ERP analysis steps

Extract Epochs

1. List all bdf files for a given subject
2. For each block, read bdf and keep it as recorded (e.g. no average ref)
3. Detrend and low-pass filter
4. Find relevant events (e.g. target onset) and extract epochs – baseline correct but NO artifact rejection
5. Save all important information about each single trial, alongside the erp epochs

Bad Channel Check

Using this relatively 'raw' epoched data, determine which channels are bad and need interpolation. There are automated algorithms to do this but I prefer doing this manually: by plotting standard deviation of all channels you can identify particularly noisy or flat ones.
Save a list of bad channels for EACH BLOCK for each subject in a cell array 'ch2interp'

Interpolate Bad Channels

Using 'ch2interp', loop through the subjects again, loading the raw epoched data, interpolating the bad channels for each block, and re-saving under a new name

Identify bad trials

Check each epoch for blink or other large-amplitude artifact, using thresholds. Can choose to detect on all channels or just important ones, in wide or narrow time window. Adjust, refine, and investigate as necessary to produce reasonable 'good' trial counts

CSD transform - optional

Some ERP studies benefit from Current Source Density transformation (2nd spatial derivative), which shrinks the foci of different generators on the scalp, reducing overlap

Sort, Average and Plot

Now derive the ERPs by averaging across trials of relevant types (e.g. stimulus strength/type, correct response). BEFORE averaging, re-reference the data (if CSD'd then no need), and reject bad/artifact trials.

Iterate?

Consider refinements e.g. many slow-shifting artifacts -> apply high-pass filter at step 1?

Subject rejection

Keep in mind at all steps that some subjects might be better excluded from the analysis ultimately. This can be because they blinked during the important time period of too many trials, or because they were not looking where they were supposed to according to eye-tracker/VEOG data (there has to be a certain tolerance), or their behaviour is very different than the rest of the group. Subject rejection should be **blind** to the presence/strength of a hypothesised effect– otherwise it is **biased!**