

Social Psychology Lab Manual

PSYC BC2137

Professor Rob Brotherton

Spring 2023

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About this handbook

This handbook is intended to serve as a resource allowing you to see from the outset what lies ahead, and as a place to collect your notes as we progress through the course.

It is important that you know in advance what to expect from this lab so that you can plan your time accordingly. That information is all here in this handbook. This laboratory handbook outlines the procedures, rationales, and techniques for lab exercises, and provides an overview of the accompanying assignment for each week.

Each lab section contains blank pages for recording notes and for collecting observations. Therefore, you should bring the lab manual to each meeting of the lab.

You should skim through this handbook at the beginning of the course so that you have at least a rough sense of what will be required and when, and so you know where you can find relevant information as and when you need it.

You'll find a section for each lab session, giving a brief overview of the main themes and questions for that session, some suggested (optional) additional readings, and any pertinent information about the accompanying assignment.

You'll also find a number of appendices, covering things like searching the academic literature, how to approach reading journal articles, summaries of the basic statistics you should be familiar with, examples of informed consent and debriefing forms, and an extensive guide to writing a lab report.

I will reiterate much of this information as part of each lab session's instructional component, and we'll greatly expand on the themes through the activities I'll have you do and our collective discussions that follow.

Lab 1: Course Overview

Course details

Professor: Dr. Rob Brotherton (rbrother@barnard.edu)

Office hour: Monday 10-11AM, Milbank 415M

Section 001

Time & venue: Wednesday 10:10-1PM, Milbank 410

Teaching Assistant: TBC

TA office hour: TBC

Section 002

Time & venue: Wednesday 1:10-4:00PM, Milbank 410

Teaching Assistant: Farhana Tanee (ft2108@barnard.edu)

TA office hour: TBC

Schedule

Date	Lab topic	Assignment	%
01/18	No lab first week of classes	Note: Most assignments are due 5pm the day after class. Exceptions are noted.	-
01/25	Introduction & Overview	Class participation (no submission; graded across the semester)	15
02/01	Project planning	Paper summary 1	5
02/08	Ethics & design	Paper summary 2	5
02/15	Measuring social psychological constructs	Paper summary 3	5
02/22	Correlational designs	Paper summary 4	5
03/01	Experimental designs	Brief lit review	5

Date	Lab topic	Assignment	%
03/08	Experimental designs continued	Brief project proposal	5
03/15	Spring Break	-	-
03/22	Writing the Introduction section	Introduction draft	5
03/29	Finalizing methods	Method draft	5
04/05	Reporting results	Planned Analysis draft	5
04/12	Interpreting findings	Discussion draft	5
04/19	Presentations	Presentation (submit slide before class)	5
04/26	Final paper workshop	Final paper & response letter	30

Lab overview

This lab is designed to offer experience participating in, reading, critiquing, and proposing research addressing social psychological phenomena. The lab will usually be taken concurrently with PSYC-BC2138 Social Psychology Lecture, and will expand upon the methodological and analytic issues introduced there, as well as giving you the opportunity to explore in greater depth a topic of your choosing from within (or beyond) those covered in the lectures by proposing your own original research project.

Class format

In the first half of the course you'll be finding, reading, and summarizing published research papers that may be relevant to your project, and working up a rough proposal. In class we'll demonstrate and analyze the methodological and analytical approaches commonly employed in social psychological research, giving you the foundation upon which to build your research proposal. In the second half of the course you'll draft each section of your proposal paper in turn before submitting the final report. In class we'll focus on refining your proposed methodology and constructing an effective research paper.

Labs are substantially more interactive and discussion-based than the traditional lecture format, and depend on everyone's participation. Your active participation across the semester will therefore contribute a substantial portion of your grade. Usually, in-person attendance of labs is mandatory; it is departmental policy to remove students who miss more than two sessions from the course. Given current pandemic-related changes to procedures, that will not be the case for this semester. If you are feeling unwell, you should not come to class. Please notify me of nonattendance before class if possible (as well as reporting symptoms to the college as appropriate).

Being part of the in-person discussion is one obvious way to participate, but it's not the only way. Different people have different styles of participation, and the lab is designed to try and accommodate and encourage different approaches (as well as allowing for the greater-than-usual possibility of missing class for health reasons). In particular, there will be a "Class Collective Lab Notes" Google Doc that everyone in the class will be able to edit; contributions there will constitute class participation just like contributing to the in-person discussion. Your level of engagement with your TA and Prof. Brotherton as you work through your project is also an important form of participation.

At a minimum, I'll be looking for some form of participation (loosely defined) from you every week; higher participation grades will be earned through regular, enthusiastic, productive participation (note that quality is more important than quantity).

The Research Proposal

The final paper for this lab will be a Research Proposal paper. Producing this will be an iterative process; each assignment will build on the previous ones until by the end of the semester you have a complete research proposal paper.

Your proposed study can be on any social-psychological topic of your choosing. However, your proposed research should be an extension of previous research, not an exact replication of another existing study, but not an entirely new question either. Proposed studies will use one of the basic methodological approaches that we will cover in the lab this semester or one that you discuss in the lecture. For example, you may propose the development and validation of a new scale (see p.); a correlational study looking at relationship among constructs (see p.); or an experimental study manipulating an independent variable and measuring its effect on a dependent variable (see p.).

The project you complete will be a research proposal. You will propose a viable piece of research that could, in theory, be conducted by you or any other researcher—but you won't actually collect data for it as part of this lab. There are a number of reasons for this. Logistically, to achieve sufficient statistical power (see Appendix C, p.) social psychological studies often require sample sizes larger than we could feasibly collect as part of this lab. Running an underpowered study is a waste of your and your participants' time. In addition, merely proposing a study without having to run it allows you to be more ambitious in the kind of research you can propose, which can allow you to explore questions of greater scope and meaning. For students who may be considering a career in academic psychology or another science, proposing studies will be an essential aspect of obtaining grants and fellowships to allow you to conduct that research. Additionally, even beyond the context of obtaining funding for proposed research, recent years have seen a move towards pre-registration of research designs within the field of psychology more broadly. This means creating and publishing a complete plan for your research before collecting the data. We'll discuss the value of this as part of this

and the coming lab sessions. By proposing a study here, you'll be essentially pre-registering a potential study design.

A few students each semester mention feeling disappointed not to get to collect data for their project. It's understandable, but in addition to the issues mentioned above, I'd urge you to think about how much work that would add to the course, and how it would add comparatively little value to your learning experience. Not having to collect data frees us to focus on refining all the details of your study in the limited time we have available, therefore developing a deeper understanding of the crucial issues on which all successful research depends: theoretical, methodological, and interpretative rigor. If you really want to experience collecting and analyzing real data, I'd suggest aiming to run your proposed study as part of an Independent Project in future, for which you can earn 4 to 8 credits depending on whether you complete it over 1 or 2 semesters.

Assignment deadlines and grading

Assignments are listed in the class schedule next to the class session to which they correspond. Most assignments are due at 5pm the day after class; exceptions are noted in *italics* on the schedule. All the assignments relate to your project proposal—the idea is to build this major piece of work incrementally over the course of the semester. The 5pm next-day deadline is necessary to give Prof. B and your TA time to provide feedback to everyone in advance of the next assignment (however, see the next section for late policy).

Late assignments

Assignments submitted after the deadline but before the next class will receive a grade without penalty; you just need to notify Professor Brotherton in advance that your work will be late. This policy is intended to ease the stress of genuine emergencies and midterm/deadline pile-ups. Knowing when you can reasonably complete work, even if it is not always by the preordained deadline, is part of successful time-management and prioritization. However, be aware that you may not receive timely feedback on late work, and since the lab is designed to build cumulatively towards the final paper, getting behind on assignments may make it hard to catch up and will likely impact your final grade.

