

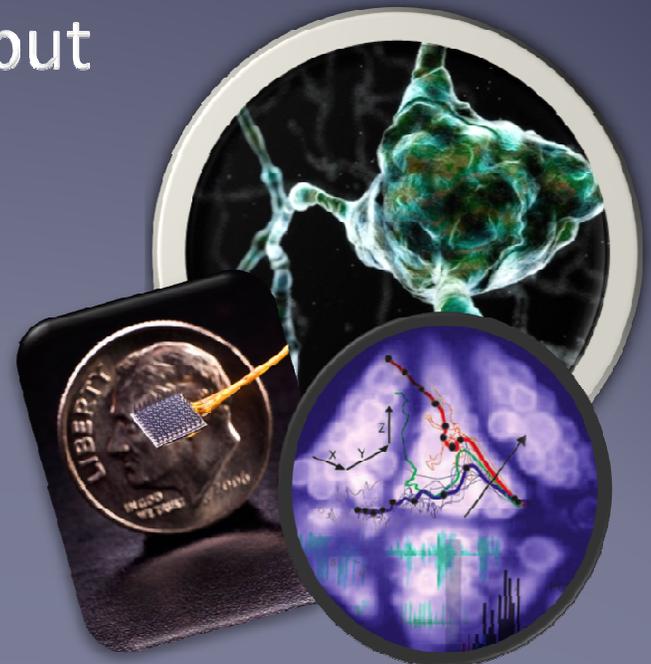
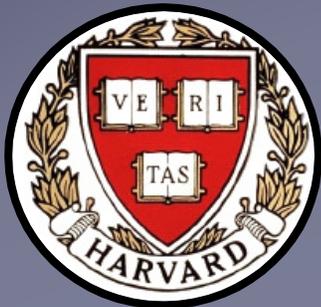


This is Your Brain on Computers, v. 2.0:

PRESENT AND FUTURE POSSIBILITIES IN ELECTRONICALLY ENHANCING THE HUMAN MIND

Class II: Tweaking Input

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Important Vocabulary

Virtual reality: An imaginary world created through brain stimulation independent of external stimuli

Full-immersion: Using every sense (sight, hearing, touch, smell, etc.)

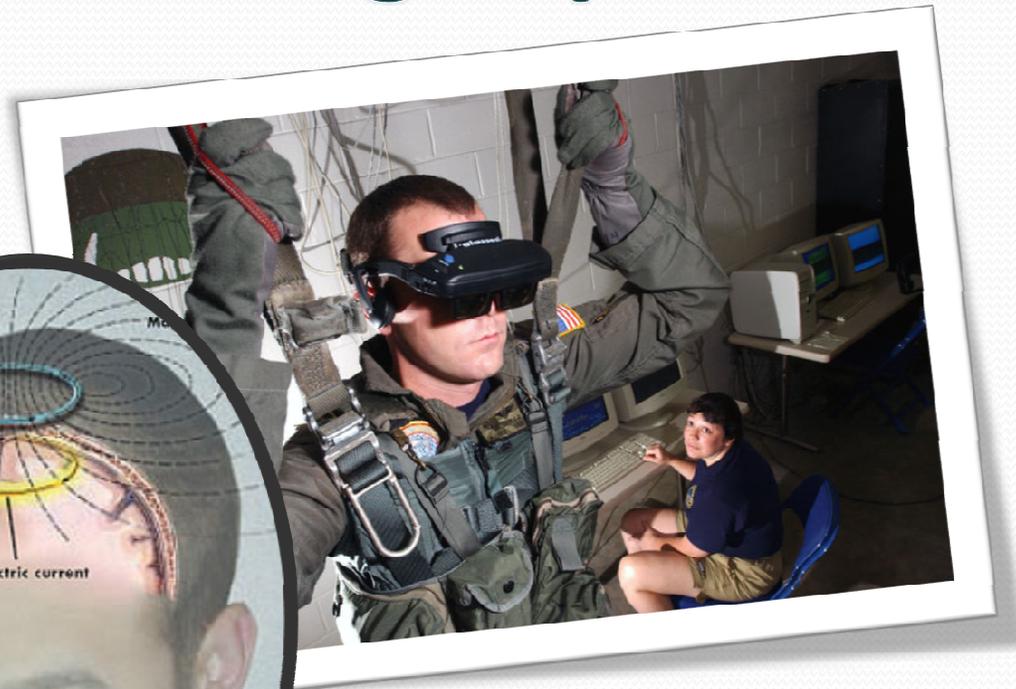
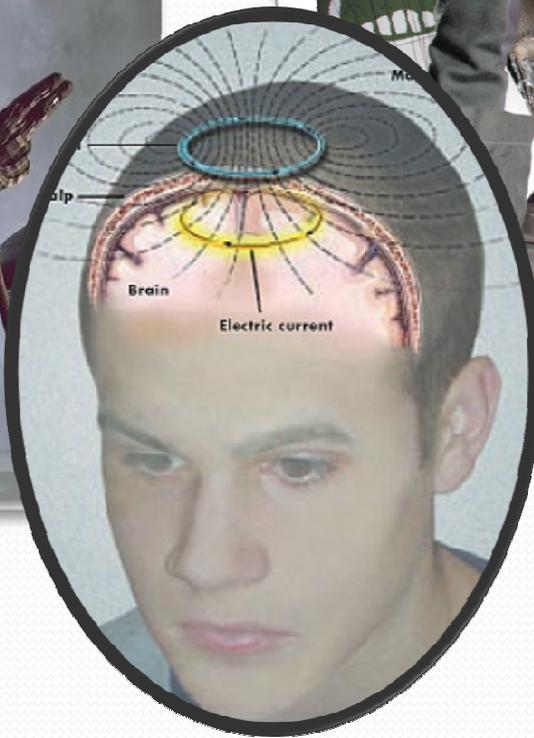
Stimulate: To cause activity in

