The question of reproducibility in brain imaging

Jean-Baptiste Poline

Brain Imaging Center, Helen Wills Neuroscience Institute, UC Berkeley

Outline

- Evidence for a crisis in reproducibility

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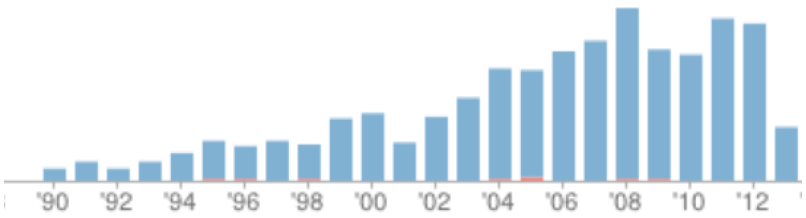
- Mesh terms “reproducibility of results” (100 in 2010)



Science finding Reproducibility crisis evidence

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- The failing concept of endophenotype (Iacono, Psychophysiology, 2014)
- Many references and warnings: eg:"Drinking from the fire hose ..." by Hunter and Kraft, 2007.

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- NIH plans to enhance reproducibility. Collins and Tabak, Nature, 2014.

What about brain imaging ? Some - *but few* - facts

- Publication does not allow replication or to find methodological issues (J. Carp Cogn Affect Behav Neurosci, 2013):

"For example, while Brown and Braver (2005) claimed that activation in the anterior cingulate cortex (ACC) is sensitive to the likelihood of committing an error, Nieuwenhuis, Tanja, Mars, Botvinick, and Hajcak (2007) reported no relationship between ACC activation and error likelihood."

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- Autism example: Toro et al., Corpus callosum size example. S. Bookheimer's examples (cereb. size, FFA, FC).

Causes and Impact

Statistical

Computational

Social

Statistical causes:(1)

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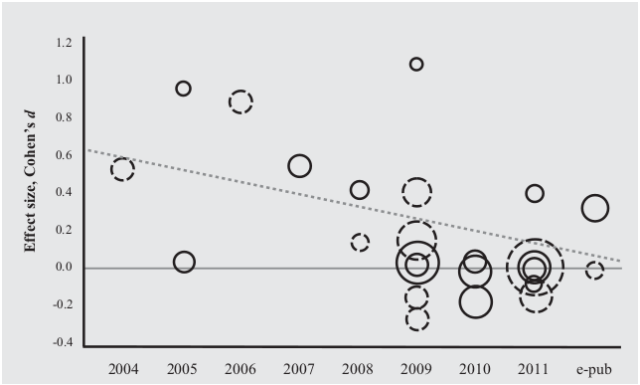
- 

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> **Significance**
>
> The lack of reproducibility of scientific research undermines public confidence in science and leads to the misuse of resources when researchers attempt to replicate and extend fallacious research findings. Using recent developments in Bayesian hypothesis testing, a root cause of nonreproducibility is traced to the conduct of significance tests at inappropriately high levels of significance. Modifications of common standards of evidence are proposed to reduce the rate of nonreproducibility of scientific research by a factor of 5 or greater.

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- Computational environment packaging not used (Neurodebian VM, Docker, . . .)

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  - is science always self-correcting ?

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- The system may select the most "productive" scientists - not necessarily the best

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- Augment the awareness of these issues, adopt data and code sharing as the standard in our field

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- Reward people who produce re-usable science

Acknowledgement

- At Berkeley: M. Brett, J. Millman, F. Perez; Simpace interest group: D. Sheltraw, C. Gallen, A. Tambini, K. K. Hwang; B. Inglis, M. D'Esposito.
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