Assignments not submitted before the next class will receive a score of zero. This policy is intended to incentivize timely submission whenever possible, and to reflect the pedagogical value that you miss out on by failing to submit work on schedule; since the assignments for this lab build iteratively on one another, it is essential that you complete them punctually and in order.

Final Grades

Your final letter grade for the course is a product of your scores for each assignment, weighted as indicated in the class schedule, and determined according to the following boundaries:

Letter grade:	A+	A	A-	B+	B	B-	C+	C	C-	D	F
Numeric score:	97	93	90	87	83	80	77	73	70	60	<60

Workload

As a general rule for the amount of time students should expect to commit to classes, the college suggests three hours per week in or outside of class per credit. Since this class is worth 1.5 credits, that corresponds to 4.5 hours per week, split between time in the classroom and time spent completing the associated assignments.

Honor code

Even though you will collaborate in lab and on the research proposal, you may not collaborate on written assignments. You must write your own reports. Students are expected to follow the Barnard Honor Code, available at <https://barnard.edu/honor-code>. Note that written work will be checked for plagiarism using TurnItIn. You will be able to see the plagiarism report for your own work. This should be useful for avoiding unintentional plagiarism (such as failing to put quotation marks around a quote you made note of from a paper you read), and for encouraging you to put ideas into your own words rather than quoting or closely paraphrasing others (which the system flags up).

Academic accommodations and general wellness

It is always important to recognize the different pressures, burdens, and stressors you may be facing, whether personal, emotional, physical, financial, mental, or academic. The current circumstances may well add to these challenges for many people in many ways. The faculty and administration recognize this, and are prepared to provide assistance to students in need. Many of the available services and sources of help are being reshaped in response to the changing circumstances. Rather than include boilerplate text here or link to sources of information which may become outdated, I encourage you to seek advice from your advisor, Dean, or the Center for Accessibility Resources & Disability Services (CARDS), and to let me know of any issues you wish to share with me that you feel are impacting your ability to complete the course to the best of your ability. Though it isn't always easy, it is better to proactively seek help rather than letting problems build up.

Notes

Lab 2: Project Planning

Key ideas

- Searching the literature
- How to read a research paper
- Beginning to decide on an appropriate research question

This session is about looking ahead to what your lab paper will consist of and starting to lay the foundations. We'll cover critical skills, including how to search the psychological literature to find existing research relevant to your interests (see Appendix A, p.) and how to skim papers to quickly determine whether they are worth spending your time on and how to read them to get the most out of them (see Appendix B, p.). We'll also practice coming up with viable hypotheses to test social psychological questions.

Assignment

Your assignment this week is to write a short summary of a published research paper that may be relevant to your project proposal. You may later decide to go in a different direction and that the paper isn't actually relevant: that's fine. The point is simply to begin discovering the kind of research other people have done on the topic you are interested in and to use it as inspiration to gradually start forming the idea for your own novel research proposal, which should build incrementally on what has been done before.

You'll post your summary publicly in the Canvas discussion thread—the idea being that other people might also find that paper relevant and worth reading, so we'll collectively be discovering and sharing a wide variety of research.

To get the best possible grades for these summaries (note that your grade and feedback will, of course, be private), you should be writing concise, detailed and thoughtful summaries, spending up to about an hour and a half to submit your best work possible. Your summary should be less than a page (no more than 400 words or so), briefly outlining the paper's:

- Background (what did the researchers base their approach on?)
- Method (what did the researchers do?)
- Results (what did they find?)

- Conclusions (what conclusions did they draw?)
- Strengths/limitations (what are the major strengths and limitations of the study, in your view?)
- Relevance to your thinking/ideas for how you could extend upon this research (what does this add to your thinking as far as the research proposal goes?)

You'll receive a score and feedback based on the following rubric (again, even though you'll post your summary publicly, your grade and feedback will be private to you, provided via SpeedGrader in Canvas).

Notes

Lab 3: Ethics and Design

Key ideas

- Asking questions that psychological research can answer
- Observing and measuring behavior
- Researcher influence over outcomes
- Pre-registration of research methods
- Informed consent and deception

As an introduction to social psychological thought, methods, and ethical considerations, this session will focus on Stanley Milgram's research on obedience to authority, conducted in the 1960s. This is one of the most famous studies in the history of social psychology to ostensibly show the power of external situations over individuals' choices. It's well known, but not necessarily well understood by people who haven't studied it in depth. In fact, over the years it has been misconstrued in many psychology textbooks. A detailed discussion and critique can teach us about the approaches, methods, and challenges of psychological inquiry, and the influence of both situations and individuals' personality and preferences on behavior. It is also revealing about the history and evolution of psychology as a field of research, and the development of ethical guidelines for research with human participants.

Suggested reading

- Milgram, S. (1963). Behavioral study of obedience. *Journal of Abnormal and Social Psychology*, 67(4), 371.
- Haslam, S. A., & Reicher, S. D. (2012). Contesting the "nature" of conformity: What Milgram and Zimbardo's studies really show. *PLoS Biology*, 10(11), e1001426.
- Reicher, S. D., Haslam, S. A., & Smith, J. R. (2012). Working toward the experimenter: Reconceptualizing obedience within the Milgram paradigm as identification-based followership. *Perspectives on Psychological Science*, 7(4), 315-324.

Assignment

You will write a summary of a second published research paper. The rubric will be largely the same as before, but you should additionally begin drawing connections between this and the previous paper you summarized.

Notes

Lab 4: Measuring Social Psychological Constructs

Key ideas

- Social psychological constructs
- Operational definitions
- Questionnaire design; attention checks; socially desirable responding

When designing research, a key first step is defining the psychological construct you are interested in and deciding how to measure that construct.

Social psychological constructs include all the attitudes, thought processes, and behaviors that we as social psychologists might be interested in. Examples include things like aggression, attraction, conformity, obedience, stereotypes, prejudice, credulity.

The challenge researchers face is how to measure complex, hypothetical constructs in an objective and quantifiable way. The specific method a researcher decides to use to measure a construct is called the operational definition. Usually there are many possible operational definitions for a given construct. The advantages, disadvantages, and practicalities of various possibilities must be considered when designing research: will participants be willing and able to pay close attention; will they be willing and able to give you accurate and honest answers; is it possible that they could misunderstand what the researcher is asking, or that different participants might interpret the same question or instruction differently; how can researchers attempt to minimize these potential problems?

Suggested reading

Collins, N. L., & Read, S. J. (1990). Adult attachment, working models, and relationship quality in dating couples. *Journal of Personality and Social Psychology*, 58(4), 644-663. <https://doi.org/10.1037/0022-3514.58.4.644>

Hone, L.C., Jarden, A., Schofield, G.M., & Duncan, S. (2014). Measuring flourishing: The impact of operational definitions on the prevalence of high levels of wellbeing. *International Journal of Wellbeing*, 4(1), 62-90. <https://doi.org/10.5502/ijw.v4i1.4>

Assignment

You will write a summary of a third published research paper. Again, you should emphasize the connections between this paper and the previous paper you read.

Notes

Lab 5: Correlation

Key ideas

- Correlational research questions
- The correlation coefficient
- Mediation
- Correlation vs causation

Having explored how social psychologists define and operationalize relevant constructs, we will now move on to looking at how such measures are used in typical research, and the analytic techniques used to uncover meaningful relationships or causal effects. We will begin with the simplest type of design, in which researchers simply measure two (or more) constructs and look at how they relate to one another.