Subjective: Pertaining to personal experience, such as the perception of a color

Receptive field: The region in space that a visual cortical neuron is responsible for “seeing”

Stimulus: A source of external information for the brain

Class II: Tweaking Input





Headsets for visual stimuli



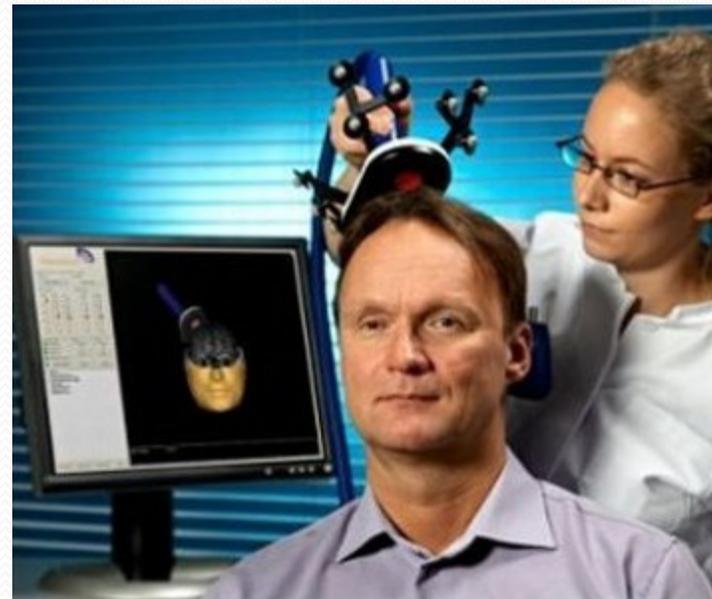
