

STOCKHOLMS UNIVERSITET

Psykologiska institutionen

Forskarutbildningen

## Course Syllabus

(200226)

## **Reproducibility**

**(3-5 hp, Spring 2020)**

Coordinator:

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## **Reproducibility**

In the last few decades, psychology has experienced a replication crisis: Many apparently well-established textbook findings have been impossible to replicate. Reasons for this include a likely abundance of false-positive results in the psychology literature (via questionable research practices), and the fact that many studies do not contain sufficient information to know what was done. For example, if it is unclear how the original data were processed and analyzed, reanalyses of these data may provide results that differ from the original results. So, not knowing all the steps that researchers took to obtain their results makes it impossible to gauge the robustness of any effect in psychology. Because reproducible results are critical for scientific progress, researchers need to do their utmost to ensure reproducibility. Two practices are particularly promising: Preregistration and data sharing.

The goal of this course is to understand how to conduct reproducible science. This course will allow students to explore key concepts in reproducibility and to help them conduct reproducible research. As part of the course, students will write a preregistration (actual or hypothetical) and learn how to share data (actual or hypothetical) via the Stockholm University depository. This course is offered as part of the research education for doctoral students at the Department of Psychology, Stockholm University.

Students are expected to read the course literature independently. Topics include reproducibility, preregistration, and data sharing. However, to facilitate understanding, students will have the opportunity to participate in discussion seminars on selected papers (ReproducibiliTea headed by Stephen Pierzchajlo and Rasmus Eklund). To complete the exam, students will need to study the literature and to complete the practical requirements (preregistration and data sharing).

The course can be taken for between 3 and 5 hp. All students will have to complete the practical requirements. For 3 hp, the reading list of scientific articles is about 150 pages long, and for each additional point (up to 5 hp), the reading list of scientific articles is extended by about 100 pages. Although a reading list is available, students may suggest alternative articles if these are more relevant for their own studies.

### **Learning outcomes**

After completing the course, students are able to:

1. Explain the importance of reproducibility for psychological research.
2. Describe landmark studies and concepts in reproducibility.
3. Write a preregistration (hypothetical or actual) according to current best practice (see OSF.org).
4. Share data openly via the Stockholm University depository (figshare).

### **Requirements for participation**

Admission to postgraduate education at a university in the social sciences or a related field.

### **Forms of examination**

Students participate in at least five discussion seminars (ReproducibiliTea) or write two-page summaries and discussions of five landmark studies in reproducibility. Students write a preregistration (hypothetical or actual) according to best practice (see OSF.org). Students share data (hypothetical or actual) according to best practice via the Stockholm University depository. The topic for the preregistration needs to be approved by the course leader.

## **Grade**

Students will earn pass or fail for their work in the discussion seminars, in the preregistration, and in data sharing. To pass the course, students need to participate in at least five discussion seminars (in person or by writing summaries), to write a preregistration (hypothetical or actual) according to best practice (see OSF.org), and to share data (hypothetical or actual) according to best practice via the Stockholm University depository.

## **Course Literature**

The list of scientific articles comprises between about 150 pages (for 3 hp) and 350 pages (5 hp).

To obtain 3 hp, students need to study about 150 pages of scientific articles. Students may choose from the list below or propose other relevant articles.

### **1. Replication crisis**

#### **Reproducibility Now: Many studies don't reproduce and why**

Open Science Collaboration (2015). Estimating the reproducibility of psychological science. *Science*, 349(6251), 943. <https://doi.org/10.1126/science.aac4716>.

#### **Reproducibility narratives**

Fanelli, D. (2018). Opinion: Is science really facing a reproducibility crisis, and do we need it to? *PNAS*, 115(11), 2628-2631.

#### **Replicating landmark studies**

Klein, R. A., et al. (2018). Many labs 2: investigating variation in replicability across sample and setting. *Advances in Methods and Practices in Psychological Science*, 1(4), 443-490.

#### **Has the debate gone too far? Things will just turn out fine, won't they?**

Pashler, H., & Harris, C. R. (2012). Is the Replicability Crisis Overblown? Three Arguments Examined. *Perspectives on Psychological Science*, 7(6), 531–536.

#### **And the future? The myth of self-correction**

Smaldino, P. E., & McElreath, R. (2016). The natural selection of bad science. *Royal Society Open Science*, 3(9), 1-17.

### **2. Questionable research practices**

#### **Examining analytic flexibility in Psychology**

Simmons, J. P., Nelson, L. D., & Simonsohn, U. (2011). False-Positive Psychology. *Psychological Science*, 22(11), 1359–1366.

#### **Examining analytic flexibility in Science**

Ioannidis J. P. A. (2005). Why Most Published Research Findings Are False. *PLoS Med*, 2(8): 0696-0701.