Simple bivariate correlations quantify the extent to which changes on one variable are associated with changes on a second variable (see Appendix C, p. 46). More complicated research might measure a third variable and ask whether it mediates the relationship between the other two; that is, can the bivariate relationship potentially be explained by the influence of a third variable?

However, while correlational techniques can tell us about associations between variables, correlational designs are generally limited in what they can tell us about causal influence. Speculation about what is causing changes must be restrained, and informed by theory and existing findings.

Suggested reading

Borgonovi, F. (2008). Doing well by doing good. The relationship between formal volunteering and self-reported health and happiness. *Social science & medicine*, 66(11), 2321-2334. <https://doi.org/10.1016/j.socscimed.2008.01.011>

Fiedler, K., Schott, M., & Meiser, T. (2011). What mediation analysis can (not) do. *Journal of Experimental Social Psychology*, 47(6), 1231-1236. <https://doi.org/10.1016/j.jesp.2011.05.007>

Assignment

You will write a summary of a fourth published research paper. By now, you should be able to point out the differences and common themes among all four papers you have summarized.

Notes

Lab 6: Experiments

Key ideas

- Correlation vs causation
- Independent and dependent variables
- Between-participants and within-participants designs

This week's lab will focus on experimental designs, in which the researcher manipulates one variable (the independent variable) and measures another (the dependent variable).

The simplest example of this design is one in which the researcher randomly assigns participants to one of two groups, and then uses statistical techniques to look for differences between the groups (see Appendix C, section on the t-test, p.).

Suggested reading

Loftus, E. F., & Palmer, J. C. (1974). Reconstruction of automobile destruction: An example of the interaction between language and memory. *Journal of Verbal Learning and Verbal Behavior*, 13(5), 585–589. [https://doi.org/10.1016/S0022-5371\(74\)80011-3](https://doi.org/10.1016/S0022-5371(74)80011-3)

Assignment

Having read and summarized (at least) four papers on your topic of interest by now, you should be ready to articulate the gist of this existing body of research, as it pertains to your proposal. This Brief Literature Review will be your opportunity to put all four studies together, in conversation with one another, and to make a case for what they collectively reveal about social psychology—and what they fail to reveal. That gap in the research will likely form the basis on your own proposed study.

Your brief literature review will be based on the four individual summaries you have written, but you should rework it to be a coherent, cohesive, persuasive review of the literature rather than just stringing together your four individual summaries. I want to know how the research all fits together, as you see it.

Your submission should include:

- Title Page
 - A page with your name, your partner’s name, and a (tentative) title for your project
 - Stick to the types of titles you see in published research papers
 - E.g. ‘The relationship between [X] and [Y]’, or ‘Differences in [Z] between [X] and [Y]’
- Literature review
 - Start by identifying the general topic of your research—that is, the area of social psychology that you are interested in investigating.
 - Review the studies you have read so far. You’ve written individual summaries of each, but here you should begin to weave them together, pointing out how they relate to one another and how they collectively inform your proposal
 - Try to finish by articulating your overall interpretation of this existing body of research. What does it show about social psychology? What does it fail to show?
- References
 - Include an APA-formatted reference for each study you cite

Notes

Lab 7: Experiments continued

Key ideas

- Control conditions
- Factorial designs

This week's lab will focus on more complex experimental designs, focusing on the value of control conditions and factorial designs. These ideas are discussed more extensively in Appendix C, section on ANOVA, p.).

Suggested reading

Symons, C. S., & Johnson, B. T. (1997). The self-reference effect in memory: a meta-analysis. *Psychological bulletin*, 121(3), 371–394.

Assignment

Now you've written a Brief Literature review of the existing studies you've read you should be ready to propose your own study. This Brief Proposal will be the first step: your initial thoughts on what form your proposed research will take. Your proposal will likely not have all the methodological details at this stage, and your thinking may yet change—that's fine. The main purpose of this brief proposal is to serve as an outline so you can start to figure out the specifics. You'll get feedback on this which should help you nail down and refine the details moving forward. That said, the more thought you put into this now, the less work you will have to do for the following drafts. This would be a good time to familiarize yourself with Appendix F: Guide to Writing Lab Reports (p.), if you haven't already, as that is what this is building towards.

Your brief proposal should include:

- Title Page
 - Same as the previous assignment, unless you've changed your approach enough to require a change of title

- Literature review
 - Include your lit review from the previous assignment, with any changes (if you've made them)
- Method -State the basic design format of your proposed study—is it a scale design study, a correlational design, or an experiment? State any constructs you plan to manipulate or measure
 - For each construct, state your operational definition (i.e. how you actually plan to manipulate or measure the psychological constructs)
- Analysis
 - What is your fundamental analytic approach? Is this a correlational study where you're looking for associations between variables, or an experimental study in which you're looking for differences between randomly-assigned groups, or a quasi-experimental study in which you're looking for differences between pre-existing groups? What is it, in a nutshell, that you expect to find?
- References
 - Include an APA-formatted reference for each study you cite

Lab 8: Writing the Introduction

Key ideas

- Style and contents of an APA Introduction section
- How to frame previous findings to create a coherent and compelling justification
- APA style for citations & references

By now, you should have settled on your proposed design (though you may still be refining the details in response to collaboration with your partner(s) and guidance from Prof. Brotherton and your TA). Now you will begin to draft your complete lab paper, one section at a time. Instruction in class this week will focus on writing good APA-style Introduction section.

There are two major components of APA style. First, there are the nitty-gritty aspects of formatting the document itself, such as how to format the title page, running head, headings of different levels, figures, page numbers etc. The APA produces a manual which details exactly how to do this. However, the conventions change from time to time; the APA style guide is now in its 7th edition, published in October 2019. Because these formatting conventions are arbitrary and subject to change, I see them as relatively unimportant for our purposes. If you won't be writing any more psych research articles, it's not worth your time learning this stuff; if you will then you're better off just using a current template when starting your documents—word processors like Word and Google Docs offer such templates built-in. I will make a Google Doc template specially tailored for this lab available.

One exception, however, is for citations and references. Since you are writing a scientific document based on existing research, it is important to cite that existing research according to the conventions of the field so that your sources can easily be checked by any interested reader. So while you can largely ignore fiddly formatting details, you will have to make an effort to use the correct citation style (or let a reference manager app like Zotero do the work for you; see Appendix B).

The second component of writing an APA-style research article is the content. For our purposes this is much more important than arbitrary formatting rules. You must ensure that all the expected content is present in your work; that unneeded content is not present, so as not to distract or take away from the clarity and coherence of your writing; and that it is communicated in the tone expected of a psychological research article. The assignment description for each draft section will give an outline of required content, and you will find more advice and tips in Appendix F: Guide to Writing Lab Reports (p.).

Assignment

You will submit a draft of your Introduction section. This will be based on the literature review you have already written, but it may require some changes of emphasis, style, and structure. The general structure of a good APA-formatted Introduction is as follows:

- The first paragraph should introduce your broad area of research, emphasizing why it is a question of interest to psychologists, and, in a few sentences, summarizing the gist of existing research and how your proposed study would add to our understanding of social psychology.
- The main body of the Introduction is your literature review. Identify current theories relevant to the topic at hand, and present an overview of the findings of other researchers who have tried to answer similar questions.
 - You should include at least 4 existing studies that relate to your question.
 - They may or may not all require the same depth of description—e.g. if your methodology is very close to a particular previous study, it would require a more thorough description than a previous study for which the methodology is less directly relevant to your project.
 - The key is to make this a logically-flowing argument rather than a simple list of studies. Make sure each paragraph focuses on a single theme (which might be one study or more than one related study), and that each paragraph also transitions from and to the next by pointing out how the studies/theme relates to the others, and how they contribute towards your own research proposal.
- The last paragraph should briefly sum up your literature review, and state the question you are trying to answer. What are your specific hypotheses or expectations?
- You should be framing this as a gap in the literature you just outlined, or a necessary extension of some existing study.

