Meta-analyzing the cortical networks for language and semantics in children

Alexander Enge, Angela D. Friederici,
Rasha Abdel Rahman, & Michael A. Skeide

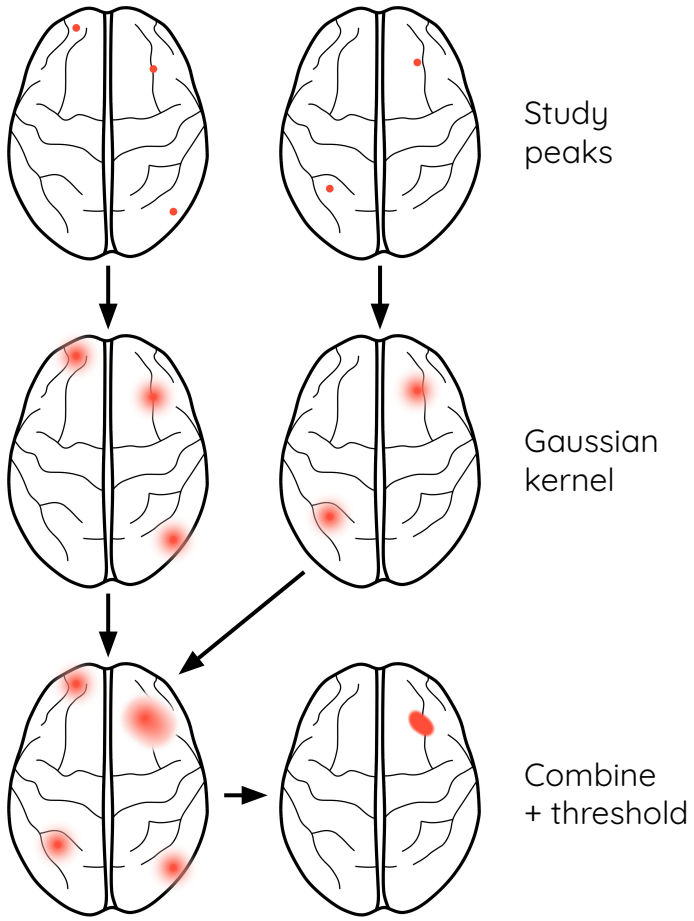
SNL Annual Meeting
8 October, 2022

SKEIDELAB

COORDINATE-BASED META-ANALYSIS

Synthesize activation peaks from imaging studies to overcome:

