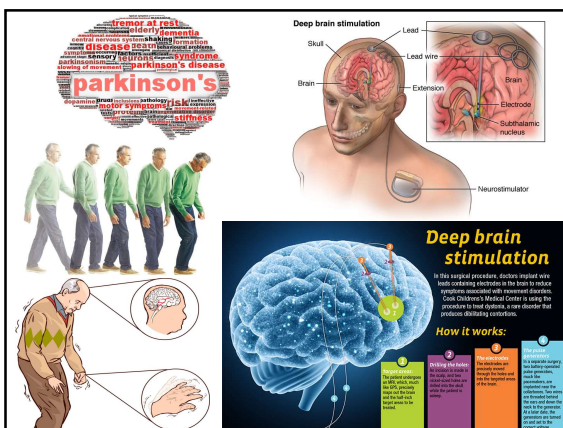
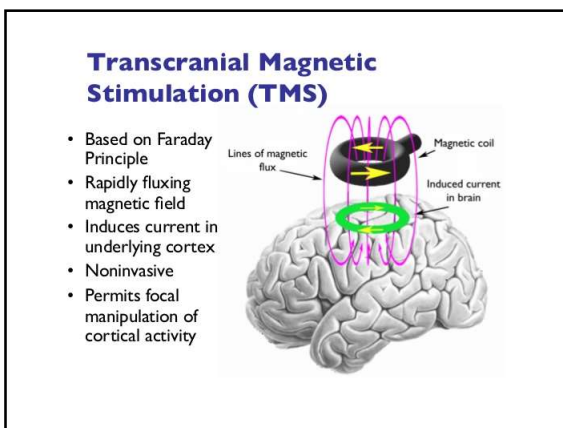
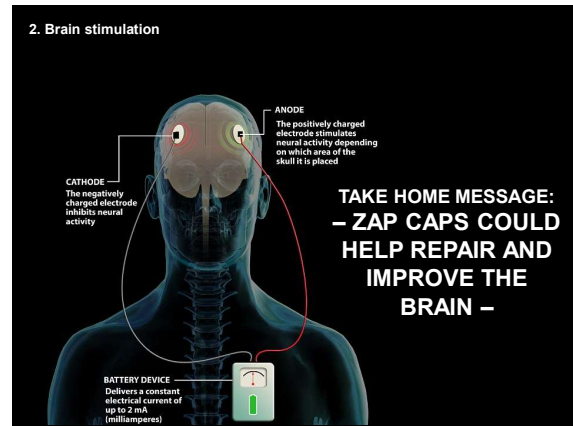
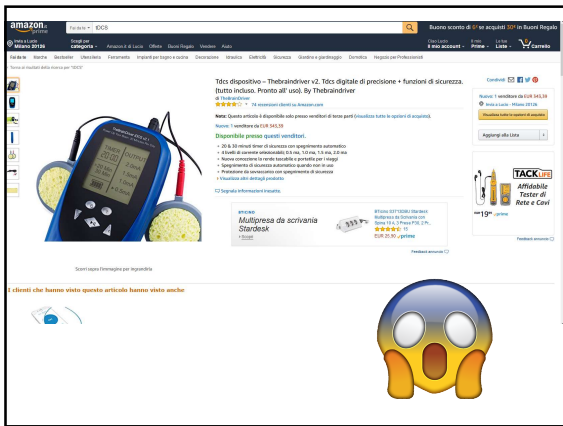
DEVICE
A battery-powered device delivers a constant electrical current of up to 2 mA (milliamperes). Researchers have demonstrated that it's safe to apply this much current for up to 30 minutes a day. DIY brain stimulators frequently use a 9-volt battery as a power source.

