

PSY305: Treatment of Psychological Data Winter 2025

Course Information

- Lectures: **Tuesdays, 10 AM – 1 PM**
- Location: **FE (371 Bloor St.), room 36**
- Instructor: **Jun Young Park, PhD**
- TA: **Mo (Eric) Cui** (PhD candidate in Psychology)

Important Dates

- February 18: **No class** (Reading Week)
- March 25: **Online class** (Tentative)

Getting Help with the Course

- Office hours: held online - please see [Quercus \(Zoom\)](#) for the link.
 - Instructor: **Thursdays 7 – 9 PM**
 - TA: **Fridays 4 – 5PM**
- Piazza: We will use [Piazza](#) to discuss course contents and assignments. The instructor will respond to Piazza posts on Mondays, Thursdays, and Saturdays (nighttime).
- Course Email: psy305.uoft@gmail.com. You may email the course email to discuss personal issues where Piazza is not an appropriate way to discuss, including accommodations.

Departmental Guidance for Undergraduate Students in Psychology

The Department of Psychology recognizes that, as a student, you may experience disruptions to your learning that are out of your control, and that there may be circumstances when you need extra support. Accordingly, the department has provided a [helpful guide](#) to clarify your and your instructor's responsibilities when navigating these situations. This guide consolidates Arts & Science Policies for undergraduate students in one place for your convenience. As an instructor in the department, I will frequently consult with these recommendations when providing you with support, and I recommend that you also consult it to learn more about your rights and responsibilities before reaching out to me.

Course Description (friendly version)

Recall topics covered in introductory psychology or neuroscience where you learned various impactful experiments or articles/books that illustrate psychology targeted to the general public. How did you *trust* these results and theories, or what did you choose when there were multiple contradicting results? Up through PSY 201 and PSY 202, you have learned the basics of how we use statistics to derive meaning from scientific data. Using these tools, PSY 305 introduces how to become “critical consumers” or “active, data-driven citizens.” We will investigate past research in psychology where study data or statistical analysis was mishandled and led to produce misinformed research and learn relevant statistical concepts. We will be using simulations to anticipate your analyses. You will embrace the process of reporting statistical results clearly and reproducibly. Eventually, you will learn how to manage data in a way that is well-reasoned and conducive to statistical analysis. Altogether, you should emerge from this class by being able to follow the data analysis process from a raw dataset to a publishable final report, readily sharing this process with others in a transparent, open, and reproducible way.

Course Schedule

I will try my best to stick to this schedule, although it is subject to changes. Any changes will be announced on the Quercus.

Date	Topics	Note
1/7	Asking questions of science Understanding "population" that your research generalizes to / Validity and reliability of various psychological measures.	R workshop out (due 1/21)
1/14	Statistical decision making and planning Defining statistical research questions / $p < 0.05$ isn't everything / Type 1 and 2 errors / power and replicability / sample size and effect size	HW 1 out (due 1/28)
1/21	Statistical analysis I Review of statistical tests (one-sample, two-sample, and paired t tests / correlation / GLM / one-way ANOVA) / Visualization in R / Reporting statistical results in the APA style.	
1/28	Statistical analysis II Continued from the previous week.	HW 2 out (due 2/11)
2/4	Replicability crisis I Case studies / Open Science Collaboration (OSC) project / Potential reasons affecting replicable research / Inflated false positives and its impact	
2/11	Replicability crisis II Continued from the previous week.	HW 3 out (due 2/25)
2/18	No class (Reading week)	
2/25	Multiple testing Jelly bean experiments / Dead salmon experiments and voodoo correlations / Puzzlingly high correlations in neuroscience / Family-wise error rate and false discovery rate	HW 4 out (due 3/11)
3/4	Beyond NHST Pitfalls of NHST / Bayes Factor	
3/11	Preregistration I: methods Why preregister? / Required and recommended components of preregistration materials / Limitations of preregistration / Case studies	HW 5 out (due 3/25)
3/18	Preregistration II: case study Continued from the previous week.	
3/25	Advanced topics	HW 6 out (due 4/4)
4/1	Course summary / Final exam preview	

Learning Outcomes

By the end of the course, students will be able to

- Understand the challenges in defining suitable measures of psychological traits.
- Understand the following statistical concepts: Type 1 error, Type 2 error, power, and effect size.
- Distinguish what can or cannot be deduced from statistics.
- Use appropriate statistical methods to address a research question, compute the required sample size, and report the effect size.
- Understand recent concerns on replicable research in the field of psychology.
- Track recent challenges in pursuing open science in research.
- Include necessary materials for preregistration.
- Use R script to produce transparent and reproducible data analysis pipelines.

