Chapter 6: Artifact Rejection and Correction Part 4

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Agenda

- Why it is sometimes better to use artifact correction rather than artifact rejection
- Rationale behind three major classes of artifact correction approaches
- Potential pitfalls with artifact correction

Why Artifact Correction May Be Useful

- 3 potential problems associated with rejecting trials with ocular artifacts
    1. Unrepresentative sample of trials
    2. Difficult to obtain a sufficient number of artifact-free trials
    3. Counterproductive

- Duel-task interference (Ochoa & Polich, 2000)

- Even more difficult to control eye movements

General Approaches to Artifact Correction

- Categories of Artifact correction
  - Regression-based procedures
  - Dipole localization procedures
  - Statistical component isolation procedures

- Why artifact correction is scary
  - Procedure that subtracts an estimated value from data
  - Much more complicated than baseline correction and re-referencing procedures
  - Unimpressive evidence about the accuracy of artifact correction
  - Generality problem

Regression-based Procedure

- Developed by Gratton et al. (1983)
- Estimate the artifactual potentials generated by blinks and eye movements and to subtract them from the EEG
- Artifact-related voltage recorded at a given electrode site

  = the size of the artifact recorded at the eyes X propagation factor
- Estimate the propagation factor btw the eyes and each of the scalp electrodes and subtract corresponding proportion of the recorded EOG activity from each site
- 47% Fpz, 18% Fz, 8% Cz (Lins et al., 1993a)
- EOG recording contains brain activity in addition to true ocular activity

Dipole Localization Procedure

- Uses dipole modeling to create a more detailed biophysical model of the artifact & its propagation through the head (Berg & Scherg, 1991a, 1991b)
- Locations of ocular dipoles are already known
- Recordings should be obtained from at least 7 electrodes near the eyes, and a set of calibration runs must be conducted for each subject (Lins et al., 1993b)
- Assumes that a vertical eye movement and the effect of the eyelid passing over the eye have the same scalp distribution, which is not true

Statistical Component Isolation Procedure

- Use statistical properties of the data → Identify a set of components characterized by a scalp distribution → Use these components to isolate and subtract the artifact-related voltages
- Statistical methods
  - Principal component analysis (PCA)
  - Independent component analysis (ICA)
  - Second-order blind inference (SOBI)
- Assume that each artifact has a fixed scalp distribution in a given subject
- Scalp distribution of EEG = weighted sum of the scalp distribution of the artifact + scalp distributions of all the other brain signals

Potential Pitfalls

1. No artifact correction technique has been demonstrated to work perfectly in all situations
    - Maintain an appropriate level of skepticism about whatever method you use, and take steps to assess the validity of the results
    - Compare artifact correction with artifact rejection
    - Vaya con Dios
2. Cannot account for the changes in sensory input caused by blinks and eye movements
    - Reject trials with blinks or eye movements that occur within a few hundred ms of stimulus onset prior to performing artifact correction

General Advice

- It is reasonable to use one of the newer correction techniques in almost any experiment
- 3 situations requiring caution with blink correction
  - When your experimental effect consists of a subtle effect with a blink-like scalp distribution and a relatively long duration of more than 200 ms
  - When the blinks are highly consistent in their timing
  - When the blinks differ significantly across groups or conditions