

Replication & Reproducibility in Social Science

CJUS-P 680-11059 (Fall 2021)

[Approved in lieu of CJUS-P 594 "Methods" degree requirement]

Wednesday, 9:25-11:55 (In-person, GY 4069)

Department of Criminal Justice
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via in-person or Zoom

Required books:

- *Science Fictions: How Fraud, Bias, Negligence, and Hype Undermine the Search for Truth.* 2020. By Stuart Ritchie. (Metropolitan).
- *What Is This Thing Called Science?* 2013 (4th. Ed.). By A.F. Chalmers. (Open University).

Course Description:

- This course aims to improve your ability to review, evaluate, and apply social science research methods and, relatedly, to critically assess "what we know" in specific research areas. In doing so, we will discuss challenges encountered when attempting to produce trustworthy and reliable empirical findings and identify some strategies for overcoming such challenges.
- Though many of the methodological issues raised in this course have been identified and debated for as long as people have engaged in social science, these issues have garnered increasing attention over the last decade alongside the emergence of the well-documented "replication crisis" in (social) science. There seems to be a growing recognition (among some) that many of the issues identified as causes of the "replication crisis" in other disciplines also are present – and perhaps even highly prevalent – in the day-to-day practice of scientific sociology, criminology, and criminal justice. Yet, as disciplines, sociology, criminology, and criminal justice have been relatively slow in adopting reforms meant to increase veracity, reliability, and trust in our empirical findings.
- I jointly designed this course in collaboration with Dr. Jacob C. Day (UNC-Wilmington), a former graduate student colleague, current collaborator, and long-time friend. Together, our aim was to develop the course that we wish we would have had as our first-year methods course in graduate school. We expect that developing an appreciation for and the technical skills necessary to practice open and reproducible science will become increasingly valued in professional social science both within and outside academia. Hence, we would rather you start your careers with these skills as opposed to retooling later in your professional careers like we are doing. We also think you are better off with a realistic and critical view of the methodological challenges that are perhaps endemic to social scientific fields. You cannot start to imagine changing typical practices and/or addressing these challenges until you have a clear picture of what you are facing.
- Of course, you should *not* expect to come out of this course knowing everything you need to know to write a thesis or dissertation and to carry out your own reproducible and trustworthy independent research. At minimum, my hope is that through this course you develop an appreciation for the scientific enterprise, the importance of research design, and the current debates and reforms related to practicing open and reproducible social science. I hope you will also come to see that learning how to collect and analyze data is just that – an ongoing process of *learning*. Likewise, as a professional social scientist, I hope you leave this course prepared to continue the difficult but rewarding investment in this learning process throughout your graduate training and throughout the rest of your professional career.

(Revised 2021.09.13)

Course goals and objectives

- My primary goal in this course is to guide and evaluate your pursuit of the following objectives:
 - *Understand meaning, causes, and possible solutions to the so-called “replication crisis”*
 - *Relatedly, identify various challenges encountered when attempting to produce trustworthy and reliable empirical findings in social science research, as well as identify potential solutions to these challenges*
 - *Understand how different philosophies of science shape approaches to research methods*
 - *Develop a capacity to review, evaluate, and apply social science research methods and to critically assess “what we know”*
 - *Develop an appreciation for, and practice, some of the technical skills necessary to conduct one’s own open, reproducible, and trustworthy social science research*
- In pursuit of these objectives, you are expected to do the following:
 - *Read assigned materials, then summarize, react, and ask questions about the readings*
 - *Demonstrate engagement with and comprehension of course materials by being prepared for and participating in class discussions in an intelligent and informed way*
 - *Complete assignments intended to provide a basic introduction in how to conduct reproducible social science research using R and RStudio*
 - *Reproduce descriptive statistics from an existing research study following reproducibility principles using R, and conduct a peer review of a classmate’s reproducibility project.*

Course Requirements:

