



MRC Cognition
and Brain
Sciences Unit



UNIVERSITY OF
CAMBRIDGE

EEG/MEG 1:

Averaging

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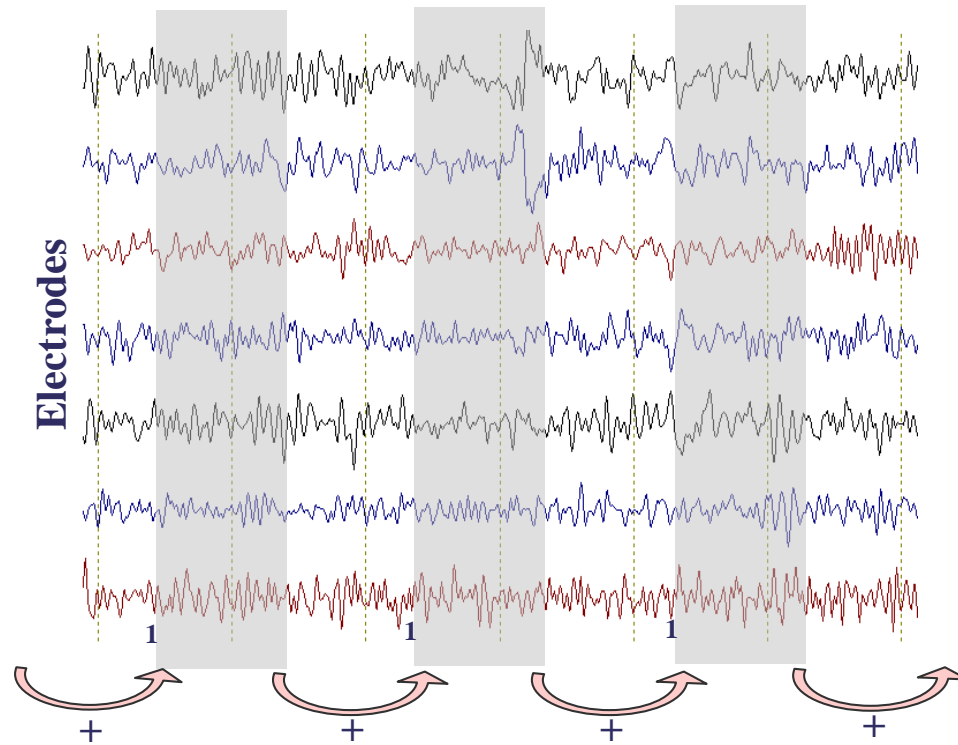
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COGNESTIC 2022

Event-Related Potentials and Fields (ERPs and ERFs)

Data Averaging

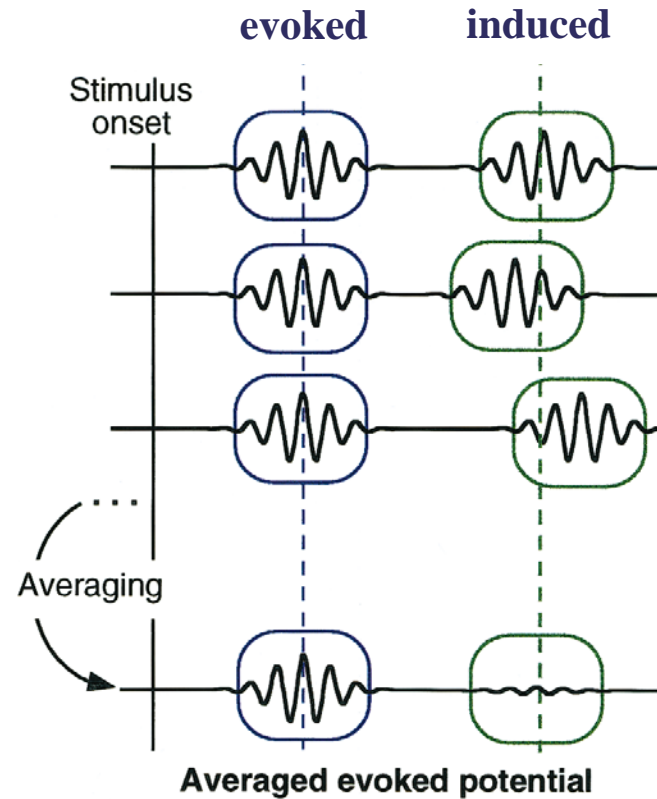
Continuous “raw” data:



Averaged data:



Evoked and Induced Activity



Tallon-Baudry & Bertrand, TICS 1999

Temporal jitter across trials has a larger effect on higher frequencies, and they are more likely to be attenuated by averaging.

