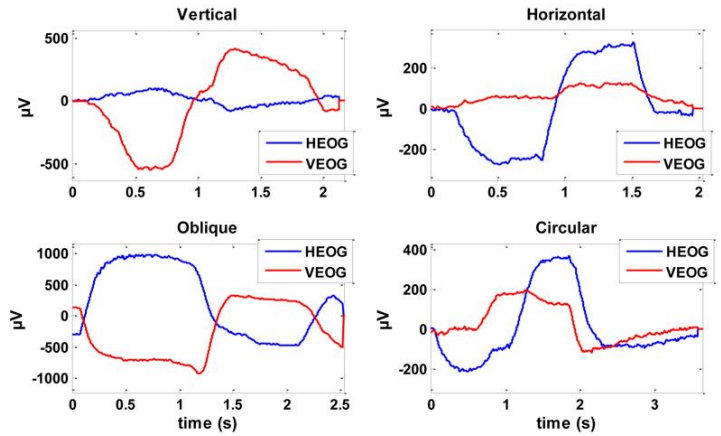
Eye movement or artefact?!

Eye movements

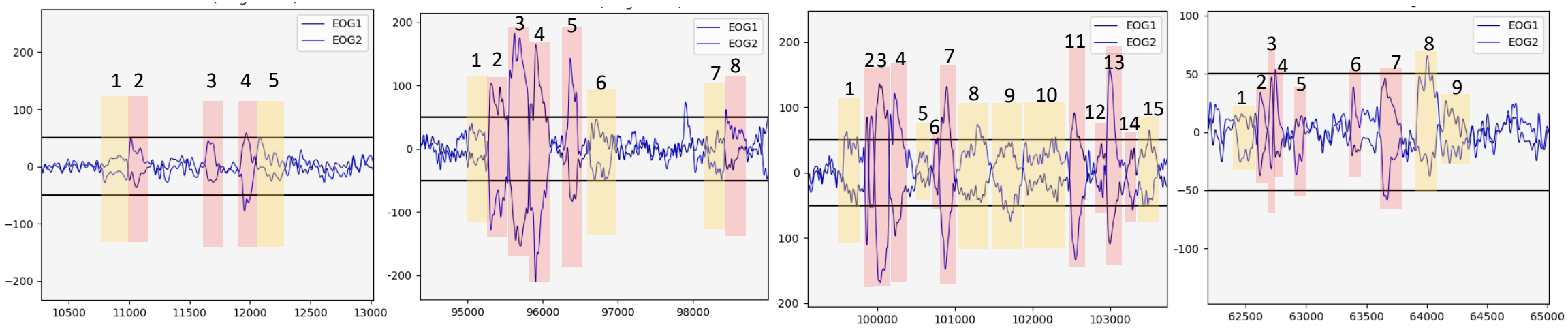


Betta et al. 2016 – BLUE LINE IS WHAT WE HAVE

Key to remember:

- Different types of eye movements look different! (see left)
- Our eye electrodes are placed so we can best capture horizontal, oblique & circular movements. We will rarely see vertical movements in our EOG channels.
- Horizontal, oblique & circular movements all share 1 defining property: **the EOG channels will have opposite polarity** so move away from each other in the graphs
- Horizontal eye movements (red highlight below) have a sharp initial deflection and gradual decay
- Circular/oblique eye movements (yellow highlight below) have a slower initial deflection & slow decay

Eye movement examples:



X axis = sample # (remember we sample at 256/second) | Y axis = voltage (uV) | black lines indicate +50uV and -50uV thresholds (as per Mauthai et al. 2016 https://doi.org/10.3109/09540261.2016.1159949)
Red highlight = Horizontal eye movement
Yellow highlight = Oblique/Circular eye movements

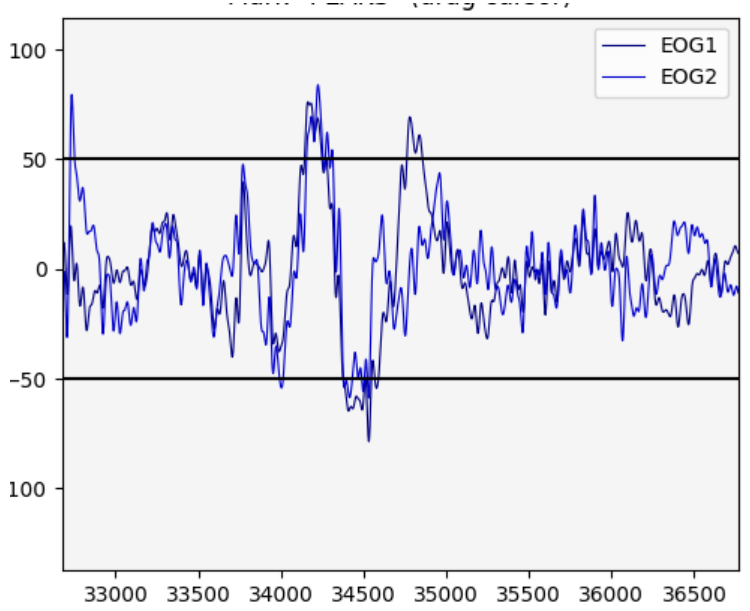
Artefacts

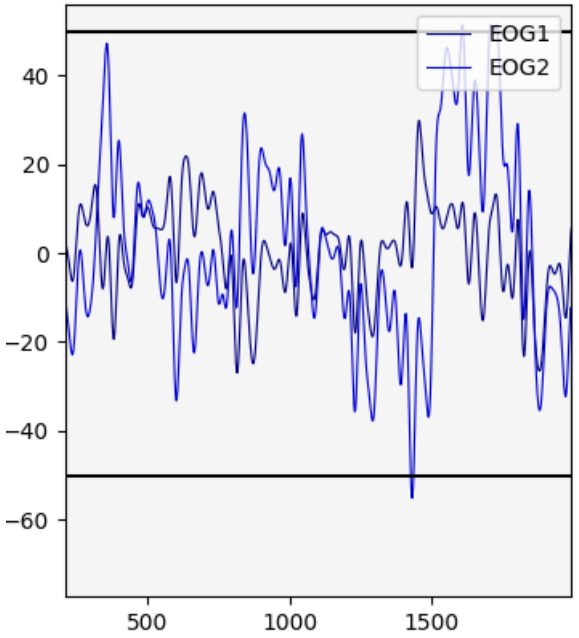
Key to remember:

- Artefacts might appear in one EOG channel or in both- it depends on the artefact
- The most common artefacts are caused by:
  - Movement – will show up as large deflections in the signal, will usually affect both channels
  - Poor connection between the electrode & skin – will show up as a noisy signal with very little variation, will usually affect 1 channel
  - Sweat – will show up as a slow oscillation around 0.5-1Hz, will usually affect 1 chanel
  - Signal bleed-through (i.e. heartbeat signal is picked up by electrode, either due to pulse under the electrode or due to channel-crossing in the amplifier) – will show up as a repetitive spiking in the signal, will affect both channels
  - Eye movements- don't need to worry about this much as we want to look at eye movements! But we don't want to look at blinks, which show as a positive deflection in both channels

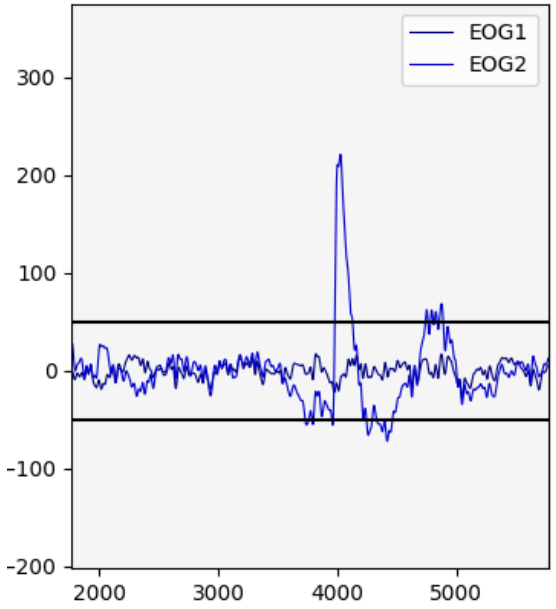
There are lots of resources online for learning (& seeing EEG artefacts- the same artefacts apply to EOG signals. For example:
https://www.bitbrain.com/blog/eeg-artifacts
https://www.ai.rug.nl/minds/uploads/Chapter%205_%20EEG_Signal%20Processing_Part%202.pdf (first few pages)
https://www.ncbi.nlm.nih.gov/books/NBK390358/

Movement artefact (2 channels)

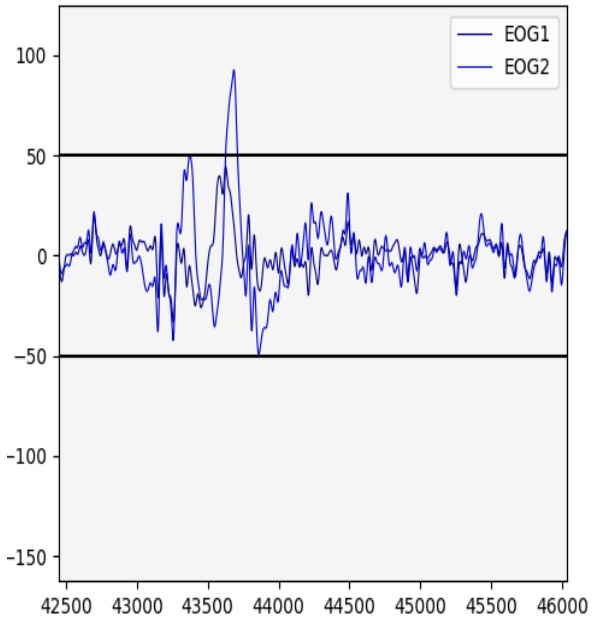




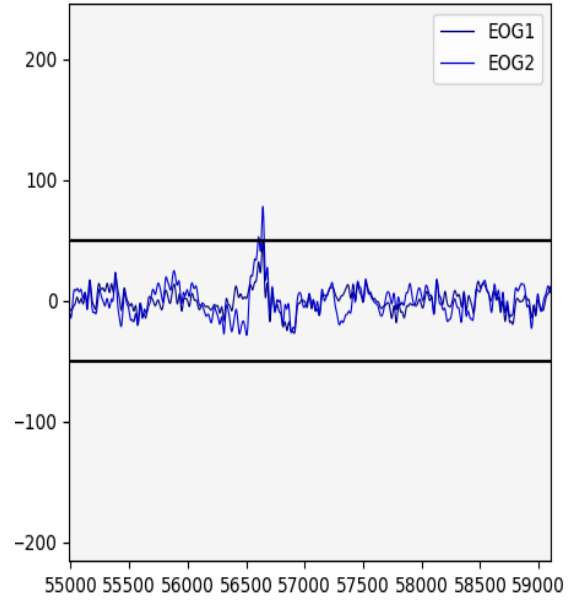
ECG artefact (signal bleed through, 2 channels)



Movement artefact (1 channel)



Movement artefact (2 channels)



Blink artefact (2 channels)