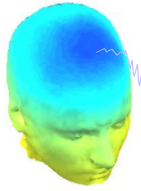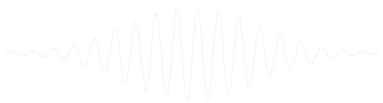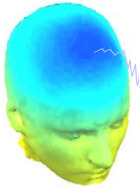# IC Evaluation Practicum (Day 1)

- **ICA Component Classifier Competition**

- **Traditional Practicum using faces_4.set**

Automating IC Identification

Luca Pion-Tonachini (`lpionton@ucsd.edu`)

Goal: Create an automated, high confidence EEG component labeler.
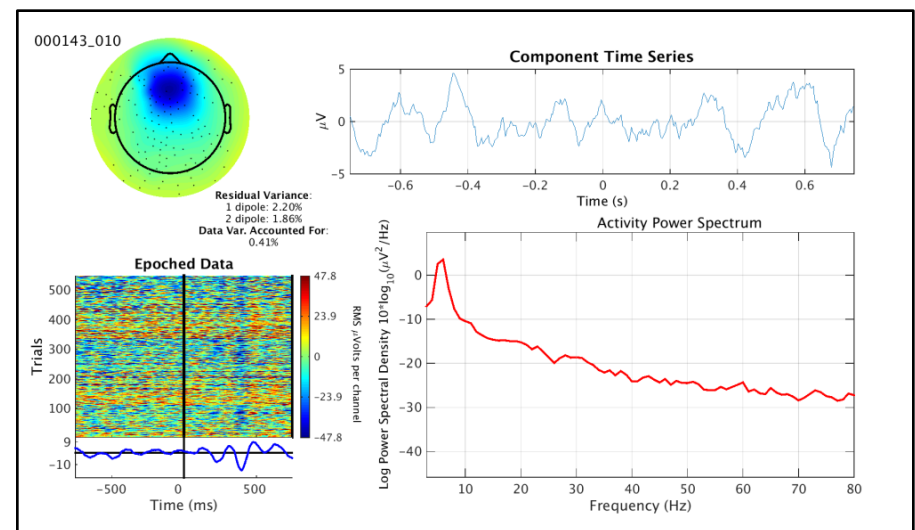
Motivation: Typically we rely on expert knowledge to pick which components to work with, but can be very time consuming with large datasets or inconvenient / infeasible when automation is the goal (BCI).
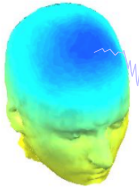
Plan:
1. Aggregate Data
2. Gather Labels
   reaching.ucsd.edu:8000/tutorial
3. Process Labels
4. Train Classifiers
   Real-time and offline versions

– let's play…

Tutorial: EEG Independent Component Labeling

Overview

We would like you to help us label independent components from EEG datasets to create an automated classifier. For more information, see Why Help Us?.

Steps to doing so

Prefix your user name with XXI, e.g. XXI_jiversen

1. Register or Log In.

2. Look at the image presented. For help reading it, see How To Label. It is essential that you go over the instructions before you start.

3. For each component presented, try to decide what type of component you are looking at. To learn how to do this, see Telling Components Apart and perform Practice Labeling.

4. Click the appropriate button or buttons to label the component. For help with our categories, first read How To Label.

5. Then click on "Next" to view a new component.

That's it! Please read the text in all the links above and perform some Practice Labels. Then click Begin Labeling.

