Exam 1

Mean 78.0%
Median 80%
Mode 86%
Min 26%
Max 98%
Std Dev 12.6%

Announcements

- None at the moment!

VII. Imaging techniques of the brain

A. CT: anatomical
B. MRI: anatomical
C. fMRI: functional
D. SPECT and PET: functional
E. EEG: functional

Anatomical/Structural Scans

- Provides a picture of the static brain
- Reveals whether structures are intact
- Can reveal atrophy
- Can reveal damage
- Can reveal intrusions (e.g. tumors)
- Can reveal developmental anomalies

Structural Scans: CT

- CT = Computed Tomography
- CAT = Computed Axial Tomography
- Utilizes X-Rays
- Low cost, widely available
- Repeat scanning results in multiple radiation exposures

Structural Scans: CT
Structural Scans: CT

Under the hood…

Structural Scans: CT & Stroke

Dim area is area of dead/missing tissue due to stroke

VII. Imaging techniques of the brain

A. CT: anatomical
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Structural Scans: CT

- Enlarged Ventricles
- No Cortical Atrophy

Structural Scans: CT

- Diffuse Cortical Atrophy
- Some ventricular enlargement

Structural Scans: MRI

- Large supercooled magnets, typically 1.5-3 Tesla
Structural Scans: MRI

- All metal must be kept out of the scanning environment
- Subjects must be screened for metal

Structural Scans: MRI Signal

- Water molecules will line-up with the strong magnetic field and spin
- Radio-frequency energy then knocks them over
- Time to again line-up with the magnetic field varies by tissue

Structural Scans: MRI

- Very high resolution images
- 2D or 3D reconstructions

Structural Scans: MRI

T1-weighted  T2-weighted

Structural Scans: MRI

Cerebral Abscess

Structural Scans: MRI

Cortical Atrophy
**VII. Imaging techniques of the brain**

A. CT: anatomical  
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**Functional Scans: fMRI**

- fMRI = functional MRI  
- Measures changes in signal intensity that arise from oxygenated blood in a region

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**Functional Scans: fMRI Caveats**

- Not a direct measure of neuronal activity.  
- Hemodynamic response is delayed 10-12 sec from brain activity

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**EXPERIENCE-DEPENDENT NEURAL-PLASTICITY**

A concept I’d meant to mention … and worth pondering
Functional Scans: fMRI

fMRI in Minimally Conscious Patients
Activations to real speech versus “reversed speech”

Patient Control Control

Schiff et al. Neurology 2005

VII. Imaging techniques of the brain

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Functional Scans: PET

- Inject radioactive tracer compound (oxygen, water, glucose, etc)
- Areas of greater metabolism will take up more of the radioactively labeled tracer
- Thus, PET is another measure of brain metabolism
- Resolution is not as fine as fMRI, either spatially or temporally

Dopamine function in Meth Abusers
PET Images (Volkow et al., 2001)

Losses in methamphetamine abusers are roughly equivalent to 40 years of aging normal aging
Functional Scans: SPECT

- Similar to PET
- Uses gamma-emitting tracers
- Poorer spatial resolution than PET

VII. Imaging techniques of the brain

A. CT: anatomical
B. MRI: anatomical
C. fMRI: functional
D. SPECT and PET: functional
E. EEG: functional
   1. Only direct noninvasive measure of brain activity
   2. Very important for assessing:
      a) Epilepsy
      b) Sleep

VI. Asymmetries in the brain

"The left side of your brain is good at math and science. The right side is creative and playful. You’ll get a raise as soon as you have the right side surgically removed."
VI. Asymmetries in the brain

A. Contralateral representation of sensory & motor functions

B. Left hemisphere
   1. Language: speech, writing, comprehension
      a. Broca's area: left frontal
      b. Wernicke's area: left temporal

Caution – handedness

VI. Asymmetries in the brain

B. Left hemisphere
   1. Language: speech, writing, comprehension
      a. Broca's area:
         1. speech production;
         2. Broca's aphasia
      b. Wernicke's area:
         1. speech comprehension;
         2. Wernicke's aphasia
         3. Generally unaware of deficits
Broca’s Aphasia

B.L.: Wife is dry dishes. Water down! Oh boy! Okay Aright. Okay ...Cookie is down...fall, and girl, okay, girl...boy...um...
Examiner: What is the boy doing?
B.L.: Cookie is...um...catch
Examiner: Who is getting the cookies?
B.L.: Girl, girl
Examiner: Who is about to fall down?
B.L.: Boy...fall down!

Wernicke’s Aphasia

H.W.: First of all this is falling down, just about, and is gonna fall down and they're both getting something to eat...but the trouble is this is gonna let go and they're both gonna fall down...but already then...I can't see well enough but I believe that either she or will have some food that's not good for you and she's to get some for her too...and that you get it and you shouldn't get it there because they shouldn't go up there and get it unless you tell them that they could have it. and so this is falling down and for sure there's one they're going to have for food and, and didn't come out right, the uh, the stuff that's uh, good for, it's not good for you but it, but you love it, um mum mum (smacks lips)...and that so they've...see that, I can't see whether it's in there or not.

Wernicke’s Aphasia

Examiner: Yes, that's not real clear. What do you think she's doing?
H.W.: But, oh, I know. She's waiting for this!
Examiner: No, I meant right here with her hand, right where you can't figure out what she's doing with that hand.
H.W.: Oh, I think she's saying I want two or three, I want one, I think, I think so, and so, so she's gonna get this one for sure it's gonna fall down there or whatever, she's gonna get that one and, and there, he's gonna get one himself or more, it all depends with this when they fall down...and when it falls down there's no problem, all they got to do is fix it and go right back up and get some more.

Asymmetries in the brain

C. Right hemisphere
1. Superior in spatial and pattern processing; cognitive maps, block design, face recognition

Example:
Mental Rotation Tasks

Example: Which face is happier?
Asymmetries in the brain

C. Right hemisphere
   1. Superior in spatial and pattern processing; cognitive maps, block design, face recognition
   2. Language skills are very limited
   3. Music?? if non-trained, yes

Caveats

- Individual differences
- Tendencies/preferences … not absolute

Asymmetries in the brain

D. The two hemispheres usually communicate via corpus callosum
   1. integrates two hemispheres

Asymmetries in the brain

D. The two hemispheres usually communicate via corpus callosum
   1. integrates two hemispheres
   2. split brain patients, however, have severed corpus callosum
Asymmetries in the brain

Split-brain patient peculiarities:

- Two words flashed tachistoscopically
- Two commands flashed tachistoscopically

E. Video of Split Brain Patient

www.youtube.com/watch?v=aCv4K5aStdU