Course Resources

- Lecture slides will be uploaded to Quercus before the lecture. I acknowledge that some slides are adapted from the course contents prepared by Dr. Elizabeth Page-Gould, which is available at <https://osf.io/z6mp4/>.
- No textbooks are required for purchase. Some (optional) reference textbooks that would be used frequently would be:
 - *Science Fictions: How Fraud, Bias, Negligence, and Hype Undermine the Search for Truth* by Stuart Ritchie
 - *Statistical Thinking for the 21st Century* by Russell A. Poldrack (available [here](#))
 - *Statistics Without Maths for Psychology* by Christine Dancey and John J. Johnston
 - *Research Methods in Psychology* by Beth Morling

Sharing Course Materials

Sharing course materials requires the instructor's written permission.

Software

We will use **R** in this course, statistical software publicly available for free at [this link](#), and it is also highly recommended to install [RStudio](#) for an interactive programming environment. Note that the University of Toronto offers an [open-source web application](#) for R and R Studio,

Why R? R has a steeper learning curve than JASP, a GUI-based interface. However, the importance of using R is being emphasized more these days because the script-based nature of R programming allows for improved reproducible research in psychology. Also, this course will adopt the "simulations" to help understand various (confusing) statistical concepts that other software does not support.

Evaluations

- *R workshop (5%)*
 - Students are required to report the grades of the "[Introduction to R](#)" tutorial, an online, self-paced course administered through Quercus. Students need to save the grade page as a pdf form. Out of 16 possible points in the tutorial, points ≥ 10 will qualify for 5% (full credits), points ≥ 8 will qualify for 4%, and so on.
- *Assignment (50%)*
 - The best five assignment grades (out of 6) will be used to scale up to 50% of the final grade. Discussions with peers are allowed and encouraged, but these are to be completed (written up) on your own.
- *Final exam (45%):*
 - It will evaluate your understanding of scientific research using data. It includes (i) T/F (ii) multiple choice (iii) short response, and (iv) case studies including preparing preregistration materials
 - The exam contents do not include **R** programming.
- *Participation credits (up to 3% extra credits)*
 - Extra credits will be given based on participation in class. "Participation" is defined by one of the following: (i) Responses to questions asked by the instructor, or (ii) questions to course contents. It excludes clarification questions (e.g., "Could you explain it one more time?" or "I don't get that".)
 - The "participation count" is defined by the number of classes you participated in, discussion points made by the instructor, or asked insightful questions in class. Students with participation counts ≥ 6 will qualify for 3%, and counts ≥ 4 will qualify for 2%, and counts ≥ 2 will qualify for 1%.

Late Submission of Assignments

- Assignments are due **11:59 PM on Tuesdays** (i.e., before the lecture begins).
- There will be a **1%** deduction in the final course grade every 24 hours past the deadline. Valid forms for requesting extensions without penalties will be Absence Declaration, VOI, or equivalent (see below). Once these forms are submitted, the instructor will determine an appropriate extension.
- You have **one (1) free 24-hour extension** that you can use for any reason. You don't need to submit any formal request, but we will check Quercus to waive penalties.

Re-grading policy

- Students are allowed to request re-grading for their assignments
- Re-grading requests must be made **2 weeks** after the grades are distributed.
- Please use the course email (psy305.uoft@gmail.com) to submit requests.
- It is the students' responsibility to justify why they deserve regrading. The instructor will regrade them upon satisfactory requests, but please note that the grade is not guaranteed to increase (and the grade may decrease).

Absence of Declaration / Verification of Illness

If you become ill and it affects your ability to do your academic work, consult the instructor right away. Normally, documentation in support of your specific medical circumstances is needed. It can be an Absence Declaration (via ACORN) or the University's Verification of Student Illness or Injury (VOI) form. The VOI indicates the impact and severity of the illness, while protecting your privacy about the details of the nature of the illness. You can submit a different form (like a letter from a doctor) as long as it is an original document and contains the same information as the VOI. For more information on the VOI or absence declaration tool for A&S students, refer to <http://www.illnessverification.utoronto.ca/> and <https://www.artsci.utoronto.ca/absence>.