If you have any suggestions, please Leave A Comment. Also – we have a Leaderboard!
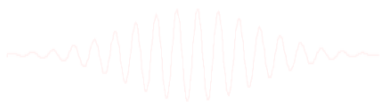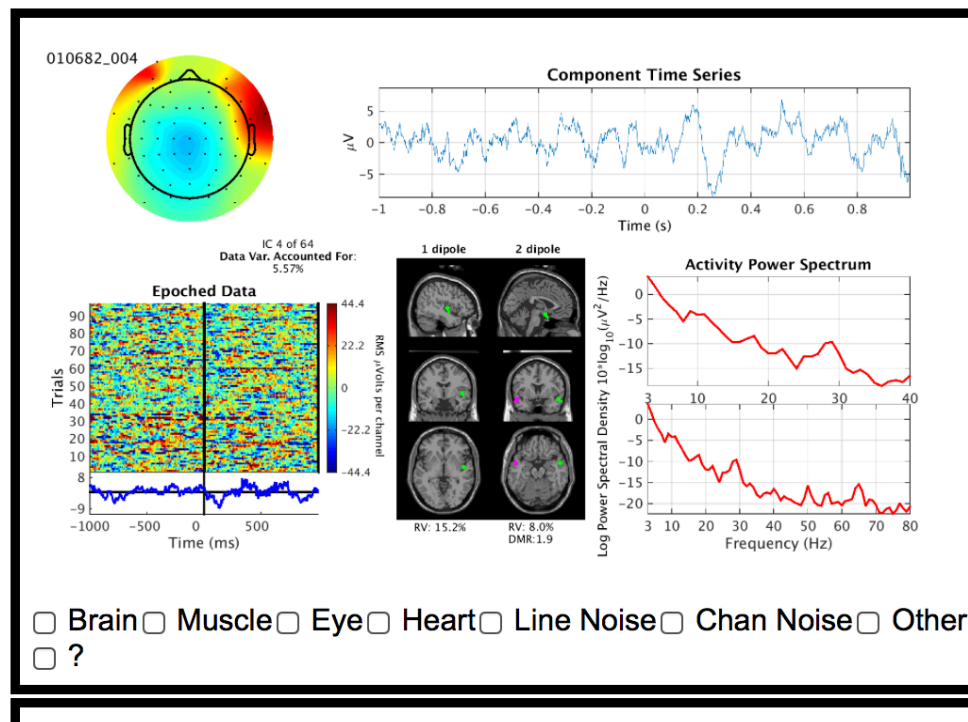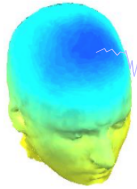
Practice First…
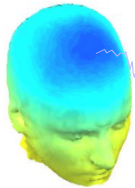
Practice

Example component images are provided below. Click on all the labels your fe[e...]
follows:

- White: no labels
- Grey: correct but insufficient labels
- Green: all labels correct
- Red: one or more labels are incorrect

Marking "?" is ignored here as that category is user dependent.

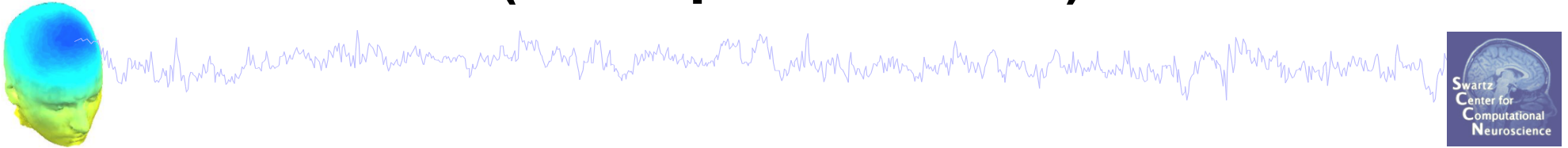☐ Brain ☐ Muscle ☐ Eye ☐ Heart ☐ Line Noise ☐ Chan Noise ☐ Other
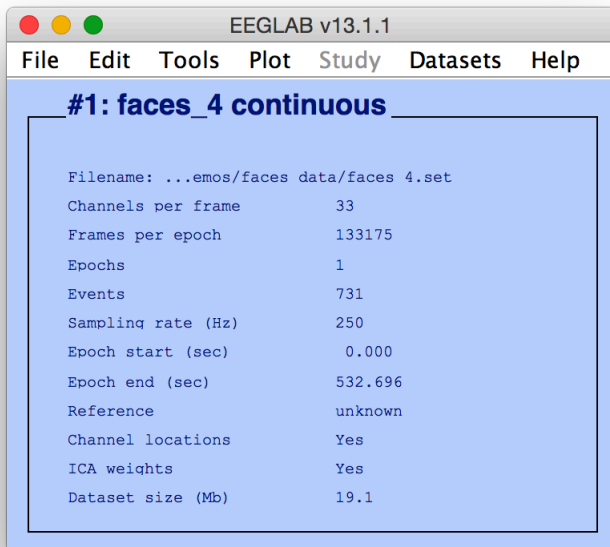☐ ?

IC Evaluation Practicum (Traditional)

- **ALL**
  - Download then load faces_4.set, epoch on face

- **Novice, Intermediate**
  - From the GUI, open the 'Reject component by map' interface
  - Explore and classify several additional ICs: muscle, channel, brain
    - ~ Justify your classification
  - Redo the "Plot → Component ERPs → With component maps" excluding your additional artifacts. What change do you observe?
  - Pick a brain IC. Plot an ERP Image
    - ~ Try sorting by phase, is there any relationship to the IC activation pattern? What about power in a frequency band of choice?