#### **Questionable Research Practices**

John, L. K., Loewenstein, G., & Prelec, D. (2012). Measuring the Prevalence of Questionable Research Practices With Incentives for Truth Telling. *Psychological Science*, 23(5), 524–532.

### **Analytical flexibility illustrated**

Silberzahn, R., et al. (2018). Many Analysts, One Data Set: Making Transparent How Variations in Analytic Choices Affect Results. *Advances in Methods and Practices in Psychological Science*, 1(3), 337–356.

### **Statistics as a ritual**

Gigerenzer, G. (2004). Mindless statistics. *The Journal of Socio-Economics*, 33(5), 587-606. doi:10.1016/j.socec.2004.09.033

## **3. Hypothesis generation vs. testing**

### **Differentiating confirmation and exploration**

Wagenmakers, E.-J., Wetzels, R., Borsboom, D., J., H. L., & Kievit, R. A. (2012). An Agenda for Purely Confirmatory Research. *Perspectives on Psychological Science*, 7(6), 632–638.

### **Scientific creativity through the historical lens**

Wagenmakers, E.-J., Dutilh, G., & Sarafoglou, A. (2018). The Creativity-Verification Cycle in Psychological Science: New Methods to Combat Old Idols. *Perspectives on Psychological Science*, 13(4), 418–427.

## **4. Reproducible science**

### **Reproducible science overview**

Munafò et al. 2017. A manifesto for reproducible science. *Nature Human Behaviour*, 1(1), 1-9.

### **Replication - important or not?**

Zwaan, R. A., Etz, A., Lucas, R. E., & Donnellan, M. B. (2018). Making replication mainstream. (Openly available at <https://psyarxiv.com/4tg9c/>)

### **Open science**

Spellman, Barbara A., Elizabeth A. Gilbert, and Katherine S. Corker. "Open Science." In *Stevens' Handbook of Experimental Psychology and Cognitive Neuroscience*, edited by John T. Wixted, 1–47. Hoboken, NJ, USA: John Wiley & Sons, Inc., 2018.

<https://doi.org/10.1002/9781119170174.epcn519>.

### **Making neuroimaging reproducible**

Poldrack, R. A., Baker, C. I., Durnez, J., Gorgolewski, K. J., Matthews, P. M., Munafò, M. R., Nichols, T. E., Poline, J.-B., Vul, E., & Yarkoni, T. (2017). Scanning the horizon: towards transparent and reproducible neuroimaging research. *Nature Reviews Neuroscience*, 18, 115-126.

### **Is writing part of open science?**

Gernsbacher, M. A. (2018). Writing Empirical Articles: Transparency, Reproducibility, Clarity, and Memorability. *Advances in Methods and Practices in Psychological Science*, 1(3), 403–414.

## 5. Preregistration

### **Preregistration revolution: what to preregister and how?**

Nosek, B. A., Ebersole, C. R., DeHaven, A. C., & Mellor, D. T. (2018). The Preregistration Revolution. *Proceedings of the National Academy of Sciences*, *115*(11), 2600–2606. <https://doi.org/10.1073/pnas.1708274114>

Ledgerwood, A. (2018). The preregistration revolution needs to distinguish between predictions and analyses. *Proceedings of the National Academy of Sciences of the United States of America*, *115*(45), E10516-E10517. <https://doi.org/10.1073/pnas.1812592115>

Nosek, B. A., Ebersole, C. R., DeHaven, A. C., & Mellor, D. T. (2018). Reply to Ledgerwood: Predictions without analysis plans are inert. *Proceedings of the National Academy of Sciences of the United States of America*, *115*(45), E10518-E10518. <https://doi.org/10.1073/pnas.1816418115>

### **Preregistered studies versus non-preregistered studies in psychology**

Scheel, A. M., Schijen, M., & Lakens, D. (2020, February 5). An excess of positive results: Comparing the standard Psychology literature with Registered Reports. <https://doi.org/10.31234/osf.io/p6e9c>

## 6. Open data

### **The case for open access**

Tennant, J. P., Waldner, F., Jacques D. C., Jacques, D. C., Masuzzo, P., Collister, L. B., & Hartgerink, C. H. J. (2019). The academic, economic and societal impacts of Open Access: an evidence-based review [version 3; referees: 4 approved, 1 approved with reservations]. *F1000Research* 2016, *5*:632.

### **Open data: challenge or solution?**

Hardwicke, T. E., et al. (2018), Data availability, reusability, and analytic reproducibility: evaluating the impact of a mandatory open data policy at the journal *Cognition*. *Royal Society Open Science*, *5*, 180448.