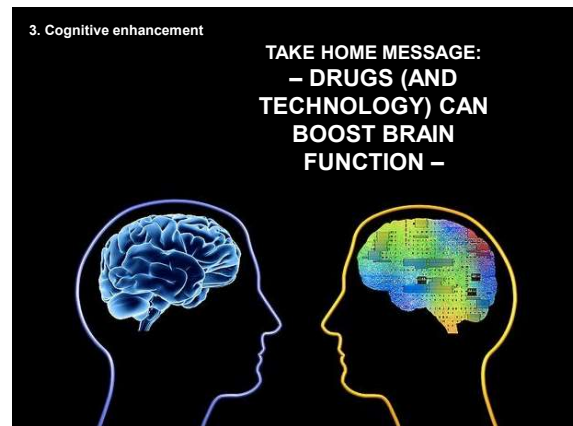
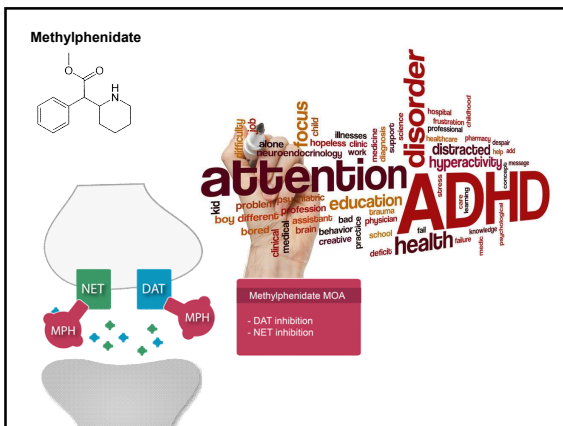
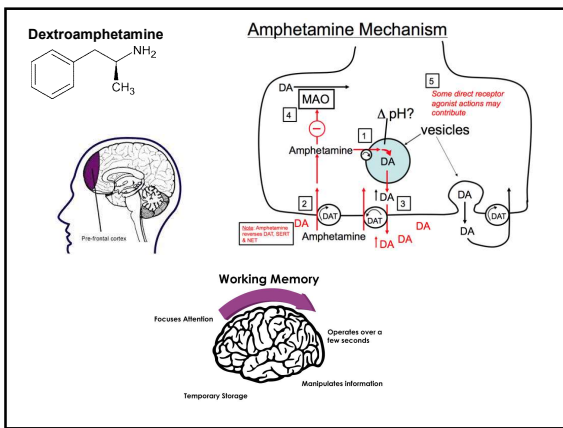
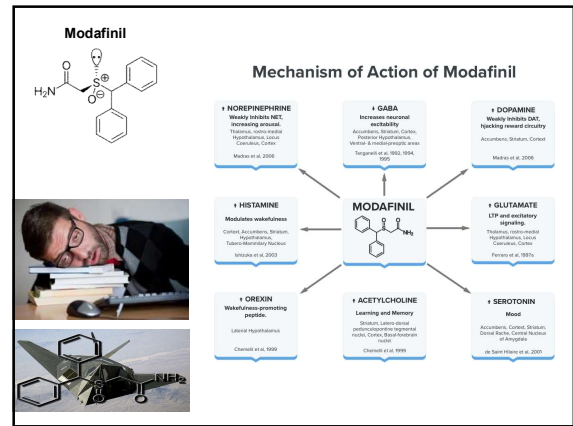
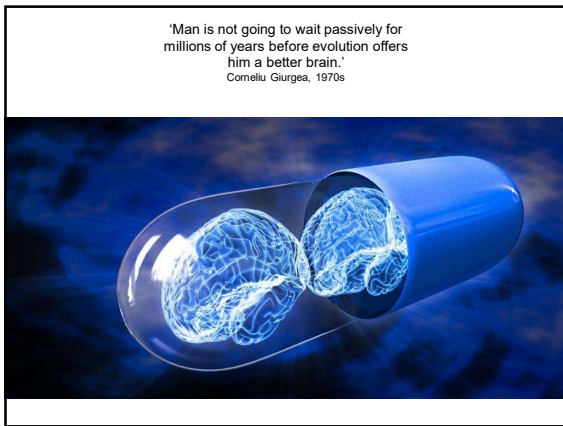
transcranial direct current stimulation (tDCS)