Force gloves for haptic stimuli



Motion-detection suits for movement in virtual world

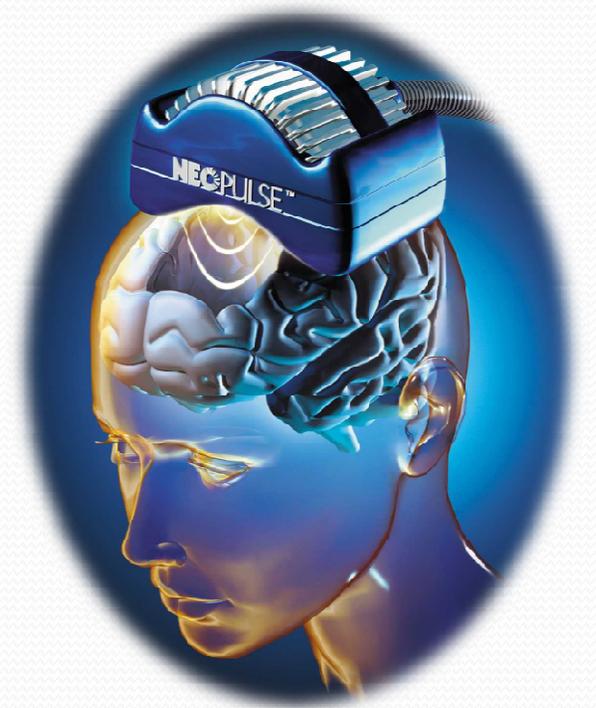
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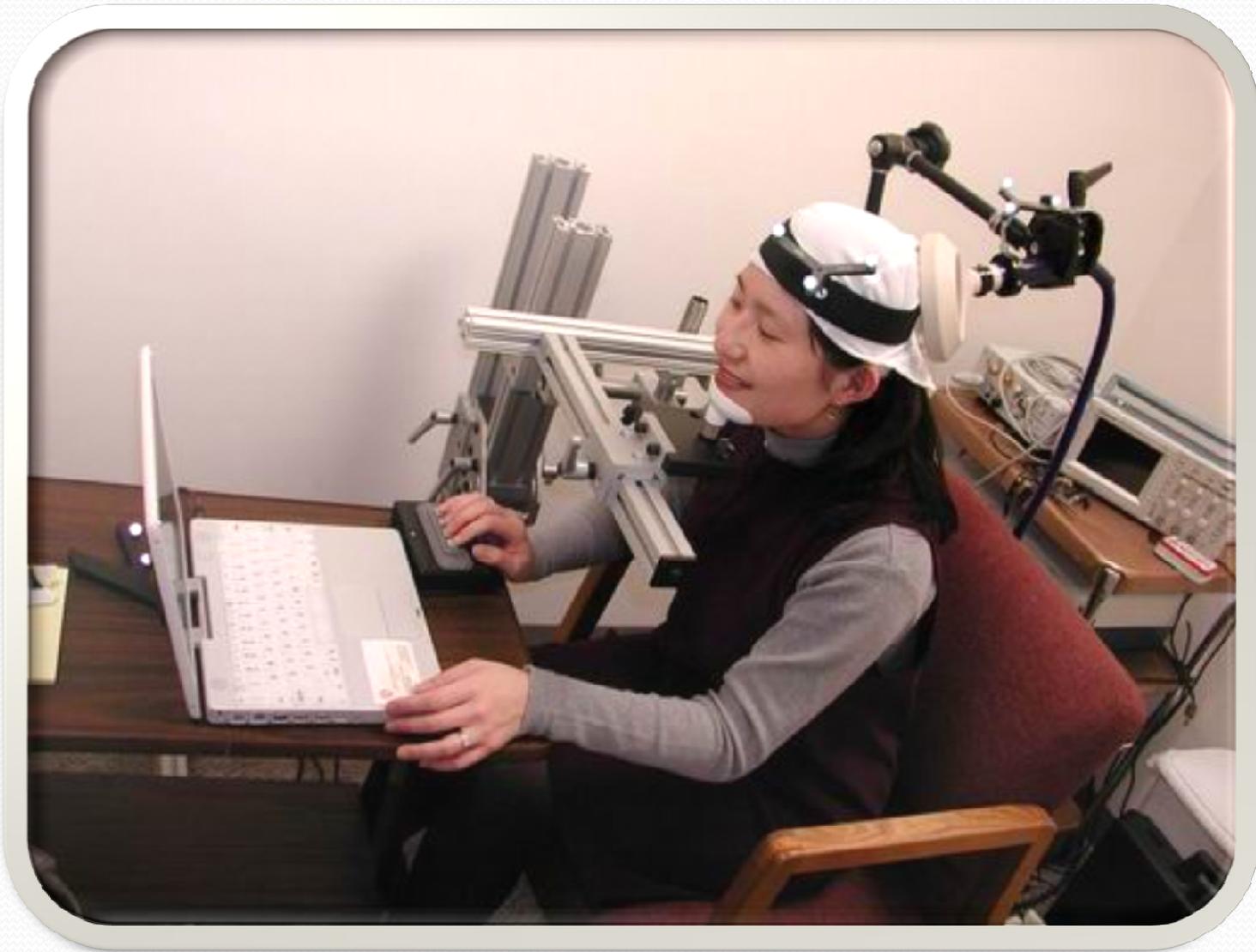
- **Case I**
 - Transcranial stimulation
- **Case II**
 - Deep brain stimulation
- **Case III**
 - Nanotechnology



