Neuroimaging of sleep deprivation effects on brain

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Sleep

- Certain stages of sleep are needed for the regeneration of neurons within the cerebral cortex.
- Other stages seem to be related to forming new memories and generating new synaptic connections.
Sleep cycle
Sleep deprivation

- Extended periods of wakefulness or a decrease of sleep over an extended period of time
- Common among students
- People believe they can train their bodies to require less sleep ➔ FALSE
Objectives

• To study the effects of sleep deprivation on healthy brain in terms of reaction time, decision making, short and long-term memory, mental arithmetic and emotional response

• To identify areas of brain most affected by sleep deprivation

• To focus study on students as a risk group
Hypothesis

Sleep deprivation has significant consequences on brain, reducing the speed as well as the efficiency of one’s actions
Materials and Methods

• Subjects: 2 different groups
  ▫ Control group:
    • 25 healthy students (no sleep disorders)
    • Age: between 18 and 30
    • 8h/night of continuous sleep
  ▫ Sleep-deprived group:
    • 25 healthy students (no sleep disorders)
    • Age: between 18 and 30
    • Less than 5h/night of sleep during long period of time (more than a month)
Materials and Methods

• Subjects of both groups are asked to do the next tasks:
  ▫ **Reaction time**: Press a button when light appears
  ▫ **Decision making**: Play game that requires quick but logical decisions
  ▫ **Memory**: Remember difference words with no semantic or syntactic relation
  ▫ **Mental arithmetic**: Solve easy math operations
  ▫ **Emotional response**: Look at aversive images
Materials and Methods

• Neuroimaging technique used: fMRI
  ▫ Contrast injected to subjects: BOLD
  ▫ Frequency of images taking: 1-4 seconds
  ▫ Size of voxels: 2-4 millimeters each side
Materials and Methods

- Example of fMRI results: *mental arithmetic*
Problems

- BOLD signal is an indirect measure of brain activity: it could be influenced by non-neural changes in the body
- Neuroimaging technique fMRI is very expensive
- Subjects must remain completely motionless
- Subjects with any ferromagnetic objects are not suitable for the study
- Reliability of subjects about their sleep habits