Lab 9: Finalizing Methods

Key ideas

- Replicability
- Informed consent & debriefing
- Style and contents of an APA Method section

This week you will finalize the details of your planned methodology, including collecting/producing all required materials, and creating Informed Consent (see Appendix D, p.) and Debriefing (see Appendix E, p.) documents. We will consider methodological rigor and replicability, as well as what researchers are required to tell participants in the informed consent and debriefing documents, and why.

Assignment

For this week's assignment, you will produce a draft of your Method section, which must include all the detail necessary for someone else to actually run your study. That means you should have pretty much figured out exactly what participants in your study would see or do: the wording of every instruction you would present to participants, every question you would ask them, every response scale you would use to collect their answers, any images/videos/other materials you'd need, etc. Any aspect you're still not quite sure about must be nailed down now.

The content of an APA-style Method section is as follows:

- Method [the following subsections should be included with level 2 headings]
 - Design
 - * State the technical design of your planned research (e.g. a single-factor, within-participants design; a 2x2 ANOVA; etc). State your independent and dependent variables (you just need to name them here; you will give more detail about how you measure them in the Materials subsection). Or, for a scale design/correlation/mediation study, state your 'variable(s) of interest'.
 - Participants

- * State how many participants you would require (see Appendix C, section on statistical power), any selection criteria (e.g. proportion of males/females or other relevant demographic characteristics), any exclusion criteria (e.g. people under 18)
- Materials
 - * Restate the constructs you plan to manipulate or measure (you can use sub-headings for each construct), and for each construct, state your operational definition (i.e. how you actually plan to manipulate or measure the psychological constructs) in enough detail that any other researcher could run your study. If including complete scales or other materials as appendices, give example questions here and refer readers to the appendix.
- Procedure
 - * Give a step-by-step walkthrough of what participants will be required to do, in the order that they would do it, from providing Informed Consent, then completing your materials, to Debriefing.
- Appendices
 - Include all materials that would be required in order to actually run the study. Include everything that participants would see:
 - * All questionnaire items and response scales
 - * Any other necessary stimuli (e.g. videos participants would watch—include a still frame and a link to the video if online)
 - * Include complete Informed Consent & Debriefing documents

Lab 10: Reporting Findings

Key ideas

- Reproducibility
- Data visualization
- Style and contents of an APA Results section

By now, you will have worked out every aspect of your study's design, and you will be ready to draft the Planned Analysis sections of your report, in which you explain how you would analyze the data your proposed design would produce. This will most likely follow the outline of one of the analyses we discussed in previous lab sessions, and covered in more detail in Appendix C.

Assignment

You'll submit a draft of your Planned Analysis section. Usually in an APA-formatted journal article this section would be called Results. But since you aren't collecting data, and are instead just formalizing a plan for how you would analyze your data, we'll call this section Planned Analysis.

This will likely be your shortest section. It should be a simple, technical statement of how you would treat your data, with some sensible anticipated results.

- Planned Analysis
 - First state any necessary data cleaning and handling
 - * E.g. how you would identify outliers in the data, and any averages you would calculate, etc
 - Then explain, using the appropriate technical terms, what you would do with your chosen variables
 - * E.g. factor analysis, validity tests, looking at the correlation(s) between variables, performing a t-test, ANOVA?
 - * Then make sensible, informed guesses (based on the research you read and cited in your Intro) about what kind of averages/differences/correlations/effect sizes you would expect to see

- You should mention some hypothetical results, e.g. the condition means you expect, the strength of correlation you anticipate.
 - You should also talk about how much variability you expect to see in the data, and how strong of an effect you expect your manipulation to produce
 - Finally, state whether you expect a significant test statistic (which, presumably, you do—but this should make sense given your overall pattern of anticipated means and variability).
- * Include a visualization of your expected findings. This doesn't have to be fancy—just a rough sketch is fine if it helps to visualize the trends you expect to see in the data (see p.).

Lab 11: Interpreting Findings

Key ideas

- Style and contents of an APA Discussion section
- Summarizing and interpreting findings
- Connecting findings to previous research

By now, you have an almost-complete draft of your research proposal paper. All that remains is to add a Discussion section. While you will not have analyzed any actual data, you will still produce a Discussion section which considers the implications of the various possible outcomes of your study.

Assignment

You'll submit a draft of your Discussion section. Your Discussion section should contain the following information:

- What would it mean if the data is consistent with your expectations?
 - How would it augment your interpretation of the previous research you outlined in the Introduction?
 - What would this say about social psychology that's new?
- What would it mean if the data is not consistent with your expectations?
 - Consider two possibilities:
 - * Your hypothesis is correct but your study fails to find support for it. Why might that be? Are there potential flaws in your methodology?
 - * Your study fails to find support not because of methodological flaws but because your hypothesis is mistaken. What are the implications for the previous research you outlined in the Introduction—might this call any of the previous findings into question? Why might the previous findings be questionable?
- What are the main strengths and weaknesses of your planned research?

- Be critical in pointing out potential flaws, but make sure also to assert the strengths of your plan—aspects that were carefully considered, and would improve somehow upon what previous research did.
- What is the overall importance of your project?
 - Your final paragraph should sum up your project’s potential contribution to the field of social psychology. This may be as narrow as replicating one existing finding, or as broad as challenging an existing theoretical perspective. Be bold but realistic.

Lab 12: Presentations

This week each project team will present their proposed project to the rest of the class.

Guide to presenting

Each team will give a two-minute presentation, accompanied by a single PowerPoint slide, which should encapsulate the motivation, methods, anticipated findings, and interpretation of your proposed project. Two minutes is not a lot of time. Apparently, people speak at a rate of around 125 to 150 words per minute on average. So a 2-minute presentation will be no more than around 300 words. The single-slide, not-many-words format demands clarity, conciseness, and being bold to spark the audience's interest in your topic.

Avoid simply reading excerpts from your paper. That would be boring, and would probably take up too many words. Make it fun and interesting. Try to grab the audience's attention and hit them with just the most important points of your ideas.

You will also have a single PowerPoint slide to accompany your presentation. Make it count. You can't just cram a load of text on there, because nobody will be able to read it. Plus, it'd distract from what you're saying. Make it a visual aid that somehow supports or clarifies what you're saying. It might be a visual representation of your design, a key piece of your experimental stimuli, a graph of your expected results, or just a pertinent meme which conveys the motivation for your question.

After your two-minute talk you'll take a few questions from the audience, and your responsiveness will contribute toward your grade as well as the quality of your presentation itself (remember a perfectly acceptable answer is often: "Good question; I don't know the answer!"). It's not usually an issue, but just in case your audience is left speechless, I suggest coming with a couple of questions or thoughts of your own that you can throw at the audience to spark more questions.

Each pair will be allotted five minutes total for their talk and Q&A. Going over time and/or failing to leave time for questions will impact your presentation grade. It is up to each pair to decide how to divide up the two-minute talk, and to practice to make sure the presentation is to time.

Guide to watching presentations

As an audience member, you are still being graded for class participation this week. That means giving everyone else's presentation the attention and enthusiasm it deserves, and rewarding their hard work with questions. (Going to the trouble of putting together a presentation only for nobody to have anything to say about it is not a good feeling.)