- Spurious findings
- Low statistical power
- Limited generalizability



Button et al. 2017; Samartsidis et al. 2017; Wager et al. 2007; Yarkoni 2020

METHOD

1. LITERATURE SEARCH

PubMed

AMERICAN PSYCHOLOGICAL ASSOCIATION

Scopus

2. META-ANALYSIS

NiMARE:
Neuroimaging Meta-Analysis Research Environment

SDM

3. GROUP COMPARISONS

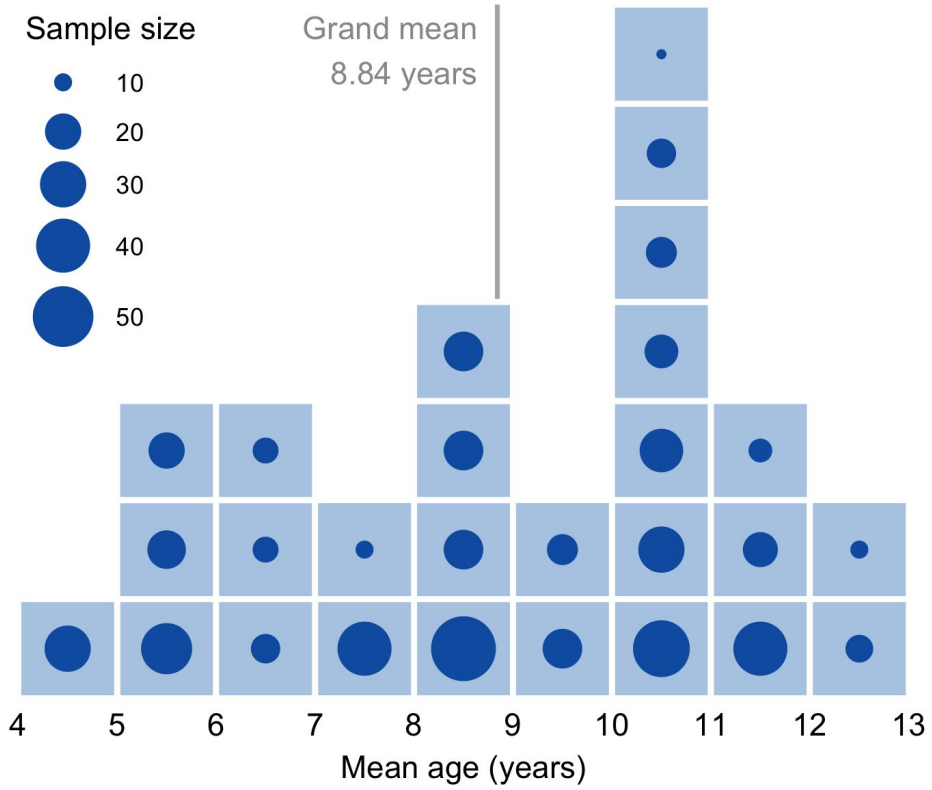
Task types
Age groups
Adult data

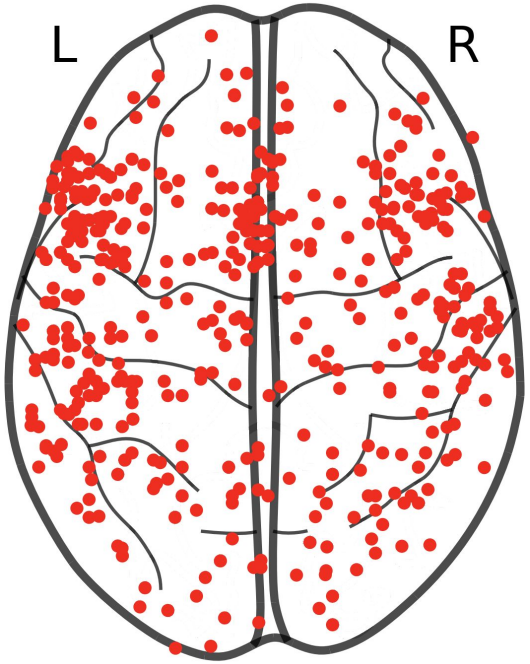
4. ROBUSTNESS CHECKS

Leave-one-out
Fail safe N

Acar et al. 2018; Albajes-Eizagirre et al. 2019; Eickhoff et al. 2012; Salo et al. 2022

