brainCOLOR meeting (11/2/2009 at Neuromorphometrics, MA):

Cortical labeling protocol

WHY
Why are we here? What are our common interests?
What applications do we have in mind for our labeling protocol and labeled data?

Arno Klein (columbia university):
- more open data necessary for more open science
- parts 1 and 2 of grant: labeled data and morphometric database (3-year NIH RO1)
- atlas data for automated anatomical labeling
- software: Mindboggle

Andy Worth (neuromorphometrics):
- grant: label oasis data with new protocol (5 years with phase 2, NIH)
- interest in dynamic atlas construction
- software: NVM, Segmentor (assisted, semi-automated anatomical labeling software and pedagogical interface)

David Kennedy (university of massachusetts, worcester):
- early developer of brain anatomy protocols (CardViews)
- consumer wanting to use labeled data for morphomety, diffusion-weighted, resting state,...
- representing nitrc.org, neuroinformatics journal, nif

David Shattuck (loni, ucla):
- developed lpba40 resource
- interested in automated labeling and validation
- software: BrainSuite

Steve Pieper (isomics):
- representing na-mic, interested in the data
- software: Slicer

Bennett Landman (vanderbilt university):
- interested in very large-scale imaging, collaborative labeling by non-experts, validation
- software: STAPLER, JIST

Satrajit Ghosh (mit):
- interested in functional neuroimaging & behavior, pediatric populations, individual differences
- software: Nipype (python-based) neuroimaging pipeline environment;
- software 1st pass at brainCOLOR.m: landmark-based cortical surface labeling with nodes + edges with functions (present state: point to volume/surface, update in surface/volume)

Jason Tourville (boston university):
- co-developed the brainCOLOR protocol with ruth carper and others
- interested in variability in macroanatomy, roi-based analysis

Greg Millington (neuromorphometrics)
- label trainee working with Jason and Andy

What are some of the limitations of this protocol and these labeled data?
What is the value of macroscopic cortical structural labeling?
What alternatives exist to labeling brain image data?

-- discussion about inferences drawn from and across image acquisitions --

AK: rant about brodmann labels derived from talairach coordinates
JT: cortical labeling: high variability, low confidence -- experience required
DS: will the rater rate confidence? JS: yes.
BL: metadata and tags

WHAT: What will be labeled?

Subject data:

Neuromorphometrics: OASIS (500-600 brains); ADNI? ICBM152?

LONI: ICBM data (presently labeling 100 brains according to LPBA40 protocol)

Mindboggle: originally OASIS, now based on online Survey 2 responses:

5: individual atlases (talairach, hammers, pick, aal, etc.)
2: adni, icbm
1: oasis, birn, shaltenbrant and bailey, dejerine, freesurfer, caret

-- discussion about subject data characteristics and availability --

- individual atlases?
- pediatric subject data?
- pathological subject data?
- small sets of repeated data (traveling birn)?
- functional/physiological/dwi/resting state data?
- multiple modality data?

BL: regarding relabeling data: 5-10% random test-retest
AW: yes, we'll be doing 10% test-retest

labeling other modalities besides T1? with different protocols? (ex: 1.5 vs. 3T borders, tumors)
DS: yes at loni (T1, T2, tract labeling,...)

WHERE: Where to label?

Anatomical definitions: refer to protocol and survey responses (JT)

web analytics (september 9 - october 31): 336 views

protocol survey 1 (general comments):

Rahul Desikan:
Would be very good to have a region for the temporopolar cortex (temporal pole). Our anatomic experience (based on Desikan et al., 2006) with this region has good and several recent studies have demonstrated this region to be an important aspect of early Alzheimer's disease. As such, would be very helpul to include this region.

B.T. Thomas Yeo:
Hi. Thanks for your efforts in getting these manual segmentation done. I am not a neuroanatomist, although I have some experiences in labeling cortical folds.
I did not notice any convention of how you are planning to handle missing landmarks. I might be biased by the (FreeSurfer) cortical surfaces I have been looking at, but for example, the sulcus separating the middle and inferior temporal gyri is weak and sometimes do not appear at all. In that case, is a line going to be arbitrarily drawn to separate the gyrus into two or the two gyri are going to be fused as one label?
I am also wondering if it will be helpful to release a small set of labeled brains (say 5-10) at the beginning of the project for another round of commenting. While the detailed protocols seem reasonable, visual inspection of some manually segmented brains might better reflect the effects of cortical folding variability on the application of the protocols.

Mangin JF:
I really enjoy discovering your initiative which is bound to federate the community. I am a bit curious however about the way you plan to identify the very variable sulci. Some of them raise a lot of ambiguities and your strategy to deal with it will largely impact further use of the database. Just to give an example to illustrate my worries, I do not think the superior frontal sulcus is always a simple simply connected elongated furrow like in the drawing. How do you define the boundary when it is split? How do you overcome the ambiguities when the intermediate frontal or the median frontal sulci are more developed than usual?

Nick Schmansky:
I noticed that the entorhinal area is noted as being optional. does that mean that some atlas subjects may not have that label? i ask because entorhinal cortex is a key area in distinguishing AD from MCI from controls: 'Automated MRI measures identify individuals with mild cognitive impairment and Alzheimer's disease.' Brain. 2009 Aug;132(Pt 8):2048-57.

Donald McLaren:
Very good idea. You might want to consulate the AAL and/or Freesurfer to see what regions they parcellate compared to those proposed.

Gael Chetelat:
This is very promising and potentially helpful!
Why wouldn't you include the hippocampus (+++) or grey matter nuclei?

-- discussion about labels --

DK: use diff docs to compare/contrast protocols
AK: re: bohland's OBART.info

BL: "Don't know" label?
JT: no, but could rate confidence
AK: multiple labelers' labels would help to infer confidence

BL: dynamic atlasing project; lots of brain images of collaborators could be made available
(1-hr. acquisitions: T1, DTI, FLAIR, fMRI (tasks), etc.)

SG & DS: SVN nightly releases

AK: feedback through the future brainCOLOR.info/org website
web-based interactive drawing on slices to get expert feedback on individual labels?

HOW: How to label?

Software descriptions:
- NVM (AW)
- brainCOLOR.m (SG)
- STAPLER (BL)
- BrainSuite (DS)

Surface vs. volume-based cortical labeling:
- issues, evaluation study results

AW: need both surface-based and volume-based labeling
JS: surface-based editing will augment and speed up volume-based labeling
DS: some version of BrainSuite enables concurrent volume and surface synchronization;
delineating sulcal curves on surface model with shortest path on mesh, with interactivity

WHO: Who is doing the labeling?

Neuromorphometrics: JT + GM, more as project progresses (5?)

Mindboggle: JT trainee at columbia university

LONI: undergrad volunteers for LPBA100 in one quarter (1 label/roi, same 56 rois)

Who else should be involved?

WHEN: When will the labels be ready?

Timelines:
Neuromorphometrics: 5 years (phase 1 & 2)
Mindboggle: 3 years
LONI: >1 year?