Good questions to ask are things like "Could you clarify X", "Had you considered Y", or "How might this relate to Z." One reason for presenting your project is to hopefully get some useful feedback from the audience with which to refine your final paper, so try to give the kind of feedback you hope to receive.

Lab 13: Final Paper

Key ideas

- Writing an Abstract
- Editing and proof reading
- Incorporating feedback

By now you have drafted and received feedback on every major section of your paper. Hopefully along the way you found the feedback useful, and you will have incorporated any useful suggestions to make your final paper as strong as it can possibly be. This editing process is a crucial part of any form of writing, including scientific reports. Most published papers you've read will have been through at least one round of extensive revisions, if not more. You should see editing as a part of the process of writing, rather than an annoying additional thing you have to do after the writing is done.

The last remaining element to add is the Abstract. This is always the last addition to a research report, as it provides a summary of everything that follows in each section of your paper. It should be between around 100–200 words, with a sentence or two summarizing each of the main sections of your paper. (This will likely be informed by your short presentation outline from the previous session).

With that done, all that remains is to submit your paper and congratulate yourself and each other on a job well done.

Assignment

You will submit your complete, APA-formatted lab report. It should consist of the following sections:

- Title Page
- Abstract
- Introduction
- Method
- Planned Analysis
- Discussion

- References
- Appendices

A Tips for Reading Research Papers

The following suggestions are guidelines for approaching research reports when you are searching the scholarly literature for previous studies relevant to your own research topic. These journal articles are usually written for other experts in the field and may contain terminology and analyses that you are unfamiliar with. Most articles that report new empirical findings have a standard format, in which the material is sectioned into an Abstract, Introduction, Method, Results, and Discussion. This means you should know where to find key information and allows for a systematic approach. You might need to revisit each section to come to a full understanding of the article.

Note that the most effective approach to reading and note-taking may be different when working on a project like this than when you are assigned specific readings for class; here I'm assuming that you are searching an unfamiliar literature and need to quickly evaluate whether the many papers you encounter are relevant enough to spend more time reading and evaluating in detail (rather than, say, critically evaluating a set article).

Note also that there are many possible ways to approach research articles. If you have a favorite method, or a hint for fellow students, please pass it on so that your suggestions can be incorporated.

Step 0. Read the title

The title of a paper is the first thing you'll see in your search results. Much of the time it should be clear from the title alone whether examining the paper further will be a good use of your time. If it seems promising, or if you're not yet sure, move on to the Abstract.

Step 1. Read the Abstract

Even though it may be confusing if you are unfamiliar with the subject matter, the abstract will give you a quick overview of the material in the article. Try to determine the overall point of the paper before starting the body of the report. Between the title and Abstract of a paper, you should be able to decide in less than a minute or so whether to continue with a paper or to discard it as irrelevant to you. For this lab, you can be ruthless; your time is very limited

and so you only want to spend it on research articles that will (hopefully) make the greatest possible contribution to your proposal.

Step 2. Skim, then read, through the Introduction

Don't spend too much time on the Introduction, unless the Abstract is overly complicated and you don't understand the point of the experiment. Begin by trying to find the hypothesis (usually near the end of the Introduction), so that you can understand where the arguments are leading. Then, read the entire Introduction and see what you can get from it. In a new area, it usually takes at least 2 readings before you understand it fully.

Step 3. Go to the Method section to get the information to better understand the Introduction

In general, the Method section should be understood fully in terms of why each step is conducted to investigate the hypotheses. While reading through the Method section you may need to review some parts of the Introduction.

Step 4. Introduction and hypothesis revisited

If at this point the study still seems relevant to you, it's worth stopping for a moment to think about what results you expect given the original hypothesis. See if you can predict what the researchers will find and roughly how they might report it. Would there be graphs; what would they look like? Seeing how your predictions pan out will give you a sense of how well you understand the research so far.

Step 5. Read though the relevant Results

Read through the entire results section, but don't agonize over it—if you haven't had a course in statistics it probably won't make much sense, and even then you may encounter more advanced statistical techniques. If there are Figures, focus on them and the associated captions, text and analyses. (And see the Summary of Basic Statistics in Appendix C).

Step 6. Skim, then read, the Discussion

First, skim through the Discussion section to find detailed confirmation of the hypotheses. There should be nothing surprising in the Discussion, if you were able to surmise the gist of the report while reading the previous sections.

Step 7. Take notes

After going through the whole article in this fashion first, read through it again while taking notes. Your notes should include a summary of the hypotheses, a brief methodology, and summary of results, and a conclusion. Also, point out what you think are the most important strengths and weaknesses of the study.

B Searching the Literature

Step 0. Keywords

Start by thinking about the *keywords* that best describe the general (or specific) theme(s) of your proposal. As you are aware, in the digital world of databases and search engines, finding the right keywords is critical to lead you to the best resources. Overly specific and you might not find much of anything. Overly general and your results might not be very useful.

- Brainstorm ideas and find vocabulary, synonyms, useful keywords to search.
- Think about whether it would help to put a phrase in quotation marks. E.g. googling *attachment theory* returns around 200 million results, whereas “*attachment theory*” returns around 3 million.
- Think about what *combination(s)* of keywords should narrow your results to the most relevant content.
- It might help to use Boolean operators such as AND, OR, or to *exclude* certain keywords from your results, NOT (see <https://guides.library.barnard.edu/boolean>).

Note that this will most likely be an ongoing process throughout your search; the results you find should help you tailor your keywords in an iterative process.

Step 1. Google it

<https://www.google.com>

Like everything else in life, the process of formulating a research proposal can begin with a Google search. For common psychology terms or ideas, Google will often lead you to a helpful Wikipedia article. You’ll probably also see results from popular psychology websites like Psychology Today. You might also find there are books or blog posts relevant to your interests.

Skimming some of these initial results can be a great way to quickly familiarize yourself with the big-picture ideas and some relevant research findings. But you should be aware that many of these kinds of resources will be *nonscholarly*. That’s not intended as an insult. It just means that they are written for a general audience. The vocabulary is less specialized, and they are not peer reviewed, and they do not always have citations and references.

The sources you cite in your proposal paper should be *scholarly*. Scholarly journals and books are written for specialized readership, by scholars or experts in a field of study, describing academic research. They are “peer reviewed” by other experts as a quality control mechanism; they have citations and references; they give the affiliation of the authors (university, research institution); and they have abstracts (in the sciences and social sciences).

Step 2. Google Scholar

<https://scholar.google.com>

Google Scholar searches the full text of scholarly articles. It casts a wide net, searching across all disciplines, and including books and other materials in addition to journal articles, so will likely find many articles not very relevant to the topic as well as those that are relevant. Some tips:

- Use “allintitle:” to search in the titles only. There is no way to search in the abstracts only.
- Set up e-Link to show links to full-text at Columbia (go to Settings – Library links).
- The “Cited by” info can be useful – more influential articles will be cited more often.
- Click the ” symbol for a search result to copy and paste the APA-style reference entry into your References section (however there are more effective ways of managing your sources and automatically generating your citations and References section; see [Managing your references](#))

Step 3. CLIO

<https://clio.columbia.edu>

Quicksearch searches the Catalog, Articles, the Academic Commons and the CUL website. Catalog (clio.columbia.edu/catalog) searches all the holdings of the CUL system.

Remember to use quotes for a phrase, and * for truncation, to find variant endings. For keyword (All Fields) searching, use the Boolean operators AND and OR e.g. (love OR sex) AND “attachment style” – see <https://guides.library.barnard.edu/boolean>.

Step 4. Scholarly Databases

<http://www.columbia.edu/cgi-bin/cul/resolve?ALD2284>

The link above should take you to PsycInfo, a database for scholarly psychology research (you can also search for *psycinfo* in a CLIO quicksearch). PsycInfo gives you the ability to do much more focused searching than Google Scholar or CLIO.

