Get Stoke(s)d! Introduction to the Special Focus

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For the past 20 years, Mark Stokes has had a remarkably outsized influence on many areas of research within cognitive neuroscience. As an undergraduate at the University of Melbourne, in the laboratory of Jason Mattingley, he contributed to several studies pioneering the use of TMS for the study of human cognition (cf. Feredoes, 2023). Although many of these addressed fundamental questions about attention, arguably the most enduring of his contributions from that time was methodological, 2005's "Simple metric for scaling motor threshold based on scalp-cortex distance: Application to studies using transcranial magnetic stimulation" (Stokes et al., 2005). Google Scholar shows that although the citation count for this introduction of "the Stokes method" initially peaked in 2011, its year-by-year histogram has remained stubbornly elevated, achieving additional modes in 2017, in 2019, and now again in 2022 (for which, already by the 9-month mark, it has already eclipsed the previously most highly cited calendar year).

For his PhD, Mark Stokes moved to Cambridge University where, in the laboratory of John Duncan, he was among the first to apply multivariate decoding analyses to neuroimaging studies of high-level cognition (cf. Duncan, 2023). Subsequently, he moved to Oxford University, initially to work with Kia Nobre as a research fellow and later establishing his own independent group and mentoring an impressive cohort of trainees (cf. Pike et al., 2023). Across his time at Oxford, he played a major role in bridging research on memory and attention, promoting a functional account of working memory in which forward-looking memory traces are informationally and computationally tuned for interacting with incoming sensory signals to guide adaptive behavior (Nobre & Stokes, 2019; cf. Myers, 2023; Nobre, 2023). In addition, and perhaps most influentially, soon after his arrival at Oxford, Mark Stokes turned his analytic acumen to developing a then-novel approach for the "retrospectively multivariate" analysis of data from single-unit extracellular recordings from awake, behaving animals. As recently as the decade of the 2000s, the preponderance of neurophysiological studies of nonhuman primates used the approach, during chronic recording sessions, of first isolating a single neuron, then recording from that neuron while the animal engaged in the behavior of interest, repeating this process across hundreds of recording sessions, then averaging the results across similarly tuned neurons. Stokes' insight was that one might learn more from such data sets by, rather than approaching them as a collection of univariate observations, treating them as a single multivariate observation by, in effect, pretending that these hundreds of units had all been recorded simultaneously. The results have been breathtakingly revealing.

The first, and perhaps most impactful, of publications to come out of Mark Stokes' "retrospectively multivariate" enterprise was a product of his enduring collaborative relationship with John Duncan—a reanalysis of recordings from the pFC of nonhuman primates performing a working memory task (Sigala, Kusunoki, Nimmo-Smith, Gaffan, & Duncan, 2008). It reported the discovery that the population-level representation of stimulus information in pFC underwent a dynamic trajectory of state transitions that reflected task- and trial-specific context (Stokes et al., 2013; cf. Adam, Rademaker, & Serences, 2023). (For example, when a new stimulus appeared, its representation in pFC transitioned, over the course of just a few hundred milliseconds, from one primarily reflecting stimulus identity to one primarily reflecting whether it was a "target" [that would require a response] or a distractor [that would not].) Critically, because this information could be read out even during periods when the average firing rate in pFC did not differ from baseline, this finding implied that these dynamic transformations were occurring at the level of changing patterns of connectivity between neurons, rather than at the level of firing rates. It may well turn out that the most enduringly consequential impact to arise from this work will have been an insight that Stokes himself derived from it: There may be an "activity-silent" basis for the representation of information in working memory (Stokes, 2015). The wide-ranging implications of this proposal are being seen, seemingly every day, in new models and experimental results in disciplines ranging from experimental psychology to computational neuroscience to cellular neurobiology (cf. Buschman & Miller, 2023; Manohar, 2023).[1]

Sadly for our field, personal circumstances have led to Dr. Stokes moving away from his role as Head of Attention group at Oxford's Department of Experimental Psychology. During the Summer of 2022, the contributions of this remarkable, and remarkably influential, cognitive neuroscientist were highlighted by an international gathering for a *Stokes Fest*[schrift] hosted on the grounds of New College (Figure 1). The articles collected in this Special Focus capture some of the spirit and ferment (cf. Wu & Buckley, 2023) that pervaded this celebration of the career of a dearly valued and admired colleague/mentor/teacher.

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Figure 1. Group photo from Stokes Fest (taken July 2, 2022, with a phone camera belonging to someone sitting in the front row, and kindly provided by N. Myers). Pictured here: 1. Eva Feredoes; 2. Chris Chambers; 3. John Duncan; 4. Mark Stokes; 5. Kia Nobre; 6. Mark Buckley; 7. Nick Myers; 8. Zita Patai; 9.Eelke Spaak; 10. Sanjay Manohar; 11. Nahid Zokaei; 12. Elkan Akyürek; 13. Dejan Draschow; 14. Sage Boettcher; 15. Valentin Wyart; 16. Freek van Ede; 17. Gustavo Rohenkohl; 18. Chris Summerfield; 19. Bernhard Staresina; 20. Nikolai Axmacher; 21. John Serences; 22. Lev Tankelevitch; 23. Michael Wolff; 24. Ilenia Salaris; 25. Emilia Piwek; 26.Michal Wojcik; 27. Robert Hepach; 28. Sam Hall-McMaster; 29. Tim Buschman; 30. Sammi Chekroud; 31. Laurence Hunt; 32. Andrew Quinn; 33. Matthew Rushworth; 34. Kathryn Atherton; 35. Alex Pike; 36. Brad Postle; 37. Diego Vidaurre. Attendees not pictured: Duncan Astle; Holly Bridge; Martin Eimer; Masud Husain; Ole Jensen; Heidi Johansen-Berg; Paul Muhle-Karbe; Kate Nation; MaryAnn Noonan; Chris Olivers; Gaia Scerif; Dante Wasmuht; Kate Watkins; Mark Woolrich; Nick Yeoung. Participating remotely: Trevor Chong; Ian Gould; Bob Knight; Zoe Kourtzi; Jason Mattingley; Alexandra Murray; Kei Watanabe. Participating via prerecorded contribution: Trevor Chong; Paul Dux; Jasper Hajonides; Jarrod Lewis-Peacock; Earl Miller; Frida Printzlau.

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Diversity in Citation Practices

Retrospective analysis of the citations in every article published in this journal from 2010 to 2021 reveals a persistent pattern of gender imbalance: Although the proportions of authorship teams (categorized by estimated gender identification of first author/last author) publishing in the *Journal of Cognitive Neuroscience* (*JoCN*) during this period were M(an)/M = .407, W(oman)/M = .32, M/W = .115, and W/W = .159, the comparable proportions for the articles that these authorship teams cited were M/M = .549, W/M = .257, M/W = .109, and W/W = .085 (Postle and Fulvio, *JoCN*, 34:1, pp. 1–3). Consequently, *JoCN* encourages all authors to consider gender balance explicitly when selecting which articles to cite and gives them the opportunity to report their article's gender citation balance. The authors of this article report its proportions of citations by gender category to be as follows: M/M = .467; W/M = .267; M/W = 0; W/W = .267.

Note

1. Indeed, on the very day that I am writing this Introduction I am seeing Stokes (2015) cited as motivation for an article on "Modulation of working memory duration by synaptic and astrocytic mechanisms" (Becker, Nold, & Tchumatchenko, 2022).

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