

2017-01-09-course-intro

Rick O. Gilmore

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Today's Topics

- Introduction to the course
- Scientific misconduct
- Is there a crisis of reproducibility?

Introduction to the course

Goals

- What are transparent, open, and reproducible science practices?
- Why are they important?
- How can one implement them?

Topics

- Tour of course website: <http://psu-psychology.github.io/psy-511-reproducible-research-spring-2017/>

Course structure

- 40 min lecture
- 10 min break
- ~ 2 hrs discussion/hands-on activities

Evaluation

Component	Points	% of Grade
Class participation	2 pts/class * 15 weeks = 30	25
Assignments	5 pts * 12 assignments = 60	50
Final projects	30	25
TOTAL	150	100

Tools we'll use

- R via RStudio
- The web
- git via GitHub
- Jupyter
- Slack, <http://psy511.slack.com> for communication, sharing, Q&A

Scientific misconduct

- Hauser
- Stapel

Is there a crisis of reproducibility?

- Fraud != failures to replicate or reproduce
- Incentives/disincentives related to fraud?
- What is the relationship between fraud and reproducibility?

The Reproducibility Project

- Reproducibility Project: Psychology
- (Collaboration 2015)
- Center for Open Science (COS), produces Open Science Framework (OSF)

(Collaboration 2015)

- 39/98 (39.7%) replication attempts were successful
- 97% of original studies reported statistically significant results vs. 36% of replications

So, did the studies replicate?

- (Gilbert et al. 2016)
 - Sampling error differences predicts < 100% reproducibility
 - Samples !=
 - Only 69% of original PIs “endorsed” replication protocol. Replication rate 4x higher (59.7% vs. 15.4%) in studies with endorsed protocol.
 - CI of *expected* effect sizes given sample/methodological variability? Many Labs project
- (Collaboration 2015) “... *seriously underestimated reproducibility of psychological science.*”

Issues

- Kudos to (Collaboration 2015) and (Gilbert et al. 2016) for addressing these issues openly
 - Data from (Collaboration 2015)
 - Data from (Gilbert et al. 2016)

Issues

- Reproducibility of “psychological science” vs. a specific finding
- What is the *true* effect size of a particular manipulation?
- Domain-specific differences in/challenges to reproducibility
- Possible confusion about types of reproducibility

Examples of differences that affect the approach to reproducibility in distinct scientific domains (Goodman, Fanelli, and Ioannidis 2016)

- Degree of determinism
- Signal to measurement-error ratio
- Complexity of designs and measurement tools
- Closeness of fit between hypothesis and experimental design or data
- Statistical or analytic methods to test hypotheses

Examples of differences that affect the approach to reproducibility in distinct scientific domains (Goodman, Fanelli, and Ioannidis 2016)

- Typical heterogeneity of experimental results
- Culture of replication, transparency, and cumulating knowledge
- Statistical criteria for truth claims
- Purposes to which findings will be put and consequences of false conclusions

What does research reproducibility mean? (Goodman, Fanelli, and Ioannidis 2016)

- Methods
- Results
- Inferential

What does research reproducibility mean? (Goodman, Fanelli, and Ioannidis 2016)

- Methods reproducibility
 - “...the ability to implement, as exactly as possible, the experimental and computational procedures, with the same data and tools, to obtain the same results.”

What does research reproducibility mean? (Goodman, Fanelli, and Ioannidis 2016)

- Results reproducibility
 - “(previously described as replicability) refers to obtaining the same results from the conduct of an independent study whose procedures are as closely matched to the original experiment as possible.”

What does research reproducibility mean? (Goodman, Fanelli, and Ioannidis 2016)

- Inferential reproducibility
 - “...refers to the drawing of qualitatively similar conclusions from either an independent replication of a study or a reanalysis of the original study”

Steps toward improving transparency and openness

- Transparency and openness promotion (TOP) guidelines in publishing
 - (Nosek et al. 2015)

TOP guidelines

- Citation
- Data transparency
- Analytic methods (code) transparency
- Design and analysis transparency
- Preregistration of studies
- Preregistration of analysis plans
- Replication

Who’s signed on and who hasn’t?

- List of signatories
- Declines
 - (Lash 2015)
 - Implementation would run counter to efforts to “... *maintain an editorial policy that encourages creativity and novelty, resists regimentation of research practices to the extent practicable, and invites challenges to current scientific habits and conventions through innovation in epidemiologic theory and practice.*”

Barriers to greater openness and transparency

- Technical
- Cultural
 - Old habits
 - Fear of embarrassment, retaliation, effects on career
- Economic
 - Intellectual property

References

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- Goodman, Steven N., Daniele Fanelli, and John P. A. Ioannidis. 2016. “What Does Research Reproducibility Mean?” *Science Translational Medicine* 8 (341): 341ps12–341ps12. doi:10.1126/scitranslmed.aaf5027.
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