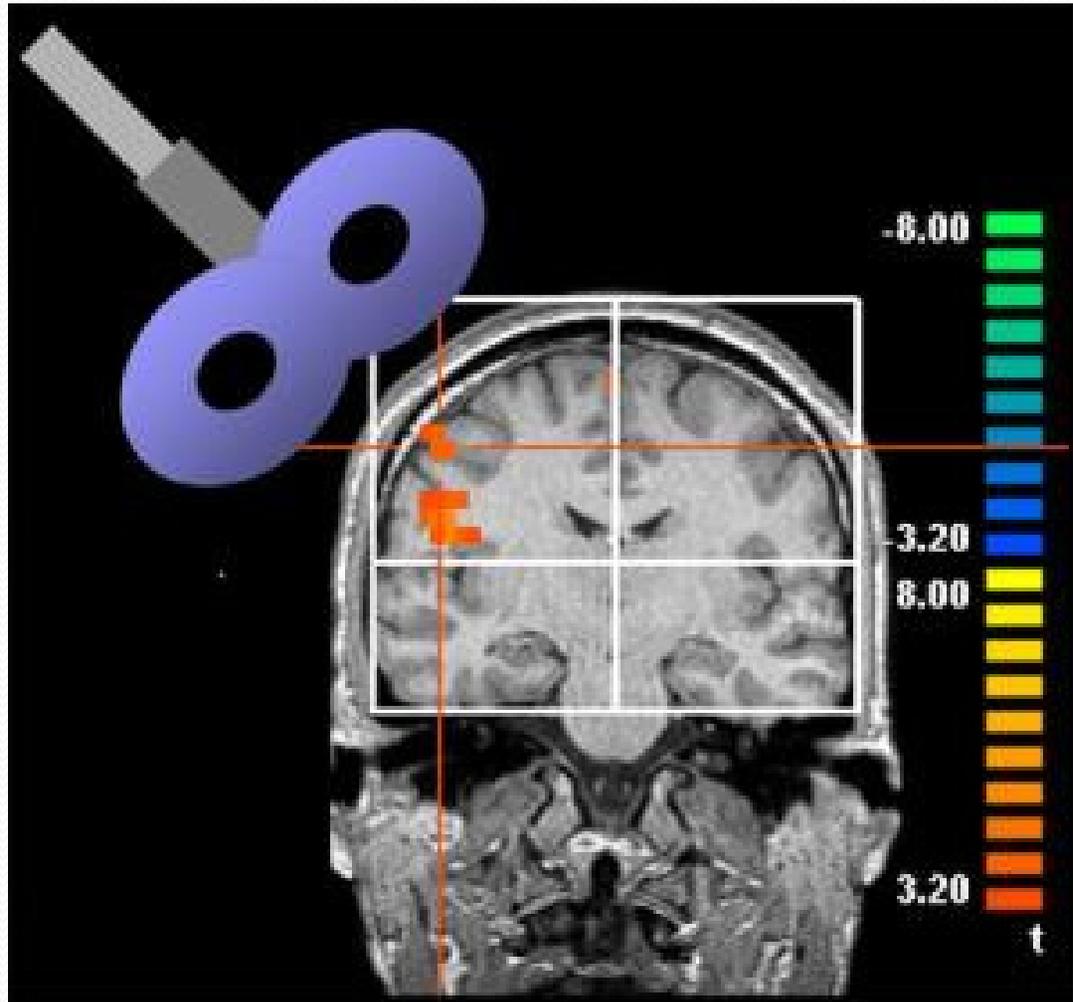
Case I: Transcranial Stimulation

- **Transcranial magnetic stimulation (TMS)**
 - Uses very powerful magnetic fields to induce brain activity
 - Has effected motor activity and visual perception in subjects
 - Different kinds of coils can stimulate neurons at different depths
- **Transcranial direct current stimulation (TDcS)**
 - Two electrodes; anode (+) and cathode (-)
 - Anode electrode stimulates brain activity
 - Cathode inhibits brain activity
 - Lower resolution than TMS
 - Shown to effect cognitive improvements but not sensory perception