- **Class participation & contribution: 10% (100 out of 1000 course points)**
 - You are expected to read and study carefully all of the assigned material prior to the class meeting in which it is to be discussed and to participate effectively in class discussion. Please note that it is acceptable to be wrong, to misinterpret, to be shy, or simply to misunderstand. However, it is unacceptable to be unprepared.
- **Reading assignments: 18% (180 out of 1000 course points)**
 - Each week you have assigned readings (marked with asterisk on schedule), you are required to submit a “Reading Assignments” document with the following sections:
 - i. Reading Summary – Summarize the weekly readings in a few sentences.
 - ii. Reading Reaction – Describe reactions you had to weekly readings.
 - iii. Discussion Questions – Write two (2) discussion questions based on weekly readings each week. At least one of these should be a “synthesis” question that covers shared ideas across multiple readings. The other question can be specific to a particular reading.
 - Reading Assignment should be submitted by **Monday at 8am** via Canvas. In addition to assessing whether Reading Assignments were turned in on time, I will evaluate these summaries, reactions, and questions for diligence, thoughtfulness, pertinence to the weekly topic of discussion, and efforts at comprehension displayed.
 - There are 13 weeks with reading assignments due; yet the scoring counts 12 assignments only (12*15pts = 180pts). For attendance flexibility purposes, I will drop one weekly grade.

- **R Assignments: 30% (300 out of 1000 course points)**
 - These assignments are intended to provide you with a basic introduction to conducting reproducible data science using R and RStudio. Each is listed as an “R Assignment” (1 through 4) on the course schedule below. See Canvas for details. After completing these assignments, you should have a firm foundation for reproducing results from a table or figure containing simple descriptive statistics (see “Reproducibility Project” below).
 - R Assignment 1 (45pts): *Introduction to R & RStudio*
 - R Assignment 2 (55pts): *Introduction to RMarkdown*
 - R Assignment 3 (100pts): *Downloading Data & Reproducing Figure*
 - R Assignment 4 (100pts): *Conceptual Replication; Visualization; Images; Reproducible Files*

- **Reproducibility Project: 32% (320 out of 1000 course points)**
 - There are four parts to this *Reproducibility Project*, listed as a “Project Assignment” (1–4) on the course schedule below. See Canvas for details. To complete this project in its entirety, you will likely need to combine what you learned in the “R Assignments” (above) with additional self-directed learning via online searches for additional R vignettes; this is a normal part of data science – in fact, it something that I do on an almost daily basis.
 - Project Assignment 1 (50pts): *Find Article with Data Available Online to Reproduce*
 - Project Assignment 2 (85pts): *Describe & Justify Reproduction, Share Image of Original Study's Table/Figure using R; Read Data into R; Summarize Raw Variables*
 - Project Assignment 3 (85pts): *Submit First Draft of Reproduction for Peer Review*
 - Project Assignment 4 (100pts): *Final Reproducibility Project*

- **Peer Review Assignment: 10% (100 out of 1000 course points)**
 - In addition to conducting your own reproducibility project, each of you will also conduct a “peer review” of one classmate’s reproducibility project.
 - Immediately following submission of the first draft of your project, I will send the link to your submitted project’s shared drive folder to ONE of your classmates to review. I will loosely follow a “single-blind” review format. That is, the reviewer will know the author, but I will not formally identify the reviewer’s name to the author. Of course, in small classes, reviewer anonymity cannot be guaranteed.
 - NOTE: You must submit the first draft of your project on time (i.e., by **8am on Wednesday, 11/10**) to participate and earn points in this required peer review. Failure to submit the term paper in on time may result in a “0” on this assignment.
 - Peer reviewers are responsible for providing detailed and constructive feedback (i.e., not just “good job!” – there are always ways we can improve our work) using a helpful and professional tone. In conducting your peer review, think about the steps you have taken so far and assess the things you have learned. E.g.,
 - *Description/Justification*: Does the author describe and justify the reproduction project aims clearly and effectively? Is the original study included in one of the project folders? Can I find the table or figure in the original study that the author is attempting to reproduce? Is the original study and that specific table/figure described clearly and accurately?

