CHOOSING AN EEG SYSTEM: EVALUATING THE PROS AND CONS AND QUALITY OF DATA AMONG TWO DIFFERENT CAPPING APPROACHES

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Background

- Modern EEG systems implement two approaches: a **gel cap system** and a **saline solution cap system**.
- Much is already known about the general benefits of the two systems but little is known about the difference in type of data produced between the two.[1]
- **RESEARCH GOAL**: To qualitatively and quantitatively evaluate the efficacy of two different EEG caps for the purposes of improving future EEG data collection and retention.

Approach

- 11 female participants (mean age=19.36; sd= ± 0.92) completed a word association task while wearing either the gel cap condition or the saline solution cap condition.
- Participants were shown a series of word pairs and were tasked with identifying whether or not the two words shown were *related* or *unrelated*.
- A total of 120 word pairs were shown.

Methods

Equipment used

- Brain Vision EEG System [2]
  - Group 1: R-Net (saline solution cap), 64 passive electrodes (*N* = 6)
  - Group 2: EasyCap (gel cap), 32 active electrodes (*N* = 5)

Data Processing

- Raw EEG files were filtered from 0.1-30 Hz and re-referenced to the average.
- Bad blocks of data were manually removed and bad electrodes were interpolated.
- Bad components were manually evaluated and removed.

ERP Analysis

- Data was epoched from -200 to 800 msec.
- Only trials in which participants responded to stimulus correctly were included.
- Mean amplitude of pre-stimulus interval (-200 to 0 msec) was subtracted from each time point in the post stimulus interval.
- Single trials were averaged together to obtain stable waveform ERP for each condition.
- All analyses occurred in the EEGlab Toolbox of Matlab.[3]

Pros & Cons

Cons: passive electrodes, higher risk of loss of impedance

Pros: quick-set up, participant friendly, easy clean up

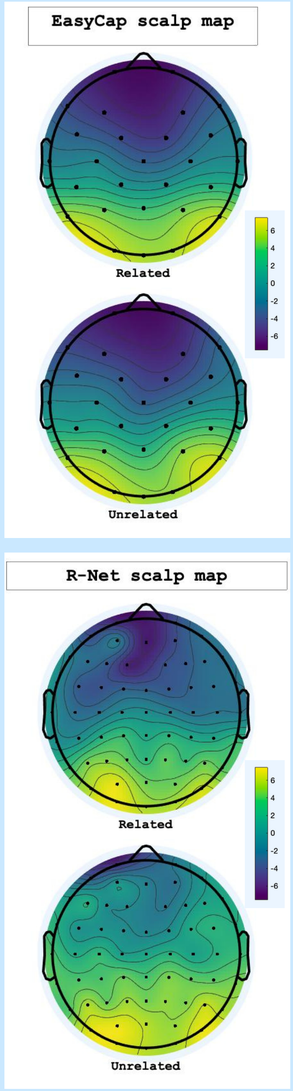
Cons: tedious set-up and clean-up, abrasion of scalp