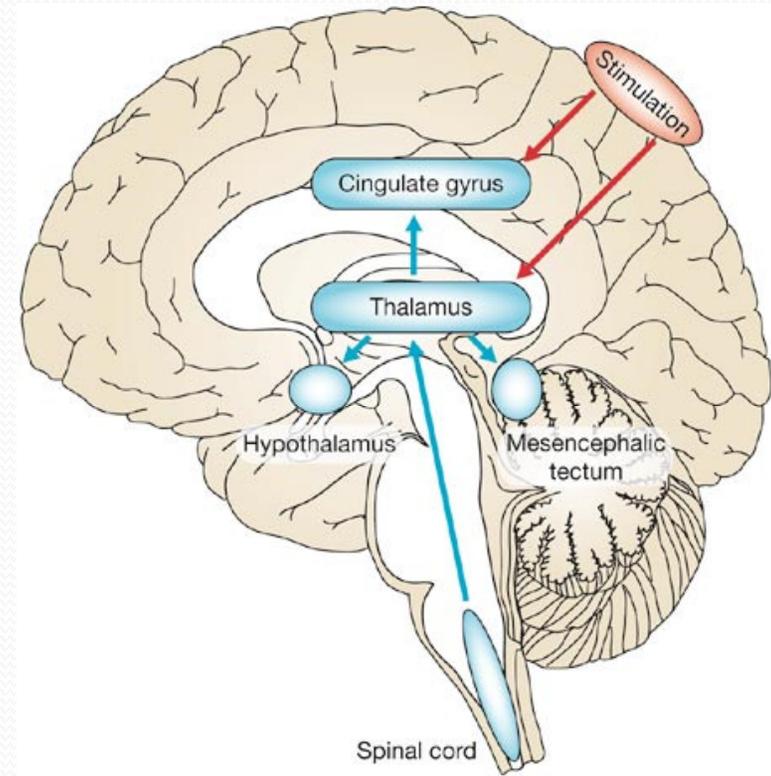
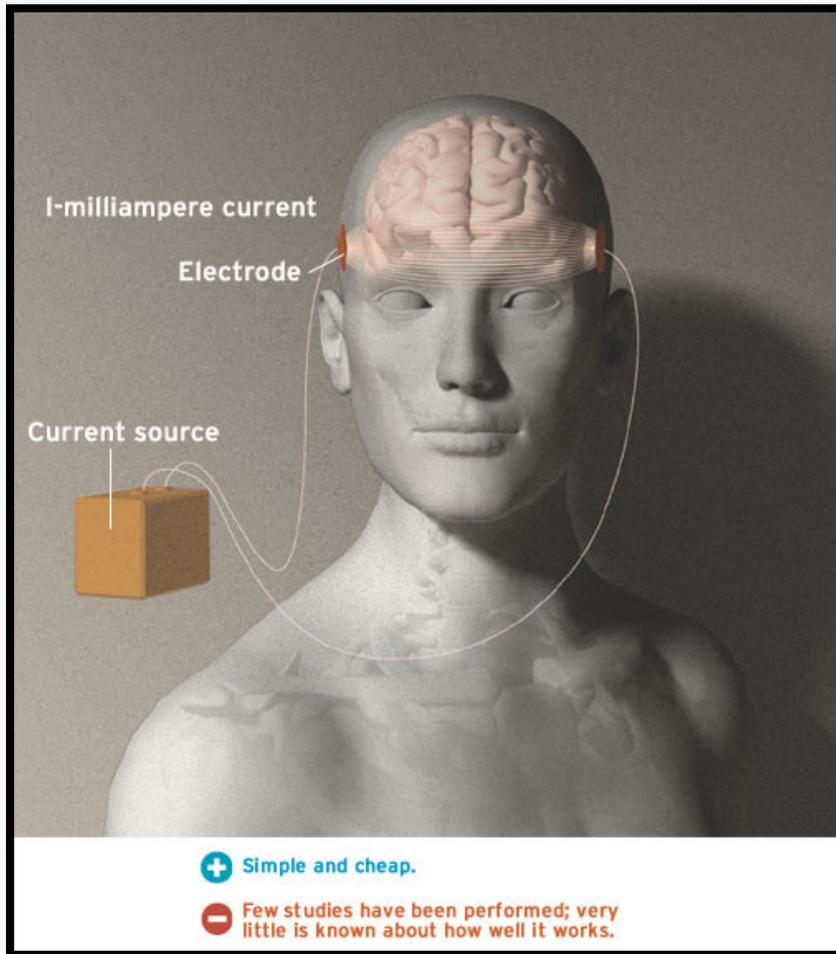




