

Reading and Re-referencing Data

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EEG data

- EEG systems return two important types of data files: **EEG data** and **triggers**
- **EEG data files** contain the raw EEG signal recorded during an EEG session
 - each EEG system outputs different data formats, e.g. .eeg, .cnt
- **trigger files** contain the experimental triggers sent during the experiment



Introducing our data file

- we're gonna use data freely available from FieldTrip here:
ftp://ftp.fieldtriptoolbox.org/pub/fieldtrip/tutorial/preprocessing_erp
- participants saw nouns that were either positive animals (e.g. puppy), negative animals (e.g. maggot), positive humans (princess) or negative humans (murderer)
- participants were cued whether to make either a positive/negative or an animal/human judgment



Reading in data with FieldTrip

- `ft_preprocessing` is FieldTrip's multi-purpose function for preprocessing steps, such as reading data, filtering and referencing
- in the first call, we're going to use it for reading in the data
- go to: <http://www.fieldtriptoolbox.org/reference> and look at the reference for `ft_preprocessing`
- find out which `cfg` option we need for reading data
- take a look at the data structure



Plotting data with FieldTrip

- plot your data using these two types of visualization:

```
plot(data.time{1}, data.trial{1}(:, :))
```

```
cfg = [];
```

```
cfg.viewmode = 'vertical';
```

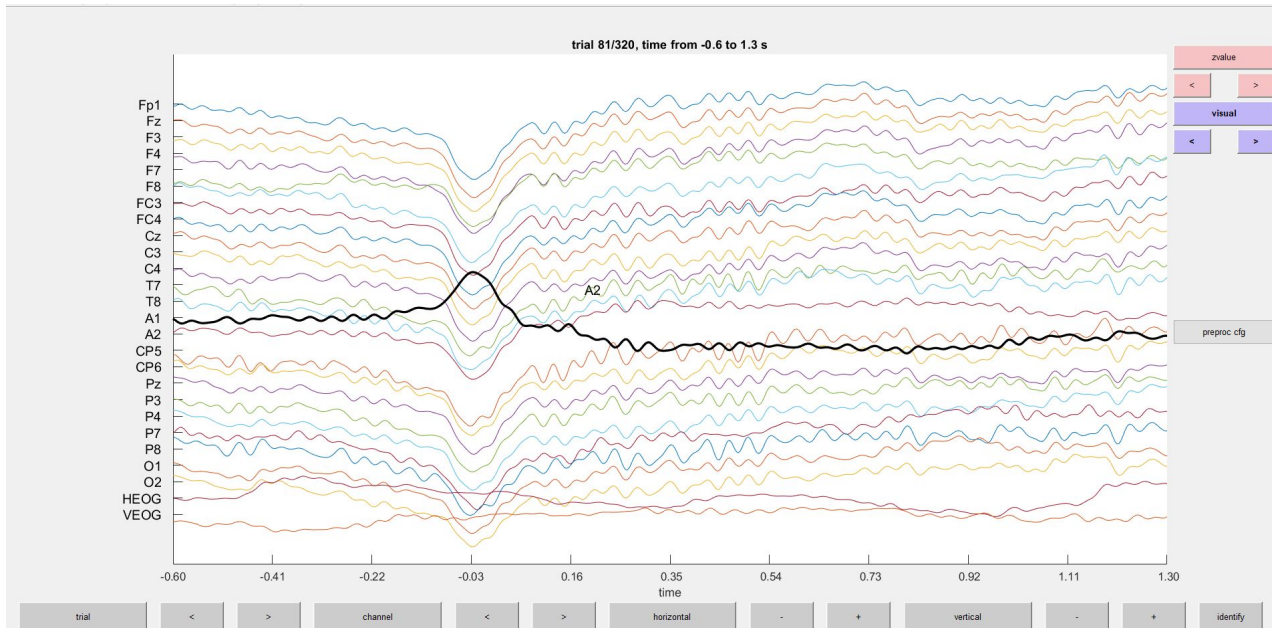
```
ft_databrowser(cfg, data_raw);
```



Referencing

- only interpret electrode voltages **after referencing**
- the signal of the reference electrode is **subtracted** from each electrode
- reference electrodes are placed so that they likely measure noise that is also picked up by other electrodes, e.g.
 - mastoid electrodes: close to other electrodes, but do not measure much brain activity because the mastoids are thick bones
 - average reference: signal measured by all electrodes is likely noise
- there is no neutral or best reference

Artifacts on the reference electrode





Re-referencing

- EEG data usually have an online reference (i.e. a reference electrode during recording)
 - this reference is only used for inspection of data during recording
- the signal is then again re-referenced offline
- for our data, we're going to re-reference offline to the **linked mastoids**



Re-referencing in FieldTrip

- use `ft_preprocessing` to re-reference your data to linked mastoids, i.e. the implicit reference (REF) and the right mastoid (RM)
- plot your data using the same two types of visualization as earlier
- do you notice any differences?