Lecture 5

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- EEG, MEG and ECOG
- PET
- fMRI and fNIRS
- TMS
- Behavior
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EEG: Electroencephalography

- Advantages
    - Relatively simple and cheap
    - Good temporal resolution
    - Measures neural activity
    - Inherently 2D
- Disadvantages
    - Poor signal quality
    - Poor spatial resolution (> 1cm)
    - Neural activity measure is biased
    - Distortion contaminates and signals

Inverse problem: go from 2D to 3D

ECoG: Electrocorticography

- Advantages

    - Relatively good signal quality
    - Good temporal resolution
    - Measures neural activity
    - Inherently 2D
- Disadvantages
    - Invasive, requires craniotomy
    - Currently old recording technology
    - Neural activity measure is biased
    - Patients often do not perform well

MEG: Magnetoencephalography

- Advantages
    - Better signal quality than EEG
    - Good temporal resolution
    - Measures neural activity
    - Inherently 2D
- Disadvantages
    - Expensive
    - Poor spatial resolution (~8mm?)
    - Neural activity measure is biased

PET: Positron Emission Tomography

- Advantages
    - Relatively simple and cheap
    - Good temporal resolution

    - Tomographic (2D slice)
- Disadvantages
    - Poor signal quality
    - Poor spatial resolution (> 1cm)
    - Probably really bad for you

fMRI: Functional Magnetic Resonance Imaging

- Advantages
    - Good spatial resolution (~3mm)
    - Inherently 3D
    - In continuous development
- Disadvantages
    - Very expensive & complicated
    - Poor temporal resolution (>1s)
    - Does not measure neural activity

dMRI: Diffusion imaging tracks water (along axons)

NIRS: Near-infrared spectroscopy

- Advantages
    - Cheaper than fMRI
    - Portable
- Disadvantages
    - Poor signal quality
    - Bad spatial resolution (>2cm?)
    - Doesn’t measure neural activity

    - Inherently 2D

NIRS-DOT: Diffuse Optical Tomography

- Advantages
    - Better spatial resolution than NIRS
    - Tomographic (recovers 3D)
- Disadvantages
    - Poor signal quality
    - Poor spatial resolution (>8mm?)
    - Expensive, complicated

TMS: Transcranial Magnetic Stimulation

- Advantages
    - Not merely correlational
    - Relatively cheap
- Disadvantages
    - Like being hit with a hammer
    - Bad spatial resolution (>3cm)
    - Inherently 2D
    - Difficult to localize

Behavior

- Advantages
    - Measures what we want to explain
    - Relatively cheap and easy
    - **Low-tech**

- Disadvantages
    - Low bandwidth
    - Interpretation usually ambiguous
    - Difficult to identify mechanism
    - Operational definitions are poor