- **Intermediate**
  - Plot ERP Image sorted by response latency
    - ~ Figure out how to realign trials to response latency instead   (Hint 'Align')
  - Plot ERSPs for selected ICs
    - ~ Explore parameter options. Why is each useful?
  - Plot component cross-coherence for pairs of ICs

- **ALL (Time permitting)**
  - Create second dataset, epoched on object
  - Examine ERP differences between the conditions using "Plot → Component ERPs → With component maps (compare)"
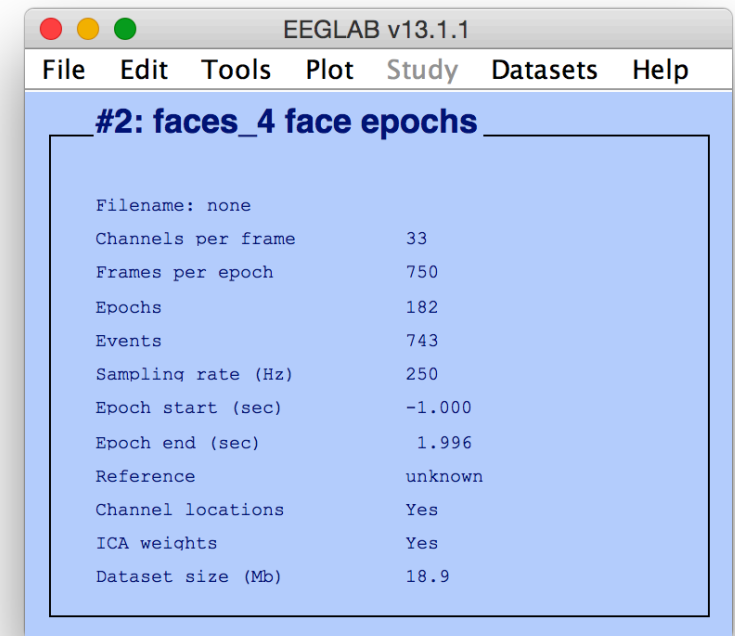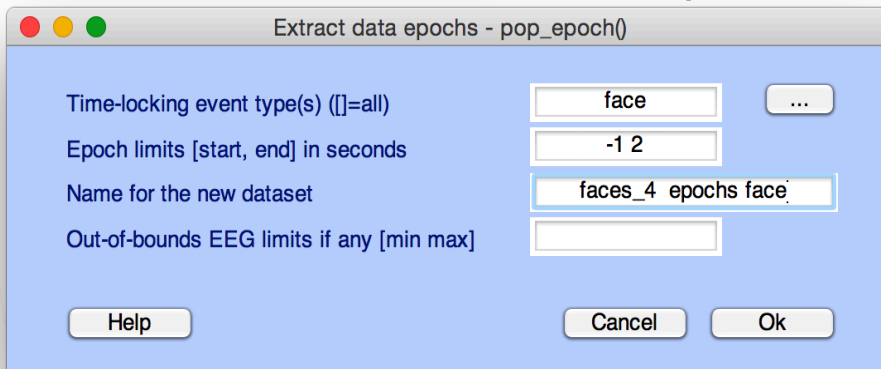 - For ICs most different between conditions, compare ERP Image, ERSP
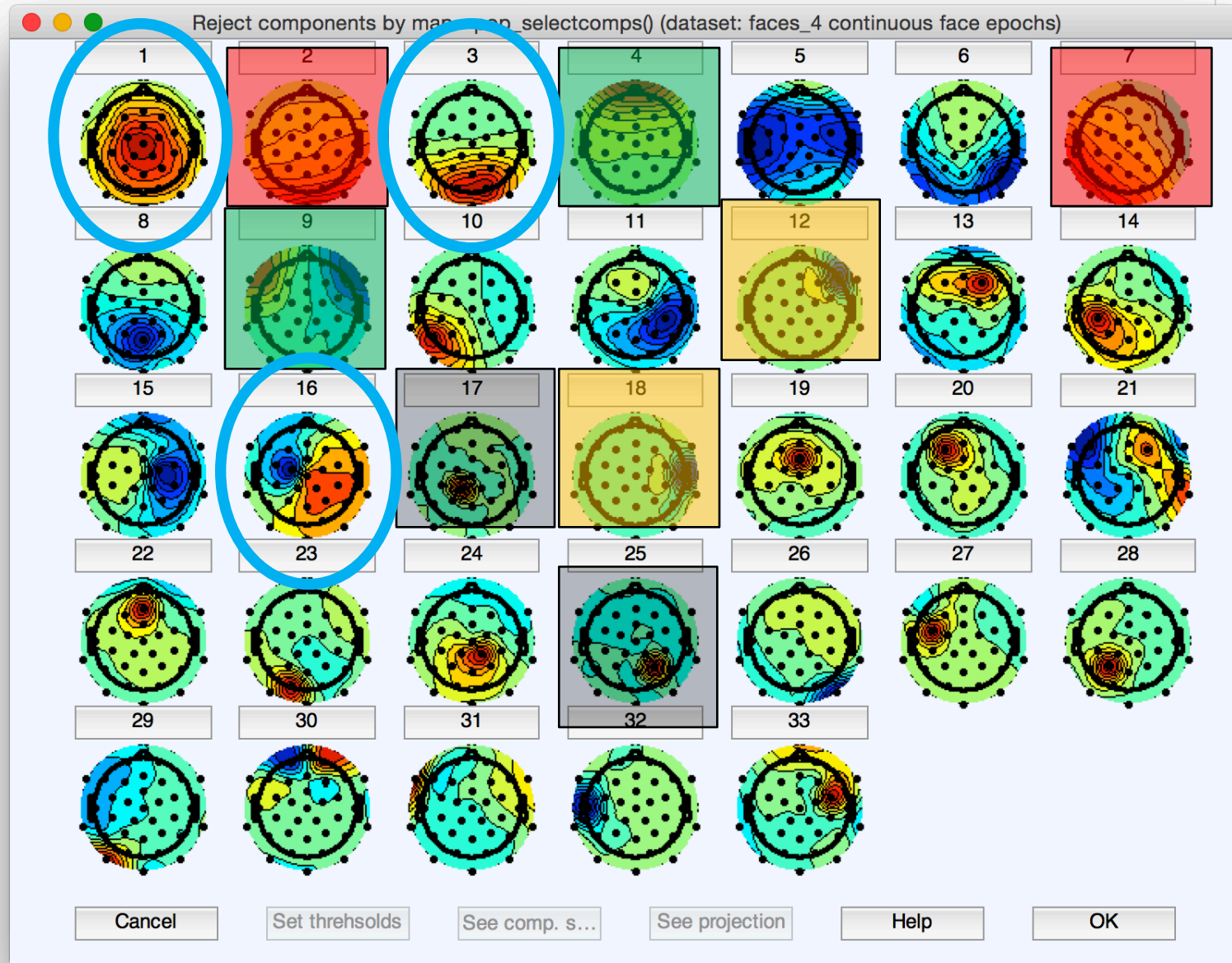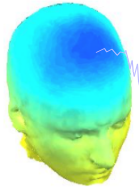
(Example Datasets)