- You can do sequential searches and then combine them with the Boolean operators AND, OR, and NOT.
- You can select where your keywords should appear, i.e. in the title, abstract, or full text of articles. If you select “Word in Major Subject Heading”, which can help narrow down your search to articles that are actually on the topic you’re interested in (rather than just containing the keyword).
- The *APA Thesaurus of Psychological Index Terms* link at the top can be useful for finding technical terms used in psychology, and other related ideas.

Step Ω. Managing your references

When you are dealing with a large number of references or multiple papers, I recommend using [Zotero](#) to assist you. It is a free application with a browser plugin to collect article details as you are searching the literature.

- See the Barnard library’s guide to Zotero at <https://guides.library.barnard.edu/citation-management/zotero>
- When you’re on a website looking at a journal article, the Zotero Connector browser add-on allows you to click a button to automatically download the article details into Zotero (including, if available, a PDF of the article). This allows you to easily keep track of all the articles you have found.
- Installing Zotero also installs a Microsoft Word plugin that allows you to insert citations in-text and automatically generate a complete, APA-formatted references section.
- Integration with Google Docs is available with the Zotero Connector browser extension as well.

A note of caution, however: always check your work. Zotero and Google Scholar don’t always get the reference details exactly right, and it would be poor form to pass along an error committed by them.

Step α. Other ideas

If you find yourself stuck, or you still aren’t even sure where to begin, you can of course talk it through with Prof. Brotherton and/or your TA. And if you want an outside opinion, there are other resources available to you. Particularly, you can request a consultation with Barnard’s subject librarian for psychology: Erin Anthony; eanthony@Barnard.Edu

The library also provides an Online Research Guide: <https://guides.library.barnard.edu/PSYC>

C Summary of Basic Statistics

Analyzing data

Once a researcher has gathered data from an experiment, she needs to interpret the data. Of course, you could just list the individual observations and try to form an intuition about the general outcome, but there are more formal means to determine whether the experimental manipulation had an effect. A statistical description summarizes the data in a way that permits interpretation.

Note that even though you will be proposing a piece of research and not actually collecting or analyzing data, familiarity with the following statistical concepts and procedures will be essential for you to propose an appropriate analysis for your proposed design, and for you to meaningfully interpret the potential results of such a design.

Descriptive statistics

The first step is to describe your data. These kinds of statistics are called descriptive statistics or summary statistics. With an experimental design where you want to compare groups, the most obvious place to start is to find an average value for the observations in a group. The average, or mean, is a measure of typical performance; it summarizes all the scores and produces a single number which represents the most typical value. The basic formula for the mean of a set of scores is:

$$M = \frac{\Sigma X}{n}$$

In this equation, X refers to all the scores in the group, and n is the number of scores in the group. The symbol Σ instructs you to sum all the scores. A simple way of saying the formula in words is: Add up all the scores in the group and divide by the number of scores in that group. If your experiment involves comparing two or more groups, you can obviously calculate the mean of each group of scores separately. If the means are different, maybe your experimental manipulation had an effect.

However, there is always variability in the scores in a group. The mean is a central value, but some scores fall below it and others above it. Therefore, researchers also need to describe the

amount of variability in scores. This puts the mean in context, describing just how representative of all the scores it is. If there is high variability, scores are spread widely and the mean is relatively unrepresentative; if there is low variability, scores are clustered tightly and the mean is relatively representative. When variability is high, the group means might be different just due to chance, not because of your experimental manipulation.

A mathematical way of describing the amount of variability in a group of scores is to calculate the deviation of each score from the mean, square the deviations, and then sum the squared deviations. This quantity is called Sum of Squares (SS). One mathematical formula is:

$$SS = \Sigma(X - M)^2$$

Dividing SS by the number of scores in the group minus 1 produces a quantity called variance, which is represented by the symbol s^2 . Variance is the average squared deviation. (Remember that to calculate an average, you add a set of scores and divide by n . Here we add a set of deviations and divide by $n - 1$. We use $n - 1$, rather than just n , because it is a necessary statistical adjustment to account for the fact that samples tend to underestimate variability.)

$$s^2 = \frac{\Sigma(X - M)^2}{n - 1}$$

Taking the square root of the variance produces another quantity, called standard deviation. It is represented mathematically by the symbol s , but in psychology papers you will most often see it represented by the letters SD.

$$SD = \sqrt{\frac{\Sigma(X - M)^2}{n - 1}}$$

While variance is the average squared deviation, SD is the average deviation in the original units (i.e. not squared). This is the most intuitive way to convey how much scores typically varied about the mean.

Inferential statistics

Knowing the standard deviation and mean for each experimental group gives you a good idea of how much scores differed within each group, and how much the groups differed on average. But researchers still need to perform a statistical test to determine whether the groups differed more than would be expected by chance alone. These kinds of statistical tests are called inferential statistics, because we are using our sample data to make an inference about what would happen if everyone in the population had taken part in our experiment, rather than just the small number of people who happened to be in our samples.

Correlation

When you measure two variables and wish to know if scores on one measure are related to scores on the other, you calculate the correlation coefficient. This quantifies the extent to which changes on one measure are related to changes on the other. For example, if higher scores on measure X are associated with higher scores on measure Y, there is a positive correlation. If higher scores on measure X are associated with lower scores on measure Y, there is a negative correlation. No correlation means that scores on X are unrelated to scores on Y.

To calculate the correlation between two variables, you must first calculate the Sum Product, SP. The mathematical formula is:

$$SP = (X - M_X)(Y - M_Y)$$

Notice that $X - M_X$ and $Y - M_Y$ are deviation scores, just like we calculated for the standard deviation. Here we have two variables, X and Y , so the equation is telling us to calculate the deviation of each score from its respective mean. We then multiply each deviation for variable X by its counterpart deviation from variable Y . These are the “products,” meaning multiplied deviation scores. Finally, the tells us to add up all those products, giving the “sum of products,” SP .

Once we have calculated SP , the correlation coefficient, symbolized by r is calculated using the following equation:

$$r = \frac{SP}{\sqrt{SS_X SS_Y}}$$

Here, SS_X and SS_Y are the Sums of Squares for each variable. Multiplying them and taking the square root gets us a measure of the variability in X and Y separately. The numerator, SP , represents the covariability of X and Y . So the equation results in covariability as a proportion of all variability. It can range from -1 , meaning a perfect negative correlation, to 0 , meaning no correlation at all, to $+1$, meaning a perfect positive correlation. As a rule of thumb, in psychology, correlations of less than around ± 0.30 are considered weak, around ± 0.30 to ± 0.70 are considered moderate, and greater than around ± 0.70 are considered large.

The t -test

One test to compare two groups of scores is the t -test. One form of the t -test formula, assuming that the two groups have equal sample sizes, is as follows:

$$t = \frac{M_1 - M_2}{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

The numerator is simply the difference between the group means (the different group means are represented by the subscripts 1 and 2). The denominator quantifies how much of a difference is to be expected due to chance alone. It divides each group variance (s^2) by the number of scores in that group, adds the answers, and then takes the square root.