Accommodations

If you have a disability or health consideration that may require accommodations, please contact Accessibility Services at <https://studentlife.utoronto.ca/as> or (416) 978-8060. For students being supported by Accessibility Services, it is recommended (though not required) to keep the instructor updated so that individualized assistance or accommodations (beyond the ones offered by AS) can be applied if needed. All information related to privacy or health conditions must not be shared.

Academic Integrity

Academic integrity is essential to the pursuit of learning and scholarship in a university, and to ensuring that a degree from the University of Toronto is a strong signal of each student's individual academic achievement. As a result, the University treats cases of cheating and plagiarism very seriously. The University of Toronto's Code of Behaviour on Academic Matters (<https://governingcouncil.utoronto.ca/secretariat/policies/code-behaviour-academic-matters-july-1-2019>) outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences. Potential offences include, but are not limited to:

- Using someone else's ideas or words without appropriate acknowledgment
- Submitting your own work in more than one course without the permission of the instructor
- Making up sources or facts.
- Obtaining or providing unauthorized assistance on any assignment
- Misrepresenting your identity on exams

All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behaviour on Academic Matters. If students have questions or concerns about what

constitutes appropriate academic behaviour or appropriate research and citation methods, they are expected to seek out additional information on academic integrity from their instructors or from other institutional resources.

Use of Generative AI in Assignments

Students may use artificial intelligence tools, including generative AI, in this course as learning aids or to help produce assignments. However, students are ultimately accountable for the work they submit.

Reading List

1. Elliott, M. L., Knodt, A. R., Ireland, D., Morris, M. L., Poulton, R., Ramrakha, S., ... & Hariri, A. R. (2020). What is the test-retest reliability of common task-functional MRI measures? New empirical evidence and a meta-analysis. *Psychological science*, 31(7), 792-806.
2. Marek, S., Tervo-Clemmens, B., Calabro, F. J., Montez, D. F., Kay, B. P., Hatoum, A. S., ... & Dosenbach, N. U. (2022). Reproducible brain-wide association studies require thousands of individuals. *Nature*, 603(7902), 654-660.
3. Open Science Collaboration. (2015). Estimating the reproducibility of psychological science. *Science*, 349(6251), aac4716.
4. Ellis, P. D. (2010). *The essential guide to effect sizes: Statistical power, meta-analysis, and the interpretation of research results* (Vol. 52). Cambridge University Press. (available at [UTL](#))
5. Simmons, J. P., Nelson, L. D., & Simonsohn, U. (2011). False-positive psychology: Undisclosed flexibility in data collection and analysis allows presenting anything as significant. *Psychological science*, 22(11), 1359-1366.
6. Simmons, J. P., & Simonsohn, U. (2017). Power posing: P-curving the evidence. *Psychological science*, 28(5), 687-693.
7. Ritchie, S. (2020). *Science fictions: Exposing fraud, bias, negligence and hype in science*. Random House.
8. Rohrer, J. M., Tierney, W., Uhlmann, E. L., DeBruine, L. M., Heyman, T., Jones, B., ... & Yarkoni, T. (2021). Putting the self in self-correction: Findings from the Loss-of-Confidence Project. *Perspectives on Psychological Science*, 16(6), 1255-1269.
9. Vul, E., Harris, C., Winkielman, P., & Pashler, H. (2009). Puzzlingly high correlations in fMRI studies of emotion, personality, and social cognition. *Perspectives on psychological science*, 4(3), 274-290.
10. Lieberman, M. D., & Cunningham, W. A. (2009). Type I and Type II error concerns in fMRI research: re-balancing the scale. *Social cognitive and affective neuroscience*, 4(4), 423-428.
11. Bennett, C. M., Miller, M. B., & Wolford, G. L. (2009). Neural correlates of interspecies perspective taking in the post-mortem Atlantic Salmon: An argument for multiple comparisons correction. *Neuroimage*, 47(Suppl 1), S125.
12. Eklund, A., Nichols, T. E., & Knutsson, H. (2016). Cluster failure: Why fMRI inferences for spatial extent have inflated false-positive rates. *Proceedings of the national academy of sciences*, 113(28), 7900-7905.
13. Botvinik-Nezer, R., Holzmeister, F., Camerer, C. F., Dreber, A., Huber, J., Johannesson, M., ... & Rieck, J. R. (2020). Variability in the analysis of a single neuroimaging dataset by many teams. *Nature*, 582(7810), 84-88.
14. Carney, D. R., Cuddy, A. J., & Yap, A. J. (2010). Power posing: Brief nonverbal displays affect neuroendocrine levels and risk tolerance. *Psychological science*, 21(10), 1363-1368.
15. Carney, D. R., Cuddy, A. J., & Yap, A. J. (2015). Review and summary of research on the embodied effects of expansive (vs. contractive) nonverbal displays. *Psychological science*, 26(5), 657-663.
16. Carney, D.R. (2016). My position on "Power Poses". Unpublished article ([link](#))
17. Raneyhill, E., Dreber, A., Johannesson, M., Leiberg, S., Sul, S., & Weber, R. A. (2015). Assessing the robustness of power posing: No effect on hormones and risk tolerance in a large sample of men and women. *Psychological science*, 26(5), 653-656.
18. Begley, C. G., & Ellis, L. M. (2012). Raise standards for preclinical cancer research. *Nature*, 483(7391), 531-533.
19. Errington, T. M., Denis, A., Perfito, N., Iorns, E., & Nosek, B. A. (2021). Challenges for assessing replicability in preclinical cancer biology. *Elife*, 10, e67995.