AUDITORY LANGUAGE PROCESSING

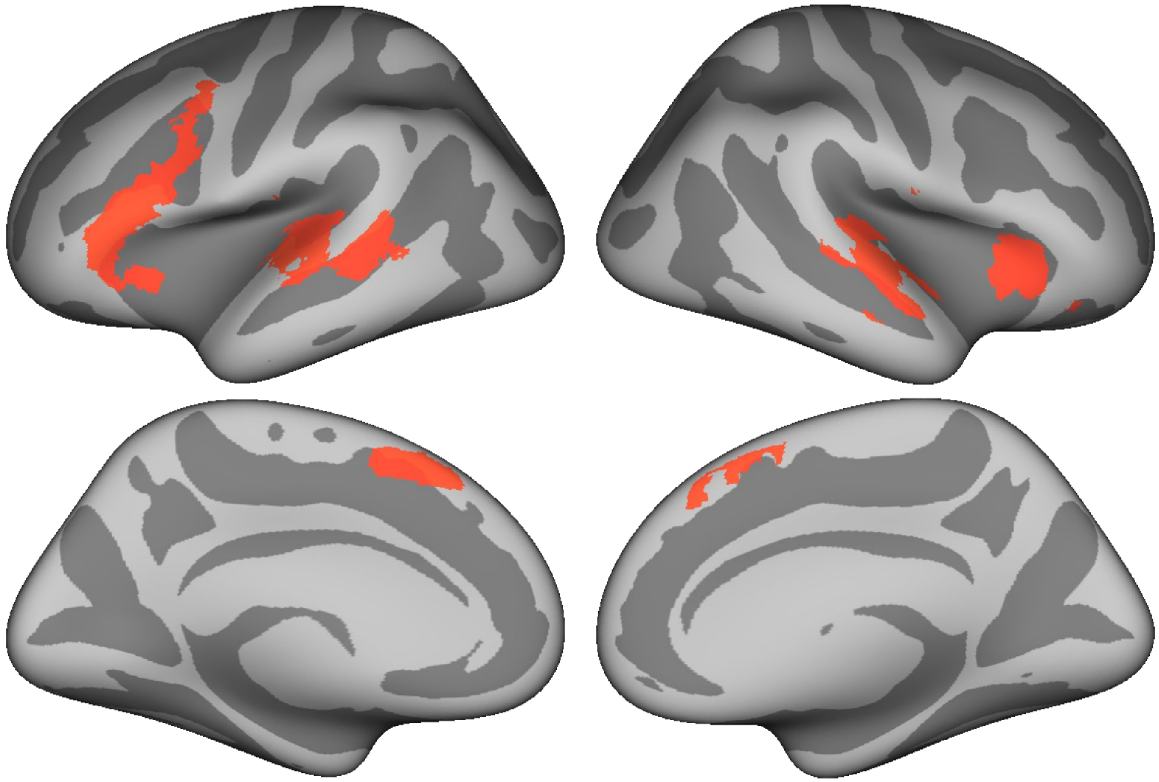




Enge, Friederici, & Skeide 2020 *NeuroImage*

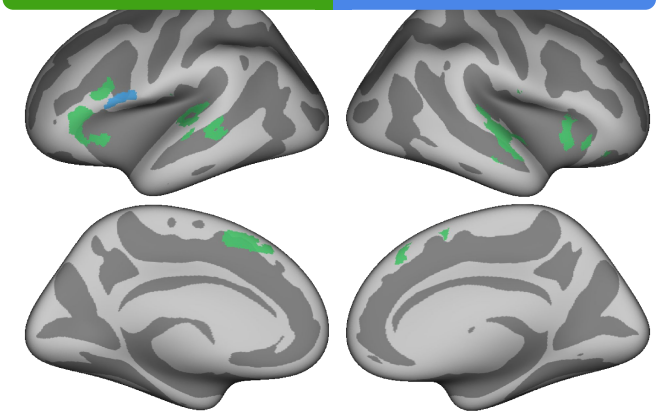
AUDITORY LANGUAGE PROCESSING

Children

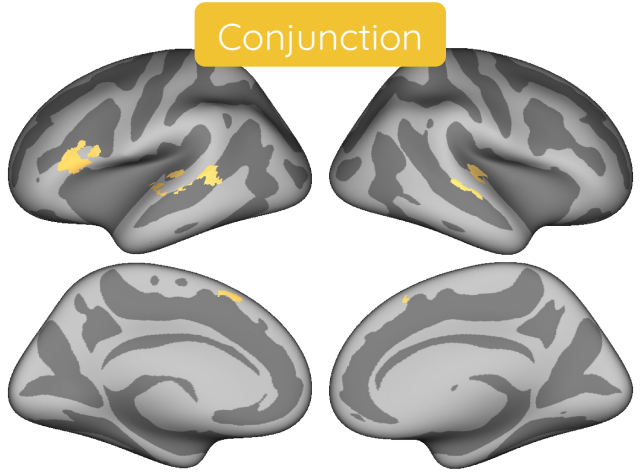


$p_{\text{cluster-FWE}} < .05$

Children > adults | Adults > children

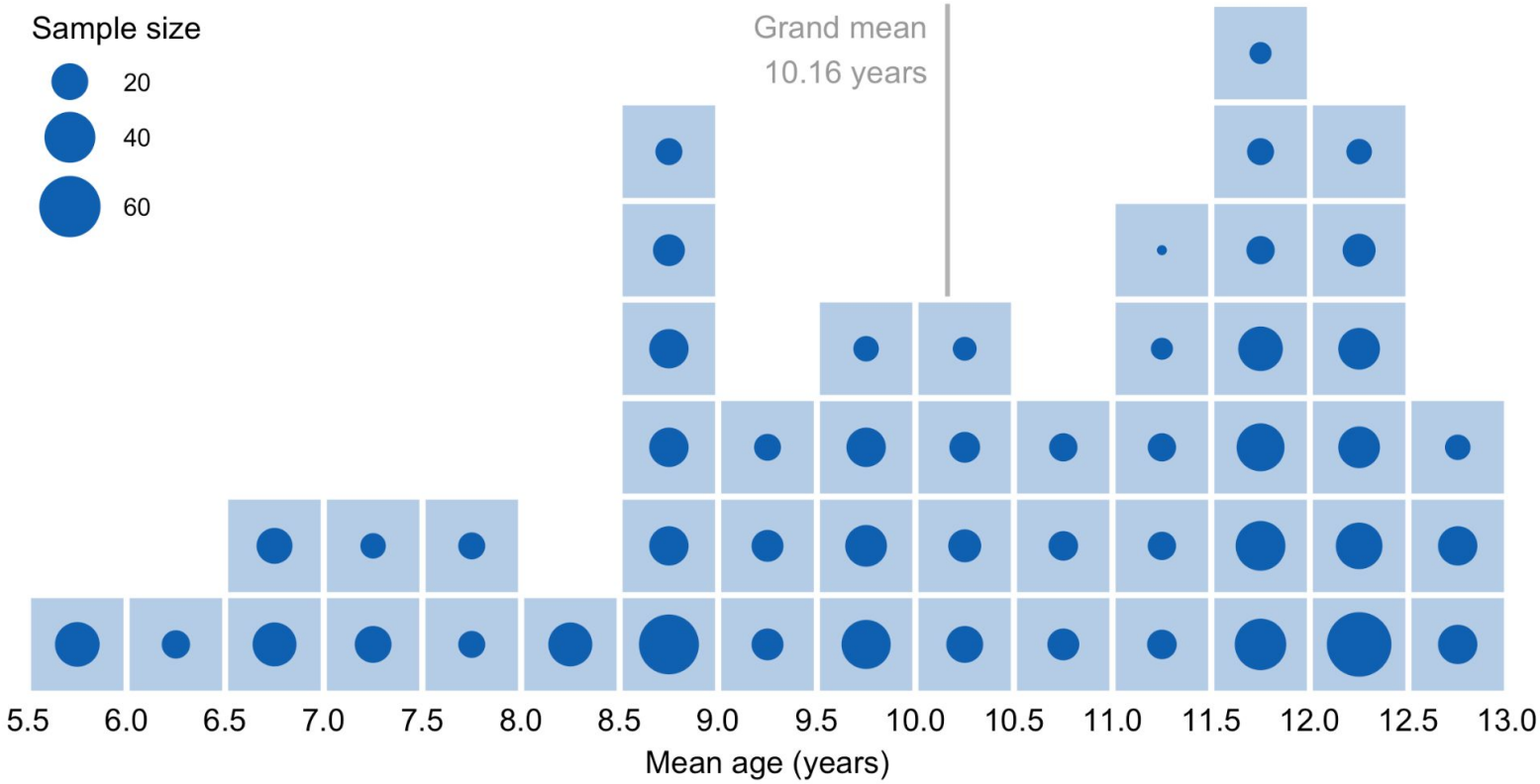


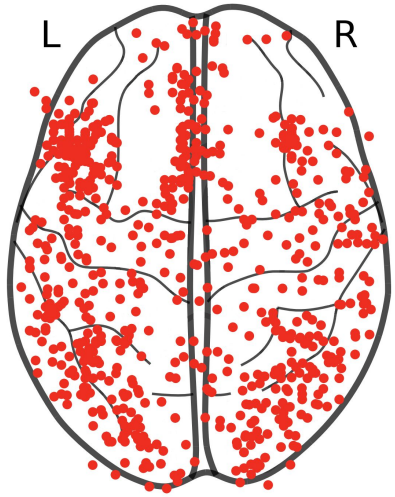
Conjunction



Enge et al. 2020; Rodd et al. 2015

SEMANTIC PROCESSING

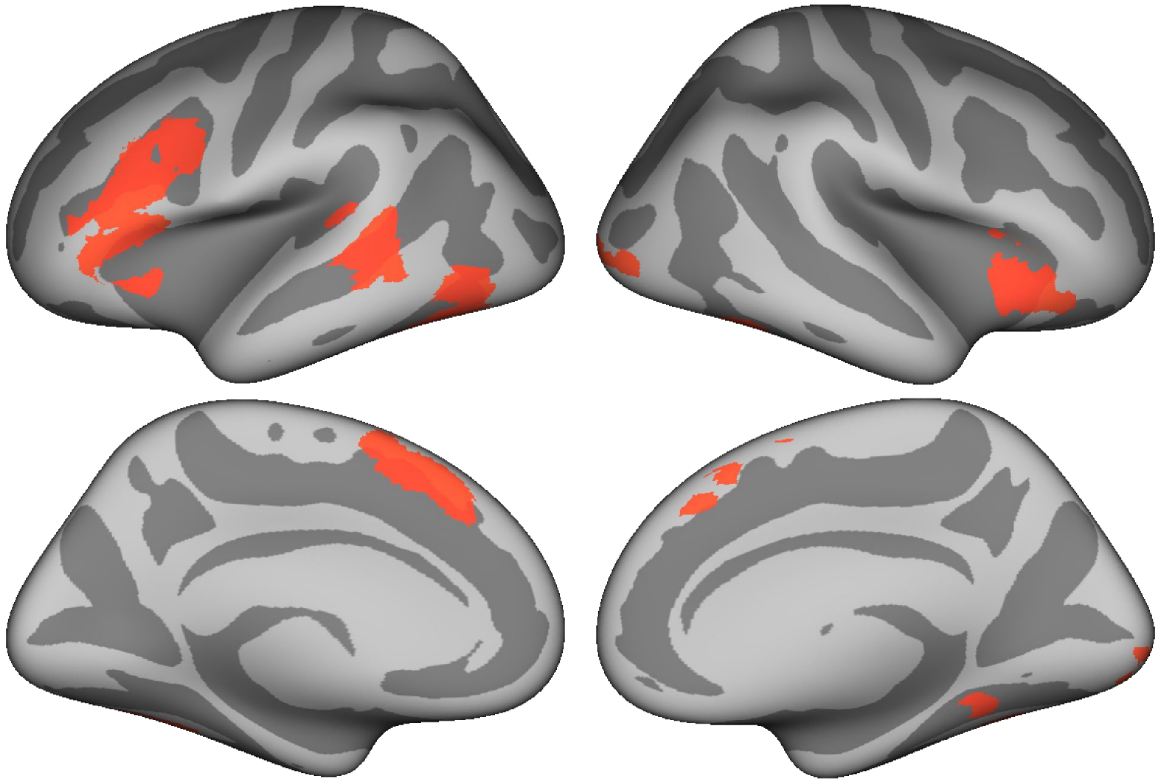




Enge, Abdel Rahman, & Skeide 2021 *NeuroImage*

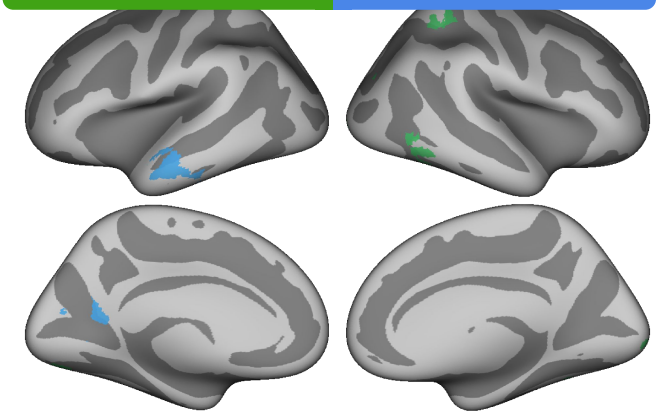
SEMANTIC PROCESSING

Children

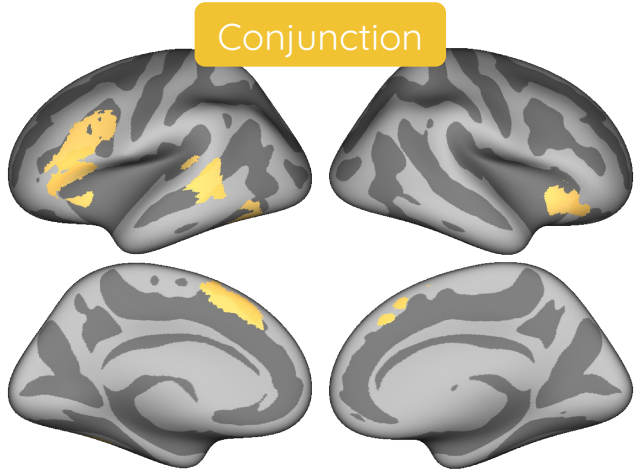


$p_{\text{cluster-FWE}} < .01$

Children > adults | Adults > children



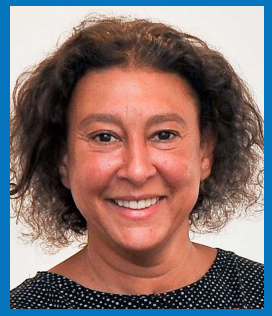
Conjunction



Enge et al. 2021; Jackson 2021

SUMMARY

- Large **overlap** in the cortical networks for language and semantics between **children** and **adults**