The size of the t statistic required to conclude that a difference between groups is real depends on the size of the samples (how many observations you took). The greater the number of observations, the smaller the t required to identify a real difference. In order to determine the exact value of t required to declare the difference in groups to be reliable, several values must be determined. One of these is the degrees of freedom for the test (df). The degrees of freedom, df , is another statistical correction that weights the number of observations in each experimental group. Basically, we lose one degree of freedom for each group, so with two groups, $df = N - 2$ (N being the total number of scores), or:

$$df = (n_1 - 1) + (n_2 - 1)$$

The other quantity to determine is alpha (α), or the significance level. By convention, this is usually set at $\alpha = .05$. This means that you are willing to chance being incorrect in your conclusion .05 (or 5%) of the time. More specifically, if you were able to repeat your experiment a hundred times, even if your experimental manipulation does nothing at all sometimes you would observe group means that are quite far apart just by chance alone. Specifying $\alpha = .05$ means that you will only regard a difference between means as statistically significant if it is one so large that it would occur just 5% of the time if your manipulation didn't actually work.

Once you know df and α , you can proceed. Associated with each df value is a critical t value. This is a cutoff value; if the t statistic you calculate for your data exceeds this critical cutoff, you conclude that there is a statically significant difference between the groups, i.e. the groups differ more than would be expected by chance alone 95% of the time (with $\alpha = .05$, there is always a 5% chance of seeing such a difference by chance).

Many tables of these cutoff values of t are available, for the many possible values of df and α . Here, we provide a table that provides a table that assumes $\alpha = .05$. Look at the table and run down the df column until you find the value of df that matches the value for your data. The number to the right of that value is the critical value for t at the $\alpha = .05$ significance level.

df	t
1	12.706
2	4.303
3	3.182
4	2.776
5	2.571
6	2.447
7	2.365
8	2.306
9	2.262
10	2.228
11	2.201
12	2.179
13	2.160
14	2.145
15	2.131
16	2.120
17	2.110
18	2.101
19	2.093
20	2.086
21	2.080
22	2.074
23	2.069
24	2.064
25	2.060
26	2.056
27	2.052
28	2.048
29	2.045
30	2.042
31	2.040
32	2.037
33	2.035
34	2.032
35	2.030
36	2.028
37	2.026
38	2.024
39	2.023
40	2.021

Effect size for two-group designs

In addition to knowing whether a difference between two groups is statistically significant, it is necessary to quantify the effect size. The most common measure of effect size for two-group designs is Cohen's d . This is a standardized way of quantifying the magnitude of difference between groups caused by the experimental manipulation, in relation to the random variability in the data. Again assuming that the two groups have the same sample size, the formula for Cohen's d is:

$$d = \frac{M_1 - M_2}{(SD_1 + SD_2)/2}$$

The numerator gives the difference between group means. The denominator adds each group's standard deviation and divides by two to give the average standard deviation of the two groups (also called pooled standard deviation). Therefore, if Cohen's $d = 1.00$, there was a difference between the groups of one standard deviation.

Cohen suggested the following rule of thumb for interpreting effect sizes in psychological research: $d = 0.2$ indicates a small effect; $d = 0.5$ indicates a moderate effect; $d = 0.8$ indicates a large effect.

Statistical power and sample size for two-group designs

An important aspect to consider when planning research is what sample size will be required—i.e., how many participants you should aim to recruit. This can be calculated in advance by using statistical principles and some assumptions about the quantities previously mentioned.

First, consider alpha. As previously mentioned, for psychological research this is usually set as $\alpha = .05$. This is also known as the Type 1 error rate, or false positive rate—the frequency at which you would mistakenly think that your experimental manipulation had an effect when really it didn't.

Second, the Type 2 error rate, or false negative rate, is how often you might fail to detect a real effect of your manipulation. This quantity is called beta (β). It is related to alpha; a smaller alpha means a more stringent test, which means we are deliberately reducing our chances of detecting a real effect. But beta is also affected by sample size. The more participants in a study, the greater statistical power it will have, because increasing sample size makes it easier to detect real differences. For psychological research, it is common to specify a desired Type 2 error rate of 20%. The corresponding 80% is called the statistical power of the study: the chances that it will successfully detect the treatment effect it is designed to detect.

Third, as previously explained, Cohen's d measures effect size by dividing the size of difference between group means by the pooled standard deviation. You should be able to estimate the effect size you expect your manipulation to have based on previous research which has studied

similar constructs. Failing that, you should specify the minimum effect size you would be willing to accept as meaningful.

Knowing the values for alpha, power, and effect size allows you to calculate the required sample size. The following is an approximate equation for calculating the required sample size:

$$n = \frac{2(Z_a + Z_B)^2}{d^2}$$

Here d is Cohen's effect size. Z_a and Z_B are constants based on the mathematical properties of the normal distribution and our specified values for alpha (.05) and desired power (.80). For these values, $Z_a = 1.96$; $Z_B = .8416$. So if you expected your manipulation to cause a small effect ($d = 0.2$), you would require $2 * (1.96 + 0.8416)^2 / 0.22 \approx 393$ participants *in each condition*. For a large effect size like 0.8, you would require $2 * (1.96 + 0.8416)^2 / 0.80 \approx 25$ participants per condition.

ANOVA

The Analysis of Variance (ANOVA) test is an extension of the t test. It is used where there are more than two groups to be compared. ANOVAs look at the ratio of variance between groups (deviations of group means from a grand mean) to error variance (deviation of individual scores). The larger the ratio, the more likely it is that the differences among groups are due to the experimental manipulation and not just due to chance.

ANOVA can even be used with more than one independent variable. Experiments often manipulate more than one independent variable, and examine the effects of those variables using ANOVA. This kind of analysis is called a “factorial” ANOVA, because there is more than one “factor”, meaning independent variable. The experimental design is referred to by the number of “levels” (meaning conditions) of each factor. For example, if a design has two independent variables, each with two different conditions, it would be referred to as a 2x2 ANOVA design. A 4x3x2 design has one factor with four levels, another factor with three levels, and a third factor with two levels.

These experiments can potentially describe the real world more completely and realistically. Consider the following example.

Some research on people's perceptions of procedural justice and fairness suggests that people feel they've been treated fairly when they get what they want. Some other research, however, suggests that people feel they've been treated fairly when they get what they deserve. So if you have behaved badly and you are then treated badly, you might be satisfied and say it was fair. A study to examine this hypothesis might manipulate people's behavior as one independent variable; participants could put in a situation where they are led to behave either positively (not cheating on a test) or negatively (cheating on a test). The second independent variable might be how a research assistant then treats the participant, either respectfully or disrespectfully. This would be a 2x2 design—two IVs, each with two levels. The dependent

variable—the thing that the researcher measures—might be participants’ feeling of how fairly they were treated.

Factorial designs are more complicated to interpret, because of the more complicated design. One type of information we get is about the effect of each variable by itself. This is called the main effect. With two independent variables, there are two main effects. In the example above, either behavior or treatment could have had a significant effect on perceived fairness.

The second type of information we get from factorial designs is called an interaction. If there is an interaction, the effect of one independent variable depends on the level of the other independent variable. So in the above example, one outcome may be to find a main effect of treatment but no interaction; people might simply think they have been treated fairly when they were treated with respect, regardless of their actual behavior. However, another possible outcome would be to find an interaction between treatment and behavior; maybe your perception of the fairness of your treatment depends on how you behaved. If you are treated poorly but you did something to deserve it, you might perceive it as fair. On the other hand, being treated respectfully for bad behavior might be perceived as unfair. This would indicate an interaction.

Effect size & power for ANOVA

The small, free application G*Power can help you determine required sample sizes for ANOVA designs. <http://www.gpower.hhu.de/>

Visualizing data

Even though you won’t be collecting data, you will be forecasting plausible-seeming results. Doing so requires understanding at least the gist of the relevant statistics as described above. One other piece of the puzzle is thinking about your hypothetical data and results visually: how would it look as a graph? In fact, if you’re unsure about what results to expect, or you’re unsure whether your expected results are really plausible, thinking about a corresponding graph can help clarify your thinking.