Pros: active electrodes

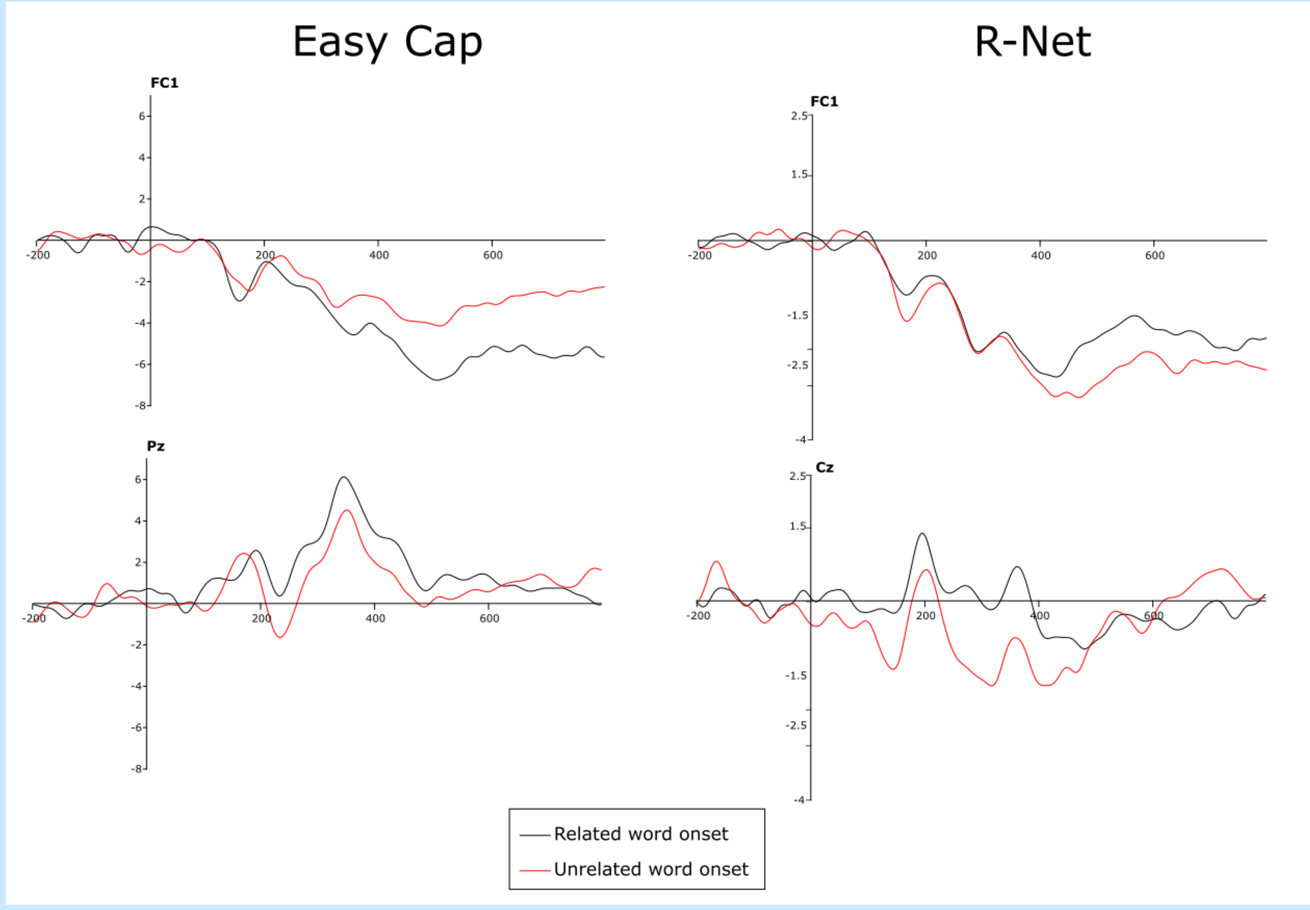
Results

Cap Type	# of Participants	# of Electrodes Interpolated	# of Components Removed
Easy Cap	5	M = 1.4, SD = 1.14	M = 2.8, SD = 0.45
R-Net	6	M = 1.83, SD = 1.72	M = 4, SD = 0.89

Scalp Maps



Waveforms



Conclusions

- Qualitatively, the R-net is more user friendly, requiring little setup/cleanup, and does not require abrasion of the participants' scalp.
- Quantitatively, the R-net had a higher loss of data, and the ERPs, while in the expected direction, appear to have a lower signal-to-noise ratio (SNR) than those produced by the Easy Cap.

Although the Easy Cap has a higher SNR, the choice of cap may truly depend on the population of interest.

References: 1. Mathewson, Harrison & Kizuk (2016), 2. Brain Vision LLC, 3. Delorme & Makeig, 2004