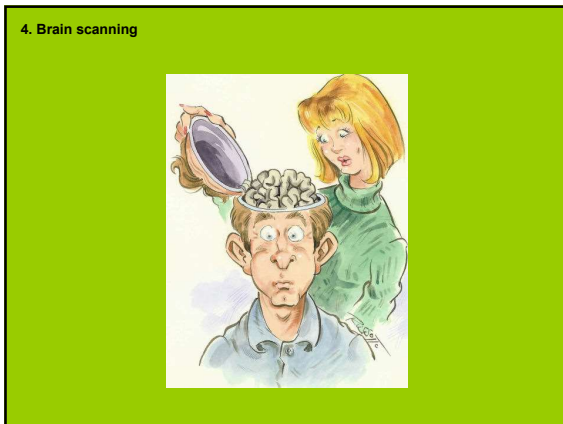
'If we are smart enough to invent technology that increases brain capacity, we should use that advantage.'
Michael Gazzaniga, 2010

BRAIN HACKERS

GAME CHANGERS







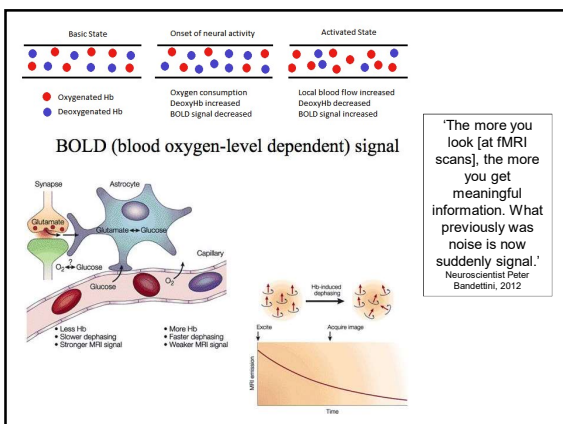
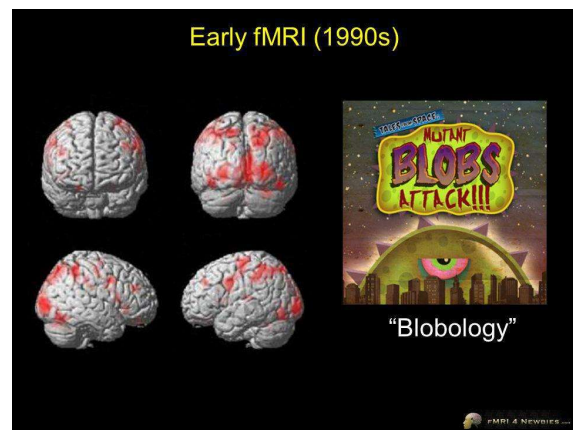
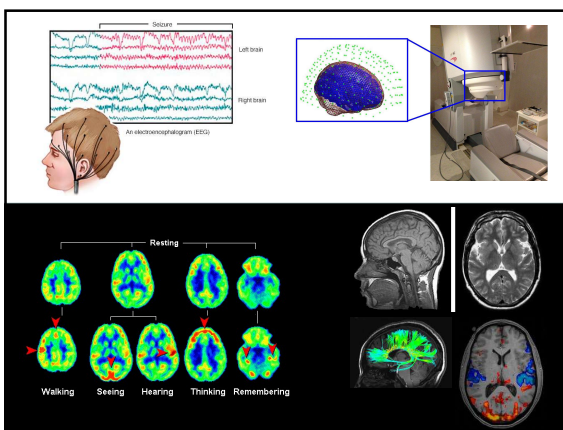
Why You Shouldn't Use fMRI

- It's the most expensive approach
- If you're interested in behavior, study behavior
- EEG/ERP/MEG have better temporal resolution
- TMS and neuropsychology speak more directly to causality
 - fMRI activation may be epiphenomenal
- neurophysiology/eCoG give more direct access to neural processing

(A)