- *Project File Structure*: Is the RMarkdown file in the “root” folder on the shared drive? Are there separate and clearly marked folders following recommended workflow practices (e.g., Data; Articles; Images)? Can I open the RMarkdown file?
- *R Code Reproducibility*: After installing any necessary packages, can I successfully run all R Code chunks, or does running the code generate errors? If errors are generated, is it immediately obvious what those errors are, and can I fix them with minimal effort to continue reviewing R Code chunks? Can I suggest anything to the author to improve their R Code chunks (e.g., error fixes; efficiency improvements; reproducibility improvements; useful additions) or their text descriptions of them?

Grade scale

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|-------------|------------|------------|------------|---------|
| A+ : 97-100 | B+ : 87-89 | C+ : 77-79 | D+ : 67-69 | F: 0-59 |
| A : 93-96 | B : 83-86 | C : 73-76 | D : 63-66 | |
| A- : 90-92 | B- : 80-82 | C- : 70-72 | D- : 60-62 | |

Special Needs:

- If you have a disability that requires accommodation, please see me as soon as possible. For more information, contact Disability Services for Students (DSS) by phone at 812-855-7578, by email at iubdss@indiana.edu, or in person at Herman B. Wells Library, Suite W 302.

Academic Integrity:

- As a student at IU, you are expected to adhere to the standards and policies detailed in the *Code of Student Rights, Responsibilities, and Conduct (Code)*. When you submit an assignment with your name on it, you are signifying that the work contained therein is yours, unless otherwise cited or referenced. Any ideas or materials taken from another source for either written or oral use must be fully acknowledged. All suspected violations of the *Code* will be reported to the Dean of Students and handled according to University policies. Sanctions for academic misconduct may include a failing grade on the assignment, reduction in your final course grade, and a failing grade in the course, among other possibilities. If you are unsure about the expectations for completing an assignment or taking a test or exam, be sure to seek clarification beforehand.

Maintaining a supportive learning environment:

- The role of all employees and students is to create and maintain a supportive and harassment-free working and learning environment for all members of the campus community. Since students learn the most when they are actively engaged in learning, classroom discussions will be a major part of the class, and I will expect everyone to engage in these discussions from an intellectual standpoint. If at any time you feel threatened or uneasy, please bring it to my attention immediately.

Technical issues:

- Technical and logistical problems, such as being unable to access a computer, computer failure, problems with internet connections (such as speed or quality of the connection) or browser, failure to check that your assignments have properly uploaded, etc., will not automatically result in remedies favorable to students. Even if the technical or logistical problem is not your fault, you are not guaranteed a retake or “do-over” for the assignment. Any such issues are dealt with on a case-by-case basis. Further, to avoid last minute problems, it is highly recommended that you complete readings, videos, and assignments as early as possible during each module.

Course Outline (* indicates reading summaries & discussion questions are due by Monday at 8:00am.)

8/25 1. Introduction

Get acquainted; Explain course logic, schedule, & assignments

9/1 2: Science: A Candle in the Dark *

Sagan (1995) *Demon-Haunted World, Ch.1: The Most Precious Thing*
Ritchie (p.1-23) *Chapter 1: How Science Works*
Chalmers (p.xix-24) *Intro. & Chapter 1: Science, Observation, & Facts*

Optional readings:

Pacheco-Vega:

[Preparing for reading-intensive seminar](#) & [AIC method](#)

R Assignment 1

Introduction to R & RStudio

9/8 3: Science: A Candle, or a House of Cards? *

Ritchie (p.25-43): *Chapter 2: The Replication Crisis*
Chalmers (p.25-37) *Chapters 2 & 3: Observation & Experiment as Intervention*
Bem (2011) *Feeling the Future*
Open Science Collab. (2015) *Estimating the Reproducibility of Psychological Science*

Optional readings:

Yarkoni (2011)

[Bem & the Psychology of Parapsychology](#)

R Assignment 2

Introduction to RMarkdown

9/15 4: Social Norms & Deviance in Science *

Ritchie (p.48-80): *Chapter 3: Fraud*
Merton (1942) *Chapter 13: Normative Structure of Science*
Bartlett (2019) *Stewart Retractions*
Pickett (2020) *Stewart Retractions*
Neyfakh (2015) *Alice Goffman & Ethnics of Ethnography*

Optional readings:

Janz & Freese 2021

Replication Golden Rule

Project Assignment 1

Find Article with Data Available Online to Reproduce

9/22 5: Is Scientific “Knowledge” Full of Bias? *

Ritchie (p.81-122): *Chapter 4: Bias*
Chalmers (p.38-54) *Chapter 4: Induction*
Roscigno & Preto-Hodge (2021) *Racist Cops*
Peyton (2021) *Racist Cops*
Hu (2021) *Race, Policing, & Limits of Social Science*

9/29 6: Negligence & “Falsification” in Social Science *

Ritchie (p.123-144): *Chapter 5: Negligence*
Chalmers (p.55-68) *Chapter 5: Intro. to Falsificationism*
Knox & Mummolo (2020) *Race & Officer-Involved Shootings*
Johnson et al. (2020) *PNAS Article Retraction*
Massey & Waters (2020) *PNAS Article Retraction*

Optional readings:

Long (2020)

Workflow for Reproducible Results

R Assignment 3

Downloading Data & Reproducing Figure

10/6 7: Don't Believe the Hype! *

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| Ritchie (p.145-172): | <i>Chapter 6: Hype</i> |
| Chalmers (p.69-80) | <i>Chapter 6: Sophisticated Falsificationism</i> |
| Miller et al. (2020) | <i>Police & Bias Training</i> |
| Kaste (2020) | <i>Police & Bias Training</i> |
| Singal (2020) | <i>Quick Fix Psychology</i> |
| <i>Optional readings:</i> | |
| Kastellec & Leoni (2007) | <i>Graphs Not Tables</i> |

10/13 8: Perverse Incentives Spoil Science *

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| Ritchie (p.175-198): | <i>Chapter 7: Perverse Incentives</i> |
| Chalmers (p.81-96) | <i>Chapter 7: Limits of Falsificationism</i> |
| Gartner et al. (2012) | <i>Salami Slicing</i> |
| Cullen et al. (2013) | <i>Salami Slicing</i> |
| Cohen (2012) | <i>Overly Similar Publications</i> |
| Tiokhin (2020) | <i>Honest Signaling in Academic Publishing</i> |
| <i>Optional readings:</i> | |
| Smaldino & McElreath (2016) | <i>Natural Selection of Bad Science</i> |
| Oreskes (2021) | <i>Why Bad Science is Appealing</i> |
| Else (2021) | <i>Fabricated Publications</i> |
| Simonsohn (2015) | Reducing Fraud in Science (Data Colada) |

R Assignment 4***Conceptual Replication; Visualization; Images; Reproducible files*****10/20 9: Questionable Research Practices (QRPs) & Open Science Practices (OSPs) ***

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| Ritchie (p.199-237): | <i>Chapter 8: Fixing Science</i> |
| Chalmers (p.97-119) | <i>Chapter 8: Kuhn's Paradigms</i> |
| Chin et al. (2021) | <i>QRPs & OSPs in Criminology</i> |
| Schimmack & von Hippel (2021) | <i>Testing the "Replicability Index," Part 1 & Part 2</i> |
| Wooditch et al. (2018) | <i>Outcome Reporting Bias</i> |
| <i>Optional readings:</i> | |
| Sweeten (2020) | <i>Standard Errors in Quantitative Criminology</i> |
| Chang & Li (2017) | <i>Failures to Reproduce with Author's Code & Help</i> |
| Perkel (2020) | Does Your Ten-Year-Old Code Still Run? |
| Simonsohn (2021) | Version control in R with Groundhog |

