Clinical Neuropsychology: Open Access

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Neurophysiology: The Principles for Upcoming Use

Diego Perez*

Department of Paediatrics, Universitat Autonoma de Barcelona, Spain

Introduction

In cognitive and clinical neurosciences, electroencephalography (EEG) stands out as the most frequently utilized method. With the increasing recording capacity of acquisition systems, computational power, and proliferation of analysis toolboxes, EEG researchers can swiftly transform data to highlight various properties of neural activity in a time-resolved manner. These considerations extend to other neurophysiological techniques such as magnetoencephalography (MEG), intracranial recordings, and various EEG-related preparations. One prominent group of methods involves time-frequency decompositions of electrophysiological time series, with the number of EEG studies utilizing such frequency-based analyses skyrocketing by over 4500% over the past two decades [1, 2].

Time-recurrence maps, featuring three-dimensional plots projected onto two aspects, serve as a cornerstone visualization tool in neurophysiological research. Typically, time is represented on the abscissa and frequency on the ordinate map, while the relief of the plot serves as a relevant dependent variable associated with that time-frequency coordinate. To convey the relief feature, a color scale is commonly utilized to indicate its magnitude. However, the selection of such colormaps may lead to perceptual errors, resulting in erroneous detections and interpretations of reported neurophysiological effects [3].

Over approximately the past few decades, a staggering 74% of published time-recurrence experimental effects in electrophysiology have utilized variants of the rainbow color spectrum. Rainbow color palettes map data values to a linear path through RGB space, transitioning from cooler blue and green hues to warmer yellow and red hues. While visually vibrant and aesthetically pleasing, rainbow plots pose accessibility challenges for viewers with color vision deficiencies and may introduce visual errors, such as anomalies in images caused by high-contrast regions and "flat" perceptual bands that give the impression of limited color bands [4].

To mitigate the drawbacks of the rainbow color scheme, numerous scientific fields, including oceanography and cartography, have developed and embraced alternative color schemes. We propose that the neurophysiology research community adopts a similarly proactive approach and encourages scientists to utilize effective visualization techniques. In this section, we delve into the scope and significance of color misappropriation in the field and offer practical guidelines for addressing these well-documented issues [5].

Jet, a MATLAB-implemented rainbow color palette, serves as an illustrative example. Although MATLAB is commonly used in electrophysiological research, the issues discussed herein apply to all rainbow palettes. Jet-like rainbow colormaps lack natural perceptual order, making it challenging for viewers to accurately interpret time-frequency maps. Moreover, rainbow colormaps pose significant challenges for viewers with color vision deficiencies, as they represent red and green colors at the same brightness level, impeding perceptual discriminability and accessibility [6-8].

To promote inclusivity and accessibility in scientific publications, we urge neurophysiologists to report their data using colormaps that possess regular perceptual order, perceptual uniformity, and accessibility for individuals with color vision deficiencies. Furthermore, we identify default colormap choices of popular time-frequency analysis toolboxes in neurophysiology and provide software recommendations for authors to adapt colormaps suitable for their data and readers [9]. Below, we provide a list of available, open-source color palettes for consideration when visualizing MATLAB-generated data [10].

Conclusion

In conclusion, we emphasize the significant drawbacks associated with using a rainbow color scheme to visualize neurophysiological data. While we refrain from prescribing a specific alternative color scheme, as the most suitable palette should be determined by individual circumstances, we advocate for a collective effort among researchers, software developers, and journal editors to discourage the use of rainbow color maps in neurophysiology. By doing so, we aim to ensure that data presentation is not only understandable but also precise and accessible to all stakeholders. This concerted action will contribute to enhancing the clarity and interpretability of neurophysiological findings, ultimately advancing the field as a whole.

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Conflict of Interest

None

References

1. Bestelmeyer PE, Phillips LH, Crombiz C, Benson P, Clair DS (2009) The P300 as a possible endophenotype for schizophrenia and bipolar disorder: Evidence from twin and patient studies. Psychiatry res 169: 212-219.
2. Blasi G, Goldberg TE, Weickert T, Das S, Kohn P, et al. (2006) Brain regions underlying response inhibition and interference monitoring and suppression. Eur J Neurosci 23: 1658-1664.
3. Bleuler E (1958) Dementia praecox or the group of schizophrenias, New York (International Universities Press) 1958.
4. Carter CS, Barch DM (2007) Cognitive neuroscience-based approaches to measuring and improving treatment effects on cognition in schizophrenia: the CNTRICS initiative. Schizophr Bull 33: 1131-1137.
5. Chambers CD, Bellgrove MA, Stokes MG, Henderson TR, Garavan H, et al. (2006) Executive “brake failure” following deactivation of human frontal lobe. J Cogn Neurosci 18: 444-455.

***Corresponding author:** Diego Perez, Department of Paediatrics, Universitat Autonoma de Barcelona, Spain, E-mail: diego@rediff.com

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6. Aron AR (2011) From reactive to proactive and selective control: developing a richer model for stopping inappropriate responses. Biol psychiatry 69: e55-e68.
7. Badcock JC, Michie PT, Johnson L, Combrinck J (2002) Acts of control in schizophrenia: dissociating the components of inhibition. Psychol Med 32: 287-297.
8. Bannon S, Gonsalvez CJ, Croft RJ, Boyce PM (2002) Response inhibition deficits in obsessive–compulsive disorder. Psychiatry Res 110: 165-174.
9. Bellgrove MA, Chambers CD, Vance A, Hall N, Karamitsios M, et al. (2006) Lateralized deficit of response inhibition in early-onset schizophrenia. Psychol Med 36: 495-505.
10. Benes FM, Vincent SL, Alsterberg G, Bird ED, SanGiovanni JP (1992) Increased GABAA receptor binding in superficial layers of cingulate cortex in schizophrenics. J Neurosci 12: 924-929.