



Impact of Reduced Dimensionality Independent Components Analysis on Event-Related Potential Measurements



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Background

- ICA is a ubiquitous tool for cleaning EEG.
- Reducing dimensionality prior to ICA can drastically reduce computation time.
- Artoni et al., 2018 detailed the deleterious effects of reduced-dimensionality ICA (rdICA) on the dipolarity and reliability of independent components (ICs).
- Though valuable for researchers interested in directly analyzing ICs, ICA is more commonly used for cleaning EEG.
- Thus, a direct examination of the impact of artifact removal via rdICA on ERP data quality is needed.

Methods

- We preprocessed 43 healthy control's EEG data under the following conditions:
 - ICA without dimension reduction
 - ICA with only 64 electrodes included (i.e. half dimensionality)
 - ICA preceded by PCA retaining 99% of the original data variance
 - ICA preceded by PCA retaining 90% variance
- We quantified ERP data quality by measuring:
 - mean amplitude
 - standardized measurement error of the single-trial mean-amplitudes
 - split-half reliability
- ERP components elicited from active oddball listening task
 - Auditory N1 measured at and surrounding Cz
 - Auditory P3 measured as the difference between rare and frequent tones at and surrounding Pz

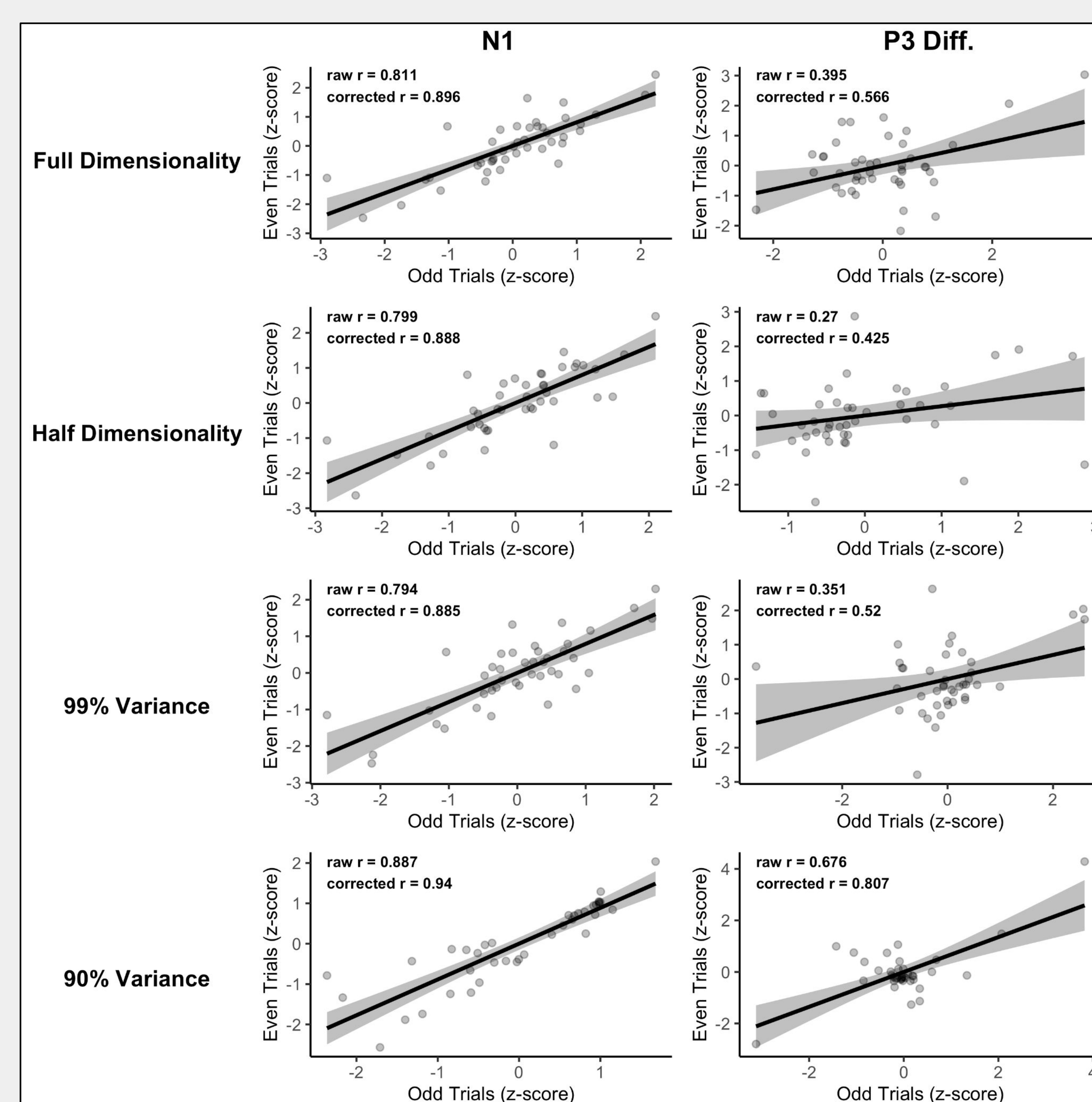
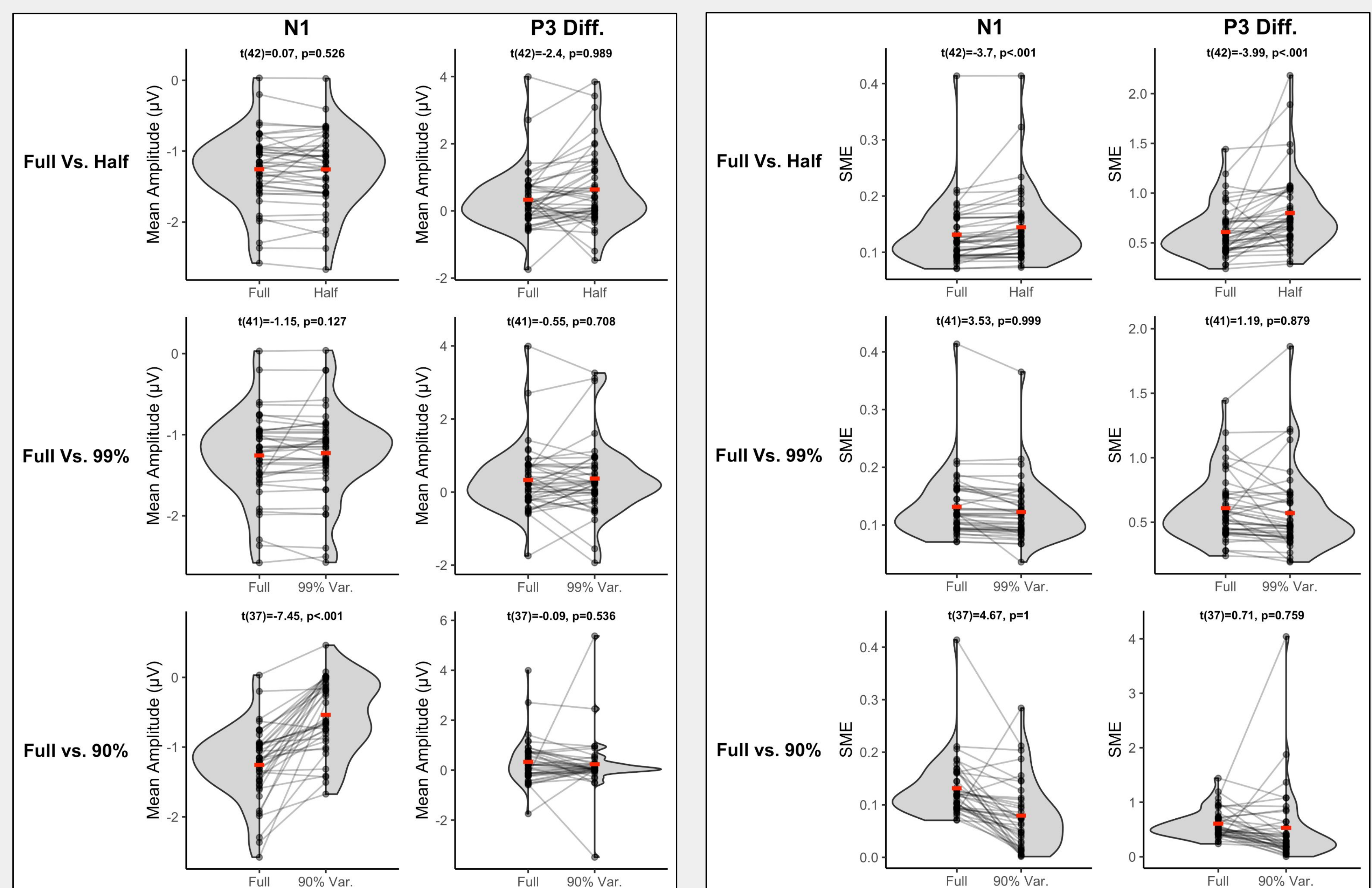
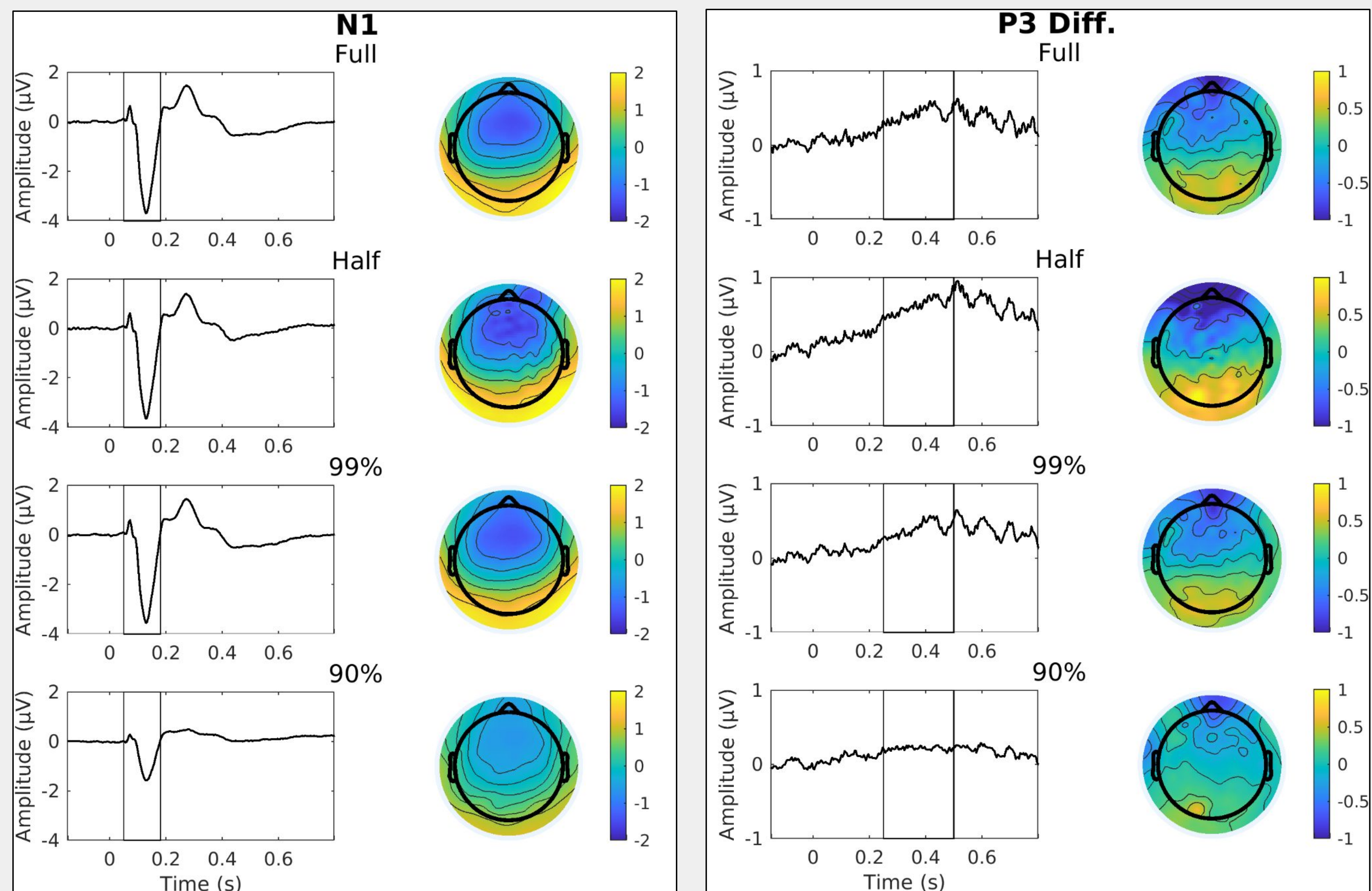
Conclusions

- Only the 90% dimension reduction for the N1 component led to a significant difference in mean amplitude relative to full dimensionality
- The SME was higher for both N1 and P3 Diff. for the half dimensionality condition only
- SMEs were *lower* for the PCA-based dimension reduction conditions
- The 90% dimension reduction condition led to the *highest* split half reliability for both N1 and P3
- This suggests that the appropriateness of a given dimension reduction technique in part depends on analytic goals
- 99% may strike a nice balance between computational efficiency and adequate data quality
- Future work should explore other methods that may better balance computational efficiency and data quality

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Results



QR code for all the nitty gritty details and further validation analyses