Transcranial magnetic stimulation



The limited depth of transcranial magnetic stimulation



Transcranial direct current stimulation

Case II: Deep Brain Stimulation

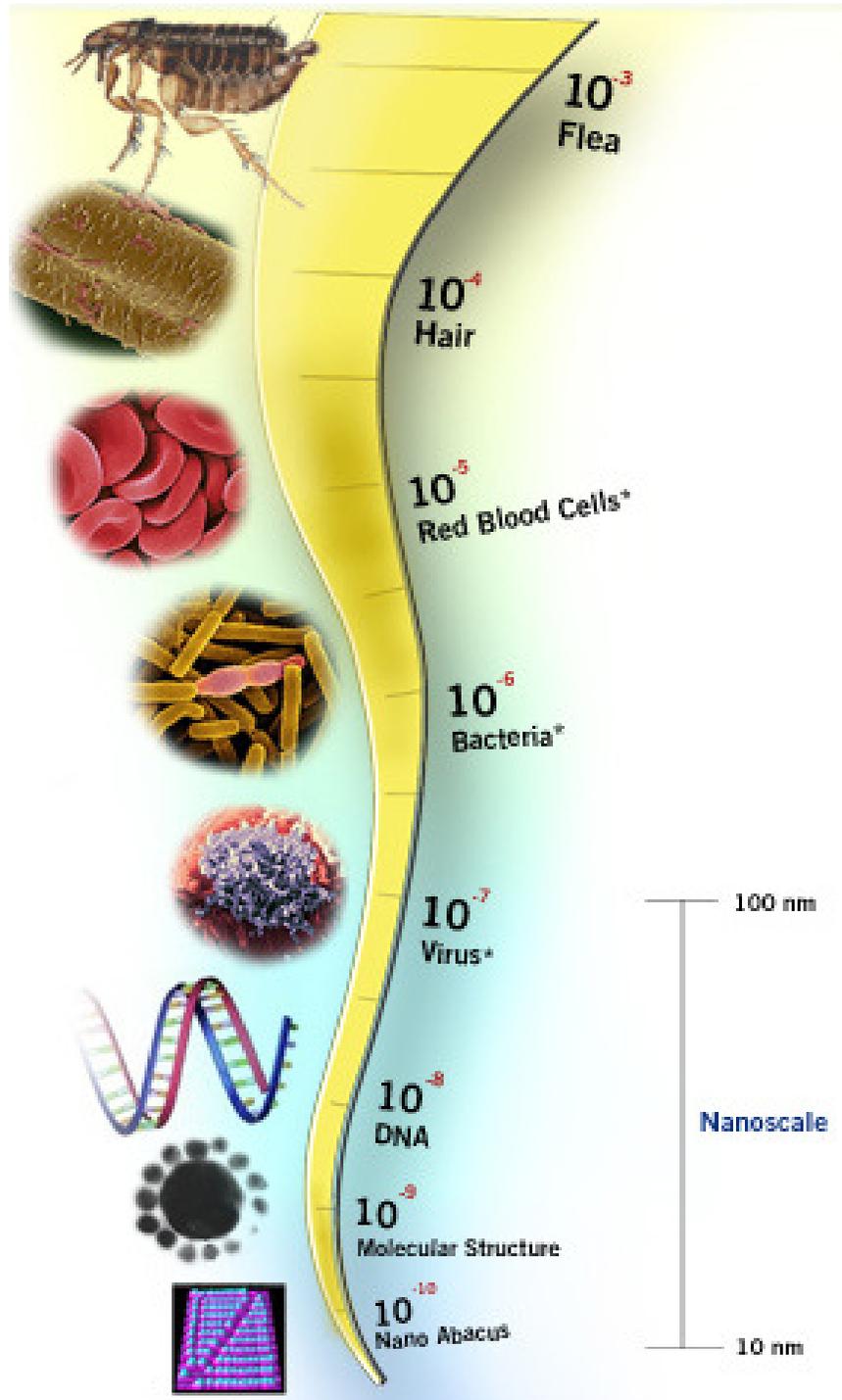
- Interferes with local neural activity
- Three major components:
 - Electrode lead
 - Extension
 - Implanted Pulse Generator (IPG)
- Treats a variety of ailments:
 - Seizures
 - Depression
 - Parkinson's Disease