Load: `EEG_data/faces_4.set`

EEGLAB v13.1.1

File   Edit   Tools   Plot   Study   Datasets   Help

#1: faces_4 continuous

Filename: ...emos/faces data/faces 4.set	
Channels per frame	33
Frames per epoch	133175
Epochs	1
Events	731
Sampling rate (Hz)	250
Epoch start (sec)	0.000
Epoch end (sec)	532.696
Reference	unknown
Channel locations	Yes
ICA weights	Yes
Dataset size (Mb)	19.1

Tools → Extract Epochs

Extract data epochs - pop_epoch()

Time-locking event type(s) ([]=all)	face ...
Epoch limits [start, end] in seconds	-1 2
Name for the new dataset	faces_4 epochs face
Out-of-bounds EEG limits if any [min max]	

Help   Cancel   Ok

EEGLAB v13.1.1

File   Edit   Tools   Plot   Study   Datasets   Help

#2: faces_4 face epochs

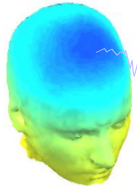|	
Filename: none	
Channels per frame	33
Frames per epoch	750
Epochs	182
Events	743
Sampling rate (Hz)	250
Epoch start (sec)	-1.000
Epoch end (sec)	1.996
Reference	unknown
Channel locations	Yes
ICA weights	Yes
Dataset size (Mb)	18.9