- Language processing: **Dissociation** in left **IFG** and **reduced lateralization**
- Semantic processing: **Reduced** recruitment of **ATL**


QUESTIONS & COMMENTS
enge@cbs.mpg.de
twitter.com/alexenge

SKEIDELAB.COM

REFERENCES

Acar, F., Seurinck, R., Eickhoff, S. B., & Moerkerke, B. (2018). Assessing robustness against potential publication bias in activation likelihood estimation (ALE) meta-analyses for fMRI. *PLOS ONE*, *13*(11), e0208177. https://doi.org/10.1371/journal.pone.0208177

Albajes-Eizagirre, A., Solanes, A., Vieta, E., & Radua, J. (2019). Voxel-based meta-analysis via permutation of subject images (PSI): Theory and implementation for SDM. *NeuroImage*, *186*, 174–184. https://doi.org/10.1016/j.neuroimage.2018.10.077

Button, K. S., Ioannidis, J. P. A., Mokrysz, C., Nosek, B. A., Flint, J., Robinson, E. S. J., & Munafò, M. R. (2013). Power failure: Why small sample size undermines the reliability of neuroscience. *Nature Reviews Neuroscience*, *14*(5), 365–376. https://doi.org/10.1038/nrn3475

Eickhoff, S. B., Bzdok, D., Laird, A. R., Kurth, F., & Fox, P. T. (2012). Activation likelihood estimation meta-analysis revisited. *NeuroImage*, *59*(3), 2349–2361. https://doi.org/10.1016/j.neuroimage.2011.09.017

Enge, A., Abdel Rahman, R., & Skeide, M. A. (2021). A meta-analysis of fMRI studies of semantic cognition in children. *NeuroImage*, *241*, 118436. https://doi.org/10.1016/j.neuroimage.2021.118436

Enge, A., Friederici, A. D., & Skeide, M. A. (2020). A meta-analysis of fMRI studies of language comprehension in children. *NeuroImage*, *215*, 116858. https://doi.org/10.1016/j.neuroimage.2020.116858

Jackson, R. L. (2021). The neural correlates of semantic control revisited. *NeuroImage*, *224*, 117444. https://doi.org/10.1016/j.neuroimage.2020.117444

Rodd, J. M., Vitello, S., Woollams, A. M., & Adank, P. (2015). Localising semantic and syntactic processing in spoken and written language comprehension: An activation likelihood estimation meta-analysis. *Brain and Language*, *141*, 89–102. https://doi.org/10.1016/j.bandl.2014.11.012

Salo, T., Yarkoni, T., Nichols, T. E., Poline, J.-B., Bilgel, M., Bottenhorn, K. L., Jarecka, D., Kent, J. D., Kimbler, A., Nielson, D. M., Oudyk, K. M., Peraza, J. A., Pérez, A., Reeders, P. C., Yanes, J. A., & Laird, A. R. (2022). NiMARE: Neuroimaging Meta-Analysis Research Environment. *NeuroLibre*, *1*(1), 7. https://doi.org/10.55458/neurolibre.00007

Samartsidis, P., Montagna, S., Nichols, T. E., & Johnson, T. D. (2017). The coordinate-based meta-analysis of neuroimaging data. *Statistical Science*, *32*(4), 580–599. https://doi.org/10.1214/17-STS624

Wager, T. D., Lindquist, M., & Kaplan, L. (2007). Meta-analysis of functional neuroimaging data: Current and future directions. *Social Cognitive and Affective Neuroscience*, *2*(2), 150–158. https://doi.org/10.1093/scan/nsm015

Yarkoni, T. (2020). The generalizability crisis. *Behavioral and Brain Sciences*, *45*, e1. https://doi.org/10.1017/S0140525X20001685