20. Hagger, M. S., Chatzisarantis, N. L., Alberts, H., Anggono, C. O., Batailler, C., Birt, A. R., ... & Zwienerberg, M. (2016). A multilab preregistered replication of the ego-depletion effect. *Perspectives on Psychological Science*, 11(4), 546-573.
21. Baumeister, R. F., Bratslavsky, E., Muraven, M., & Tice, D. M. (2018). Ego depletion: Is the active self a limited resource?. In *Self-regulation and self-control* (pp. 16-44). Routledge.
22. Bargh, J. A., Chen, M., & Burrows, L. (1996). Automaticity of social behavior: Direct effects of trait construct and stereotype activation on action. *Journal of personality and social psychology*, 71(2), 230.
23. Zhong, C. B., & Liljenquist, K. (2006). Washing away your sins: Threatened morality and physical cleansing. *Science*, 313(5792), 1451-1452.
24. Earp, B. D., Everett, J. A., Madva, E. N., & Hamlin, J. K. (2014). Out, damned spot: Can the "Macbeth Effect" be replicated?. *Basic and Applied Social Psychology*, 36(1), 91-98.
25. Pashler, H., Coburn, N., & Harris, C. R. (2012). Priming of social distance? Failure to replicate effects on social and food judgments.
26. Doyen, S., Klein, O., Pichon, C. L., & Cleeremans, A. (2012). Behavioral priming: it's all in the mind, but whose mind?. *PloS one*, 7(1), e29081.
27. Cassidy, S. A., Dimova, R., Giguère, B., Spence, J. R., & Stanley, D. J. (2019). Failing grade: 89% of introduction-to-psychology textbooks that define or explain statistical significance do so incorrectly. *Advances in Methods and Practices in Psychological Science*, 2(3), 233-239.
28. American Statistical Association. (2016). American Statistical Association releases statement on statistical significance and p-values. *Alexandria, VA: American Statistical Association*.
29. Kaplan, R. M., & Irvin, V. L. (2015). Likelihood of null effects of large NHLBI clinical trials has increased over time. *PloS one*, 10(8), e0132382.
30. Van't Veer, A. E., & Giner-Sorolla, R. (2016). Pre-registration in social psychology—A discussion and suggested template. *Journal of experimental social psychology*, 67, 2-12.
31. Ioannidis, J. P. (2005). Why most published research findings are false. *PLoS medicine*, 2(8), e124.
32. Button, K. S., Ioannidis, J. P., Mokrysz, C., Nosek, B. A., Flint, J., Robinson, E. S., & Munafò, M. R. (2013). Power failure: why small sample size undermines the reliability of neuroscience. *Nature reviews neuroscience*, 14(5), 365-376.
33. Wicherts, J. M., Borsboom, D., Kats, J., & Molenaar, D. (2006). The poor availability of psychological research data for reanalysis. *American psychologist*, 61(7), 726.