`Subtract Baseline [-1000 0]`

(Some other examples use stern_125Hz.set)
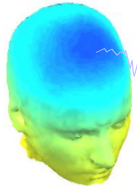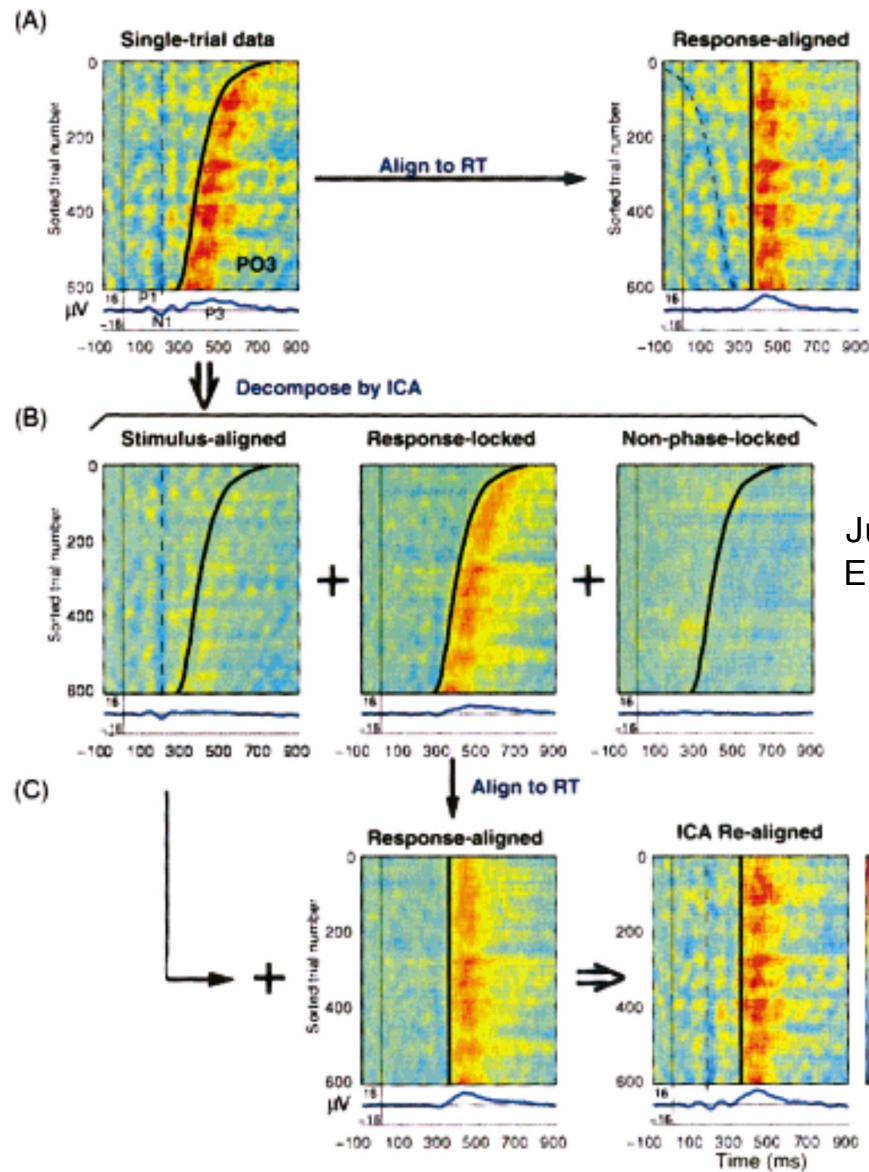
IC Classification…so far

Eye
Muscle
Cardiac
Badchan
Brain

IC Evaluation Practicum (Traditional)

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  - For ICs most different between conditions, compare ERP Image, ERSP

Realigning Trials: Stimulus vs. Response

(A) Single-trial data | Response-aligned — Align to RT

Decompose by ICA

(B) Stimulus-aligned + Response-locked + Non-phase-locked

Jung T-P, Makeig SD, Westerfield M, Townsend J, Courchesne E, Sejnowski TJ (2001) Analysis and visualization of single-trial event-related potentials. Hum Brain Mapp 14:166–85.

(C) Align to RT — Response-aligned → ICA Re-aligned

Nice method for generating dual ERPs