Open Science: a *vision* for a fair and equitable science

Dr William Xiang Quan Ngiam (he/him/his)

University of Chicago

My positionality

I am:

- a cisgender, heterosexual male
- Australian-born and a native English speaker
- of Asian ethnicity
- working as a postdoc in the United States at a R1 university
- able-bodied
- a first-generation college graduate and doctoral graduate

- I won't be able to address all imbalances and inequities in vision science, those not mentioned in my talk are not any less important and most definitely require a better spokesperson.

My beliefs

- The Open Science movement provides opportunities to address inequities in vision science, and in science broadly

- But the Open Science movement (in and of itself) is not guaranteed to provide equity in vision science and that Open Science itself is not totally equitable (yet)

- So, we need diversity, equity and inclusion initiatives in both vision science and Open Science

My goals for this talk

- Empower any researchers (especially early-career researchers) to engage in Open Science practices
  - Sharing experimental data, code and materials
  - Preprints or open access of scientific manuscripts
  - Encouraging collaborations

- But also implore early-career researchers to consider the diversity, equality, inclusivity of their research practices
  - Collaborations
  - Citation practices

What is Open Science?

- "An umbrella term used to refer to the concepts of openness, transparency, rigor, reproducibility, replicability, and accumulation of knowledge, which are considered fundamental features of science" (Crüwell et al., 2018)

- A rapidly growing and evolving movement in response to the reproducibility crisis that is improving how science is being done!
  - Open sharing of code, data and research materials
  - More replications and re-analyses
  - Preprints and open access publishing
  - Preregistration and registered reports

Crüwell, S., van Doorn, J., Etz, A., Makel, M. C., Moshontz, H., Niebaum, J. C., Orben, A., Parsons, S., & Schulte-Mecklenbeck, M. (2018). 7 Easy Steps to Open Science: An Annotated Reading List. https://doi.org/10.31234/osf.io/cfzyx
Allen, C., & Mehler, D. M. (2019). Open science challenges, benefits and tips in early career and beyond. PLoS biology, 17(5), e3000246.

Open Science is an opportunity to address barriers and shift power structures in (vision) science

Some barriers in doing vision science

- Not having the know-how
  - For success within academic structures (conferences, scientific publishing, collaborations)

- Not having the funding/equipment/software
  - To conduct vision science experiments
  - To afford article processing charges and publish open access

- Not having the contacts/network
  - To receive feedback or establish professional relationships and collaborations
  - For opportunities in science and academia

Open sharing of code/materials

- Hosting experimental code on public repositories (Github/Open Science Framework)
  - Can be a learning resource and a starting foundation for others' own experiments – may remove barriers and therefore promote the diversity of the researchers in a field
  - Can be used to replicate experiments and further understanding of methodologies
- Having publicly accessible experimental stimuli sets
  - Addresses any potential hidden know-how in the curation of a stimulus set (moves power away from hoarders of research materials)
  - Shines a light on the importance and value of curating a stimulus set or dataset (perhaps otherwise "invisible labor")

- An example: running an online study
  - Requires programming knowledge (JavaScript)
  - Requires knowledge of online experiment platforms (Prolific/Mechanical Turk)
  - Publicly available code could reduce or remove these barriers to conducting research!

Open sharing of data

- Making experimental datasets openly accessible on public repositories (Open Science Framework)
  - Can help those who lack the necessary funding or equipment to collect the relevant experimental data
  - Increases opportunities for scientific progress without data collection

- An example: re-analysis of an fMRI dataset
  - fMRI requires know-how to program for, access to a scanner, funds to pay for the experiment
  - Having the dataset available gives others a chance to reanalyze the dataset for their hypotheses and learn how to handle the fMRI data

Open access publishing

- Making scientific papers publicly accessible via preprints (PsyArXiv and bioRxiv) or publishing in open access journals
  - Receives more citations and coverage than non-OA research, potentially because of increased ease of access and visibility (McKiernan et al., 2016)
  - Note the financial limitations to publish open access – but open access shifts power away from publishers
  - Perhaps a chance to spotlight underrepresented researchers!

- Considering other content formats for sharing our research
  - Creating open educational resources (e.g. how-to or explainer videos)
  - Writing informal blogposts addressing issues

McKiernan, E. C., Bourne, P. E., Brown, C. T., Buck, S., Kenall, A., Lin, J., ... & Yarkoni, T. (2016). Point of view: How open science helps researchers succeed. *elife*, *5*, e16800.

(Non-)Inclusivity in Open Science

- Open Science itself has not been totally inclusive
  - #bropenscience – those who criticize methods and research in a condescending and gatekeeping manner (Whitaker and Guest, 2020)
  - Feminist researchers in science experience marginalization in science, with similar barriers and pressures to engage in Open Science (Pownall et al., 2020 and see Alejandra, 2018)

- Open Science has not been accessible to all scientists (Bahlai et al., 2019)
  - Open scholarship has different barriers across languages and countries
  - Early-career researchers under the pressure of a 'publish or perish' incentive structure may feel like they cannot afford to engage in Open Science

Whitaker, K., & Guest, O. (2020). #bropenscience is broken science: Kirstie Whitaker and Olivia Guest ask how open 'open science' really is. *The Psychologist, 33*, 34-37.
Pownall, M., Talbot, C. V., Henschel, A., Lautarescu, A., Lloyd, K., Hartmann, H., … Siegel, J. A. (2020, October 13). Navigating Open Science as Early Career Feminist Researchers. https://doi.org/10.1177/03616843211029255
Alejandra, D. (2018) – https://medium.com/@denalbz/reimagining-open-science-through-a-feminist-lens-546f3d10fa65
Bahlai, C., Bartlett, L. J., Burgio, K. R., Fournier, A. M., Keiser, C. N., Poisot, T., & Whitney, K. S. (2019). Open science isn't always open to all scientists. American Scientist, 107(2), 78-82.

Encouraging collaborations

- Collaborations speed up scientific progress
  - Sharing of knowledge and division of labor
  - Sharing of resources can remove some barriers to entry for other researchers
- Promotes inclusivity in the scientific community
  - May distribute research and networking opportunities and visibility to underrepresented/marginalized populations
  - May help move away from the current 'hero science' incentive structure

- An example: Psychological Science Accelerator
  - A network of psychological science laboratories across 82 countries that coordinates data collection for democratically selected studies

Psychological Science Accelerator - https://psysciacc.org/

Citation practices

- Considering equality in citation practices
  - Gender imbalances have been found across science and in subfields
    - Men tend to be first and last author in neuroscience reference lists despite increasing diversity and this is largely driven by the citation practices of men (Dworkin et al., 2020)
    - The Gender Citation Balance Index-alyzer (https://postlab.psych.wisc.edu/gcbialyzer/) is a useful tool
  - Using the Contributor Roles Taxonomy (CRediT) to fairly and transparently recognize researchers' contributions
    - Promotes recognition of non-writing research contributions (often by early-career researchers)
    - Could initiate reform of outdated incentive structures

Dworkin, J. D., Linn, K. A., Teich, E. G., Zurn, P., Shinohara, R. T., & Bassett, D. S. (2020). The extent and drivers of gender imbalance in neuroscience reference lists. *Nature neuroscience*, *23*(8), 918-926.
Contributor Roles Taxonomy (CRediT) – https://credit.niso.org/
GCBI-alyzer – https://postlab.psych.wisc.edu/gcbialyzer/

A step towards an ideal science

Open Science is an <u>opportunity</u> to move the future of science towards being more inclusive and equitable

And it's in the hands of early-career researchers!

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You can find me at:

@will_ngiam

wngiam@uchicago.edu

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