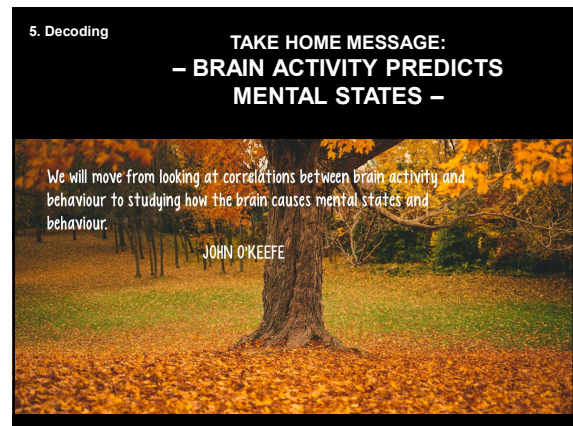
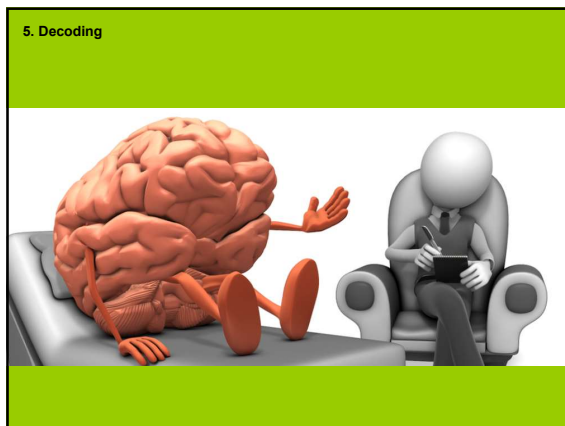
(B)

Epiphenomena
Huettel et al. fMRI



4. Brain scanning

TAKE HOME MESSAGE:
 – WE CAN MEASURE THE STRUCTURE AND FUNCTION OF THE LIVING BRAIN –



TRAINING

Image: Shoe, Cat

fMRI scan

Visual pattern

Output: =SHOE, =CAT

TESTING

Image: Shoe

fMRI scan

Visual pattern

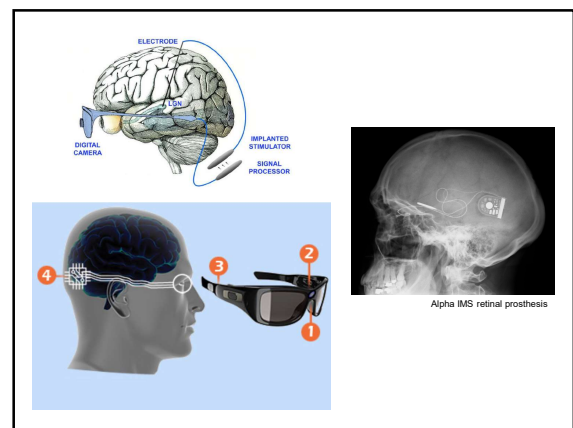
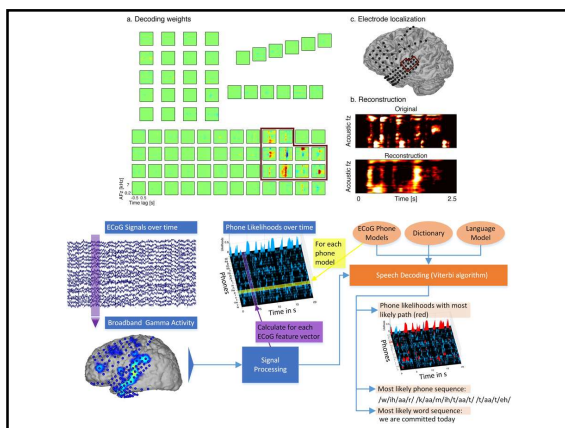
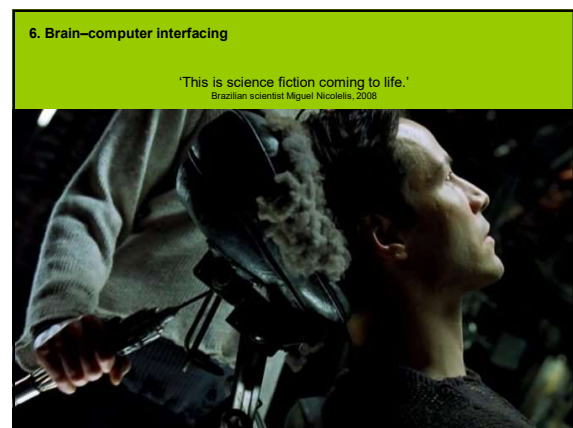
Output: =SHOE?