10/27 10: Garden of Forking Paths *

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| Ritchie (p.239-254): | <i>Epilogue & Reading a Scientific Paper</i> |
| Chalmers (p.121-137) | <i>Chapter 9: Lakatos</i> |
| Gelman & Loken (2013) | <i>Garden of Forking Paths</i> |
| Rohrer et al. (2021) | <i>Loss of Confidence Project</i> |
| Siberzahn & Uhlmann (2015) | <i>Many Analysts, One Data Set</i> |
| <i>Optional readings:</i> | |
| Ioannidis (2005) | <i>Why Most Published Research is False</i> |
| Simmons et al. (2011) | <i>Researcher Degrees of Freedom</i> |

Project Assignment 2***Describe/Justify Reproduction, Read Data, Summarize Vars***

11/3 11: Wait, Is There a Theory Crisis Too? *

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| Chalmers (p.138-147) | <i>Chapter 10: Feyerabend</i> |
| Eronen & Bringmann (2021) | <i>Theory Crisis in Psychology</i> |
| Fried (2021) | On Theory |
| Dooley & Goodison (2020) | <i>Rejecting Theory in US Criminology</i> |
| Farrall & Sparks (2020) | <i>Response to Rejecting Theory in US Criminology</i> |
| <i>Optional readings:</i> | |
| Meehl (1967) | <i>Theory Testing in Psychology & Physics</i> |
| Fried (2021) | <i>Theories and Models</i> |
| Robinaugh et al. (2021) | <i>Formal Theory</i> |

11/10 12: Messy Measurement & Unclear Causality *

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| Chalmers (p.149-160) | <i>Chapter 11: Against a Universal Method</i> |
| Rohrer (2018) | <i>Graphical Causal Models</i> |
| Flake & Fried (2020) | <i>Questionable Measurement Practices</i> |
| Lundberg et al. 2021 | <i>What is Your Estimand?</i> |
| Auspurg & Brüderl (2021) | <i>Many Analysts, One Data Set Revisited</i> |
| De Menard (2020) | What's Wrong with Social Science |
| <i>Optional readings:</i> | |
| Gordon et al. (2020) | <i>Replication Rates by Field</i> |

Project Assignment 3***Submit Reproduction for Peer Review***

11/17 No Class – ASC Meetings

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| <u><i>Optional Assignment/Activity</i></u> | <i>Translating Causal Claims into Graphical Causal Models [R]</i> |
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11/24 No Class –Thanksgiving Break

12/1 13: Better Science with Bayes? *

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| Chalmers (p.161-177) | <i>Chapter 12: Bayesian Approach</i> |
| Gelman & Weakliem (2009) | <i>Of Beauty, Sex, & Power</i> |
| Brauer et al. (2019) | <i>Improving Inferences from Underpowered Designs</i> |
| Wasserstein & Lazar (2016) | <i>ASA Statement on p-Values</i> |
| Greenland et al. (2016) | <i>Guide to p-Value Misinterpretations</i> |

Optional readings:

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| Kruschke & Liddell (2018) | <i>Bayesian Data Analysis for Newcomers</i> |
| Lakens (2021) | <i>Correctly Used p-Value</i> |
| Lakens (2021) | <i>Sample Size Justification</i> |
| Barnes et al. (2020) | <i>Statistical Power in Criminology</i> |
| “New Statistics” ESCI | Visualizations |