Data Averaging

The necessary number of trials depends on effect size, noise, variability across participants, your stats etc. – the more the better if feasible.

For random noise, variance goes down with n , and standard deviation with \sqrt{n} .

For “one-off” artefacts, amplitude in the average goes down with n .

“Robust Averaging” procedures exist (e.g. in SPM) that weigh epochs with an estimate of their reliability (e.g. distance to mean).

Artefact Rejection

Usually, epochs are excluded from averaging when their data exceed some maximum-minimum criterion.

Make sure “chronically bad channels” are excluded from this procedure (or there won’t be any data left to average).

Prior to any procedure that combines signals across channels, such as average reference, SSP or ICA, bad channels should be removed or interpolated (or signals from bad channels may be projected into the good ones).

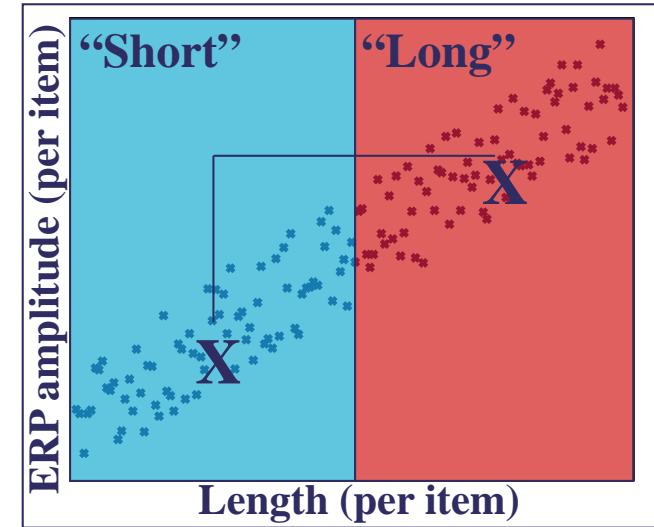
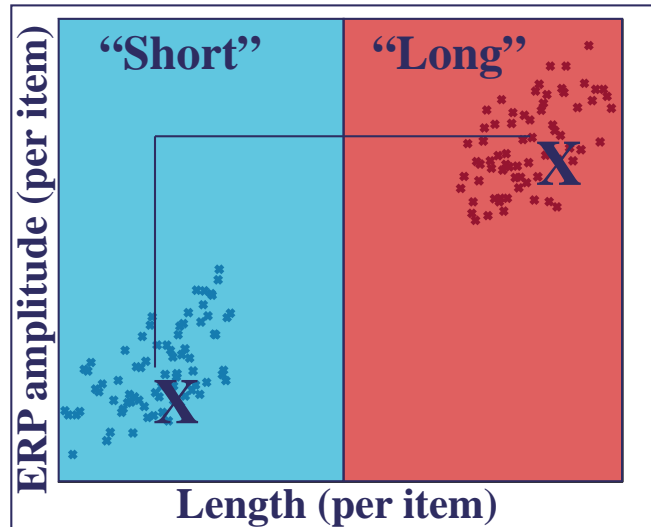
Appropriate filtering and artefact correction (e.g. ICA) should be applied beforehand (but don’t feel too safe: artefacts may slip through).

The proof of the pudding is in the eating:
Check data quality by visual inspection, compute SNRs, etc.

Parametric vs Factorial Designs

Consider parametric analysis/GLM if stimulus variables are continuous.

(still less common in EEG/MEG than in fMRI analysis)





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Thank you