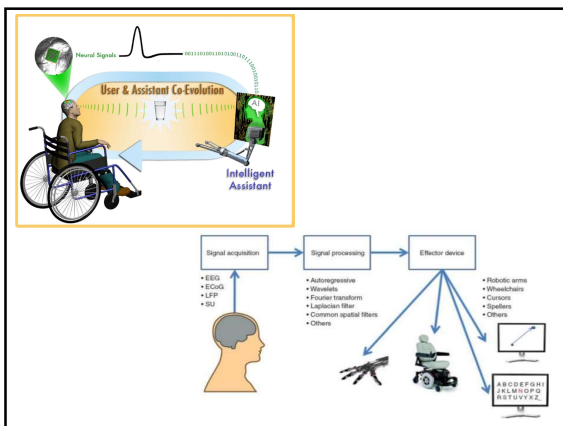
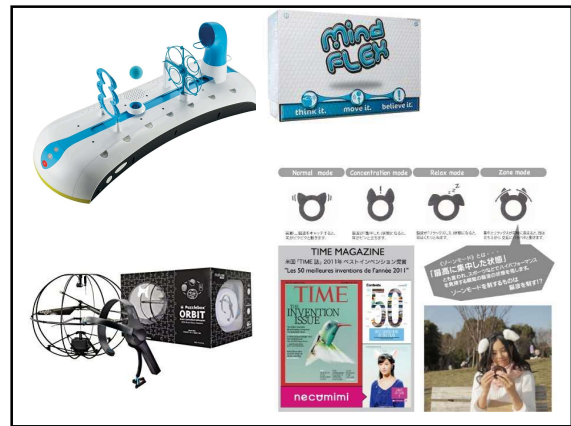
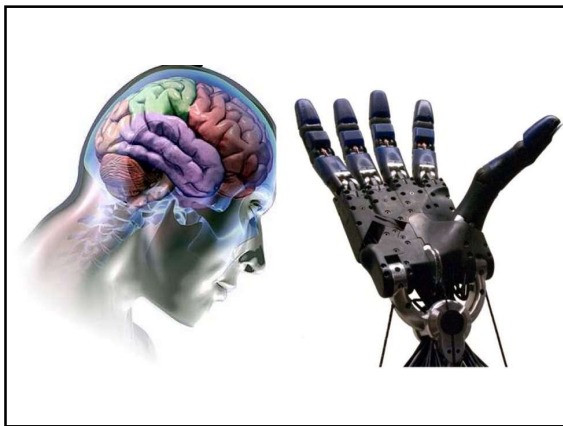
During testing, the program tries to guess the object viewed on the basis of what it has learned about similar patterns of activity.

"We are opening a window into the movies in our minds."
Jack Gallant, 2011

Presented clip

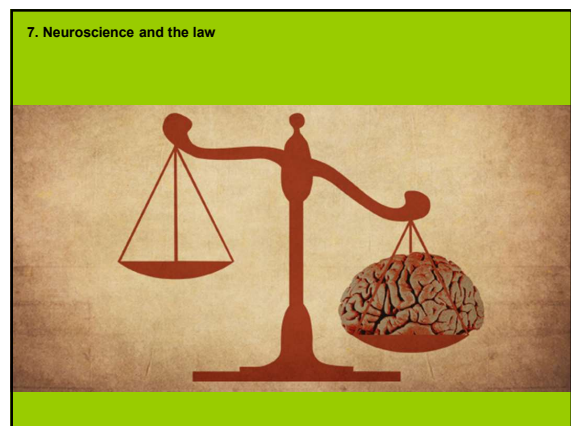
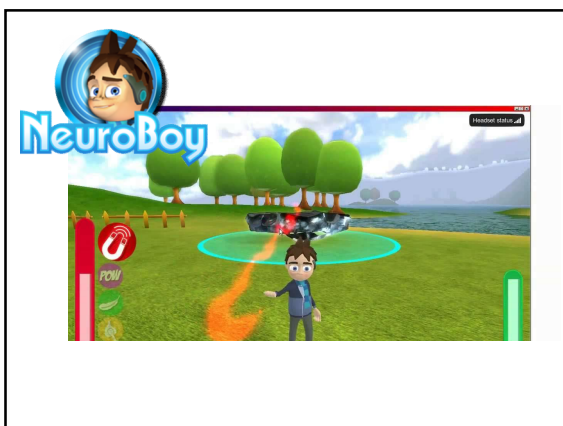
Clip reconstructed from brain activity





6. Brain-computer interfacing

**TAKE HOME MESSAGE:
– MACHINES CAN
TRANSLATE THOUGHTS
INTO ACTIONS –**



Oh this is bullshit...