Peer Review Assignment***Submit Peer Review of Classmate’s Reproduction***

12/8 14: Preregister Your Risky Predictions *

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| Chalmers (p.179-196) | <i>Chapter 13: New Experimentalism</i> |
| Gelman et al. (2019) | Review #2 (Haig) from Many Perspectives on Mayo's SIST |
| Navarro (2020) | <i>Paths in Strange Spaces</i> |
| Scheel et al. (2021) | <i>Should We Spend Less Time Testing Hypotheses?</i> |
| Murphy et al. (2021) | <i>Ethnography & Data Transparency in Information Age</i> |
| <i>Optional readings:</i> | |
| Chatard et al. (2020) | <i>Failing to Follow Preregistration</i> |
| Lakens (2018) | Strong vs. Weak Hypothesis Tests |
| Lakens (2019) | <i>Preregistration & Error Control</i> |
| Szollosi et al. (2019) | <i>Is Preregistration Worthwhile?</i> |
| Aguinis & Solarino (2019) | <i>Transparency & Replicability in Qualitative Research</i> |
| Pratt et al. (2020) | <i>Decoupling Transparency from Replication in Qual. Research</i> |
| Additional resources: | Transparency & OSP in Qualitative Research |
| Wilson & Botham (2021) | <i>Addressing reproducibility concerns in grant proposals</i> |

12/15 Finals Week

Project Assignment 4

Final Reproducibility Project Due

Course Reference List

Main Books

- Chalmers, Alan. 2013. *What Is This Thing Called Science?* 4th ed. Queensland, Australia: University of Queensland Press.
- Ritchie, Stuart. 2020. *Science Fictions*. New York: Metropolitan Books.

Articles, Blogs, and Chapters

- Aguinis, Herman, and Angelo M. Solarino. 2019. "Transparency and Replicability in Qualitative Research: The Case of Interviews with Elite Informants." *Strategic Management Journal* 40 (8): 1291–1315. <https://doi.org/10.1002/smj.3015>.
- Auspurg, Katrin, and Josef Brüderl. 2021. "Has the Credibility of the Social Sciences Been Credibly Destroyed? Reanalyzing the 'Many Analysts, One Data Set' Project." *Socius* 7 (January): 23780231211024420. <https://doi.org/10.1177/23780231211024421>.
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- Chatard, Armand, Gilad Hirschberger, and Tom Pyszczynski. 2020. "A Word of Caution about Many Labs 4: If You Fail to Follow Your Preregistered Plan, You May Fail to Find a Real Effect." PsyArXiv. <https://doi.org/10.31234/osf.io/ejubn>.
- Chin, Jason, Justin Pickett, Simine Vazire, and Alex O. Holcombe. 2021. "Questionable Research Practices and Open Science in Quantitative Criminology." SocArXiv. <https://doi.org/10.31235/osf.io/bwm7s>.
- Cohen, Phillip N. 2012. "One Case of Very Similar Publications, with Some Implications and Suggestions." *Family Inequality* (blog). June 11, 2012. <https://familyinequality.wordpress.com/2012/06/11/one-case/>.

- Cullen, Francis T. 2013. "The Corruption of Benevolence Revisited: Why Editorial Snooping is a Bad Idea." *The Criminologist* 38 (2): 22-26. <https://asc41.com/wp-content/uploads/ASC-Criminologist-2013-03.pdf>
- *Block, Carolyn Rebecca, Osgood, D. Wayne, Gartner, Rosemary, Baumer, Eric, and Cullen, Francis T. 2013. "Overly Similar Journal Submissions: A Discussion." *The Criminologist* 38 (2): 21-26. <https://asc41.com/wp-content/uploads/ASC-Criminologist-2013-03.pdf>
- De Menard, Alvaro. 2020. "What's Wrong with Social Science and How to Fix It: Reflections After Reading 2578 Papers." *Fantastic Anachronism* (blog). September 11, 2020. <https://fantasticanachronism.com/2020/09/11/whats-wrong-with-social-science-and-how-to-fix-it/index.html>.
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- Gelman, Andrew, and Eric Loken. 2013. "The Garden of Forking Paths : Why Multiple Comparisons Can Be a Problem , Even When There Is No ' Fishing Expedition ' or ' p-Hacking ' and the Research Hypothesis Was Posited Ahead of Time *." http://www.stat.columbia.edu/~gelman/research/unpublished/p_hacking.pdf.
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