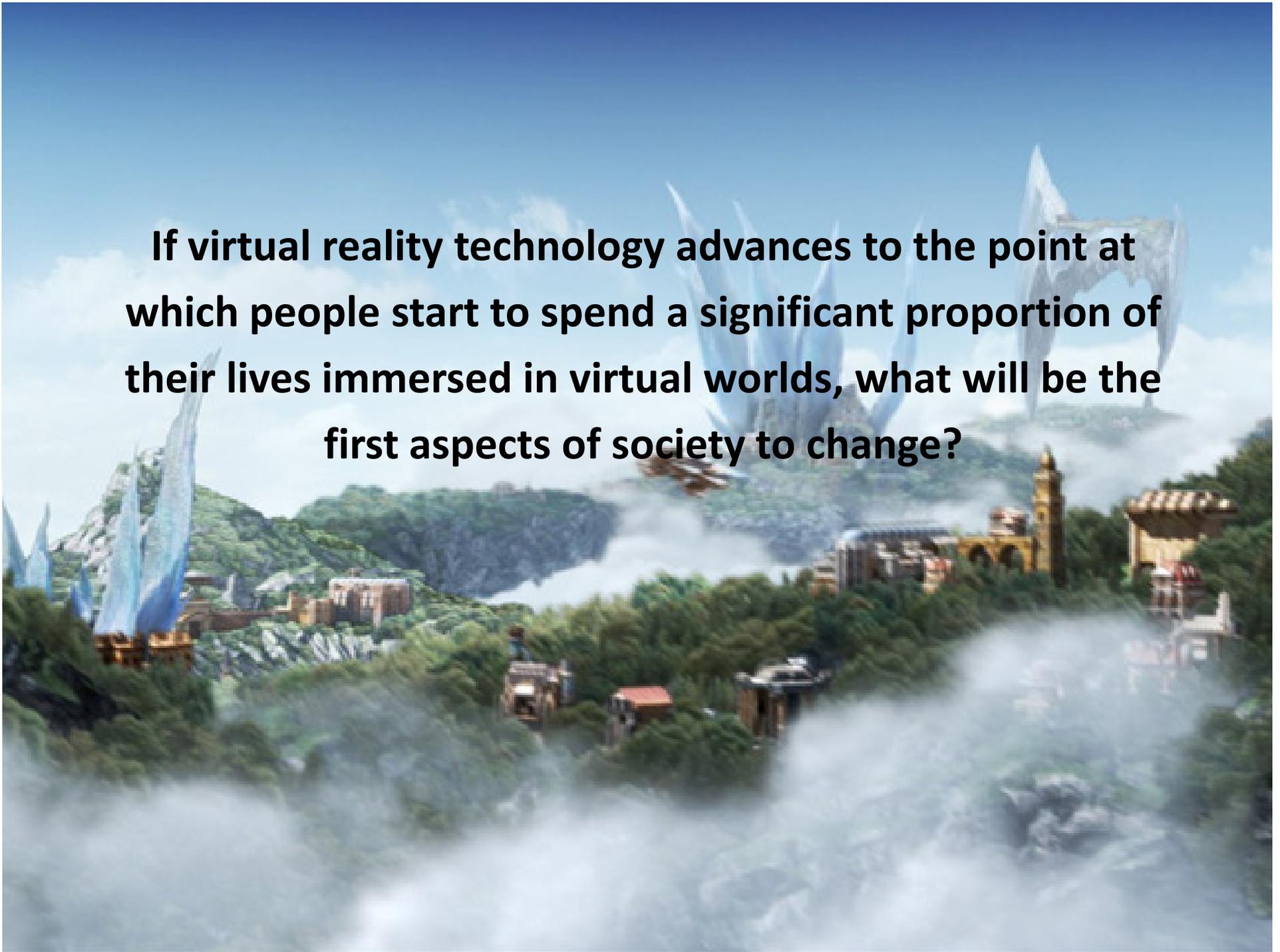
Case III: Nanotechnology

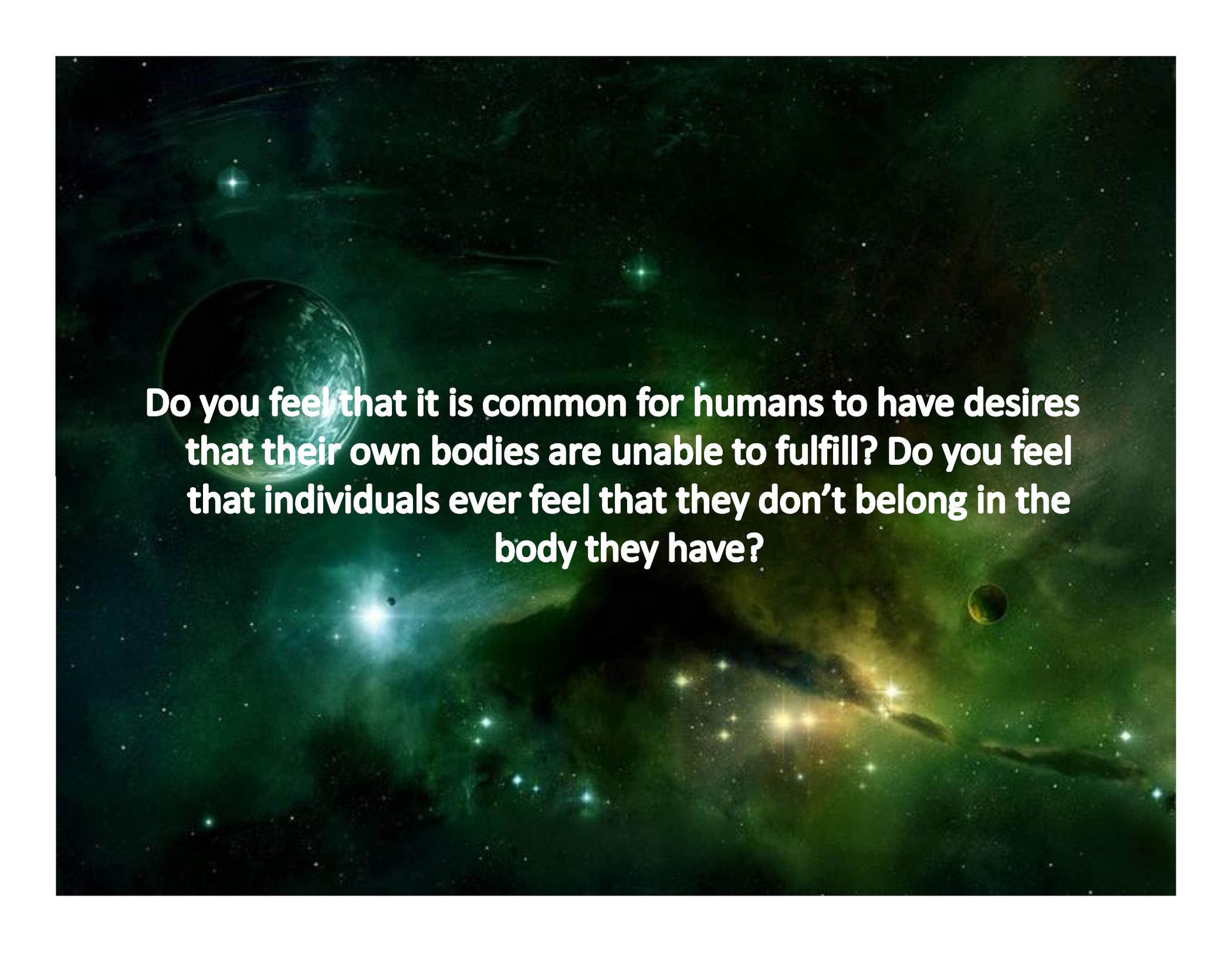
- Predicted by Ray Kurzweil to be an integral part of virtual reality technology by 2030
- Can use nanobots to individually stimulate neural receptors
- Supported by existence of “neuron transistors” developed at Max Planck Institute
 - Silicon chips that stimulate and suppress neural firing without interacting with the neuron
 - Used to control a leech from a computer
 - By 1996, had already attached 16 transistors to a single neuron
 - Can now attach thousands





If virtual reality technology advances to the point at which people start to spend a significant proportion of their lives immersed in virtual worlds, what will be the first aspects of society to change?



A vibrant space scene featuring a large, glowing greenish nebula with intricate patterns and colors. The background is filled with numerous stars of varying brightness and colors, including bright yellow and white ones. Several planets are visible, including a large, detailed Earth-like planet on the left and a smaller, reddish planet on the right. The overall atmosphere is ethereal and cosmic.

Do you feel that it is common for humans to have desires that their own bodies are unable to fulfill? Do you feel that individuals ever feel that they don't belong in the body they have?

Any questions?