'Our growing knowledge about the brain makes notions of volition, culpability and, ultimately, the very premise of a criminal justice system, deeply suspect.'
American neuroscientist Robert Sapolsky, 2011

7. Neuroscience and the law

**TAKE HOME MESSAGE:
– BRAIN RESEARCH
COULD CHANGE THE
LEGAL SYSTEM – FOR
BETTER OR WORSE –**

2000: American man who suddenly acquired paedophilic behaviours. The man, a schoolteacher then in his 40s, began visiting prostitutes and collecting child pornography, and eventually started making subtle sexual advances towards his 12-year-old stepdaughter. His wife got wind of this, and he was subsequently arrested and charged with child molestation. While awaiting sentencing, the man complained of worsening headaches, and these became so unbearable that he was admitted to an emergency room the night before he was due to be sentenced. An MRI scan revealed that he had an egg-sized tumour in his right orbitofrontal cortex, a part of the brain involved in decision-making and social behaviour. Neurosurgeons removed the tumour, and the man's inappropriate sexual behaviours immediately disappeared. About a year after the surgery, however, his paedophilic desires returned, and he started secretly viewing child pornography again. Another brain scan showed that the tumour had grown back – evidently, a portion of it had been missed during the first operation. The surgeons operated once again to remove it, and the man's behaviour returned to normal.

2007 The Law and Neuroscience Project is established with \$ 10m funding from the MacArthur Foundation

2008 An judge convicts someone of murder on the basis of brain-scanning data

DETOUR →

8. Neuroethics

'[Neuroethics is] the examination of what is right and wrong, good and bad about the treatment of, perfection of, or unwelcome invasion of and worrisome manipulation of the human brain.'
William Safire, 2002

International Neuroethics Society

NIH Public Access
Author Manuscript
Published in final edited form as:
Psychol Public Policy Law. 2013 May 1; 19(2): 222-234. doi:10.1037/a0028841.

Using Brain Imaging for Lie Detection: Where Science, Law and Research Policy Collide

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¹Associate Professor, University of Pennsylvania Perelman School of Medicine
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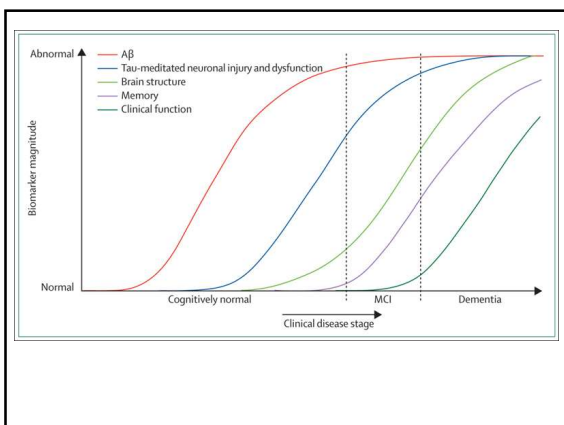
... 'Supremely frightful would be the effect of any human endeavour to mock the stupendous mechanism of the creator of the world.'
Mary Shelley, 1831

2007, The Wall Street Journal exposes an 'epidemic' of psychosurgery in China:
e.g., n. accumbens removal in alcoholics



8. Neuroethics

**TAKE HOME MESSAGE:
- BRAIN
RESEARCH
POSES MAJOR
CHALLENGES FOR
SOCIETY -**



- Should dopamine-based drug therapies be offered to patients with Parkinson's disease if they may produce unwanted side effects such as compulsive gambling?
 - Should professors and students use stimulant drugs to enhance their academic performance?
 - Should brain stimulation be used to enhance cognitive functioning in healthy people?
 - What should researchers do if they find signs of brain damage while scanning someone's brain as part of a study?
 - Does brain damage make someone less responsible for their actions and, if so, what are the implications for the criminal justice system?
 - Should surgical amputation be offered to people suffering from body integrity identity disorder?
 - Etc... etc... etc...
-