There are a few standard ways of visualizing data, depending on the nature of the data and the design of the study. (Note that my examples here are deliberately rough; a pencil sketch is perfectly fine as long as it is clear.)

For bivariate correlational data, a scatterplot is usually appropriate. This will have a labelled x-axis and y-axis, one for each of your two variables. Which variable goes on which axis is somewhat arbitrary, though if you can think of your variables as a “predictor” (something you would know about a person) and “predicted” (the variable you want to predict based on the predictor), you can put the predictor on the x-axis and predicted on the y-axis (see Figure 1).

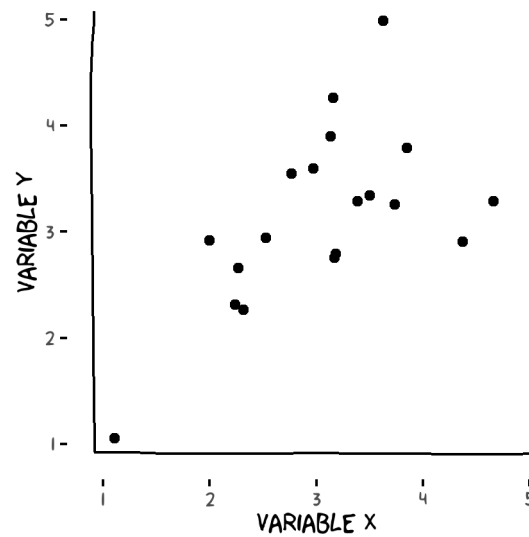


Figure C.1: Example of a scatterplot showing a dot for each hypothetical data point. Note that axes should have meaningful labels.

For comparing groups—either two groups in a t-test design or three (or more) groups in a single-factor ANOVA design—a bar graph is often the best choice. Here the categorical grouping variable will be on the x-axis and scores on the dependent variables will be on the y-axis. Each bar represents a different group, and the height of the bar represents the average score on the DV of all participants within that group.

For a 2x2 ANOVA design, a line graph can be clearest. In this case, one IV is represented as two marks on the x-axis, and the second IV is represented by separate lines (different colors, or solid and dashed, say). The y-axis represents scores on the DV.

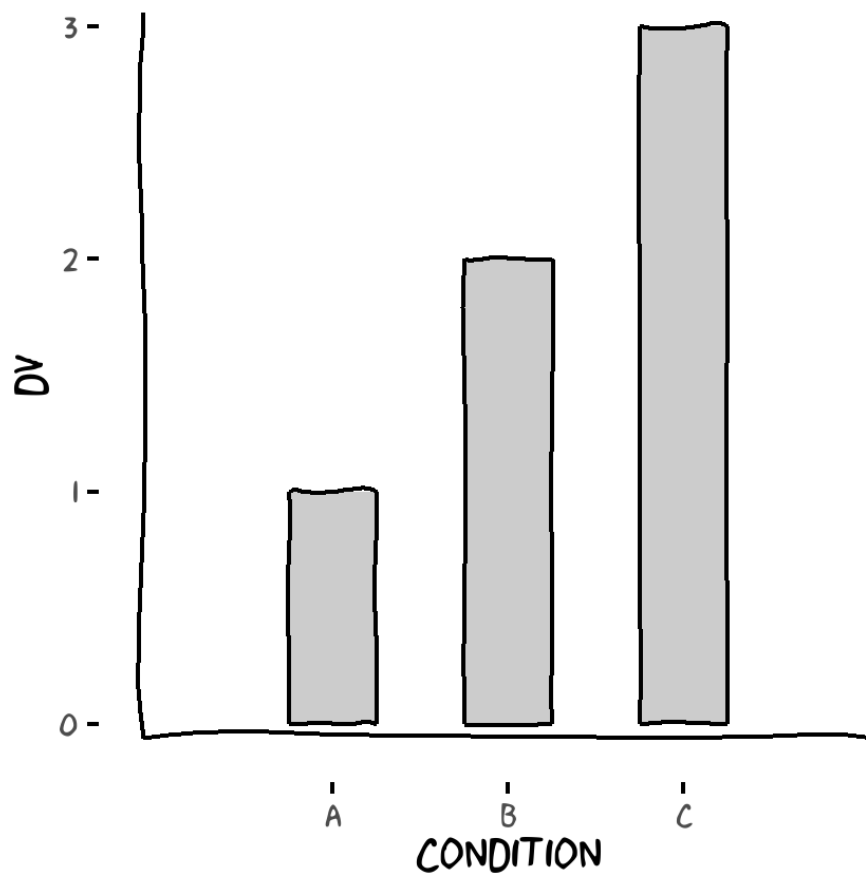


Figure C.2: Example of a bar graph showing average scores on the dependent variable for three groups of the independent variable. Note that, again, your graph would have more meaningful labels.

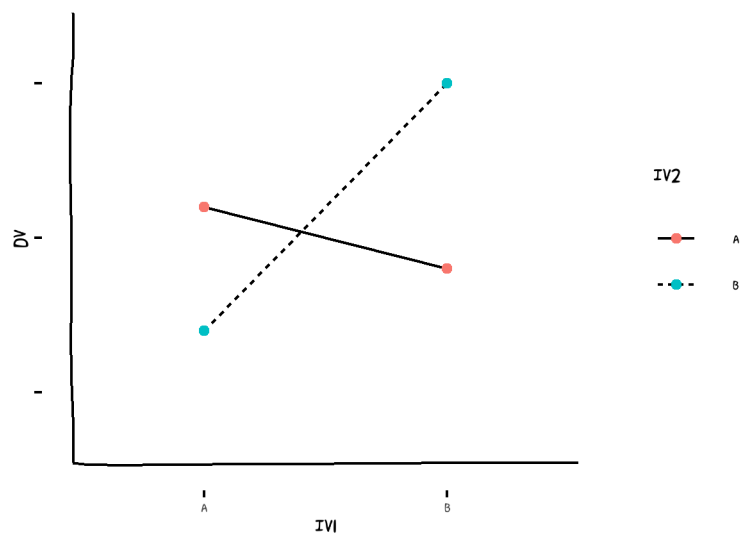


Figure C.3: Example of a 2x2 line graph. The two conditions of IV1 are represented on the x-axis, and the two conditions of IV2 are represented by the solid and dashed lines.

D Example consent form

Barnard College Department of Psychology

Research Consent Form

Investigators: [*Your names and contact information*]

Description: This research project is being conducted for Social Psychology Lab. The experiment concerns... You will be asked to...

[Write what the task entails—not the full instructions, but a brief overview. What is the general question you are interested in? What will participants do to help you find the answer? How long is it expected to take? Make sure to be general enough to ensure your participants are not influenced toward acting in a certain way.]

Risks and benefits: There are no risks associated with this experiment. The benefits are the contribution to our understanding of [[whatever your study is about]], the opportunity to experience the methods of data collection and measurement that are common in social psychology, and the opportunity to contribute data to a project used in the training of students in social psychology.

Confidentiality: Your data are recorded with no identifier other than a randomly assigned ID number. Data are compiled into a file with no other identifying information. Right to withdraw: You may withdraw from the experiment at any time, without penalty. Any data already collected will be erased.

Use of your data: All data reports will be based on the cumulative set of data collected. No individual results will be presented.

Contact information: If you want additional information about this research and your participation in it, or have any questions or concerns, please contact the instructor of this course, Rob Brotherton, at rbrotherton@barnard.edu.

I have read the above information about hereby give my voluntary consent to participate.

Signature _____ Date _____

E Example debriefing document

Here's an example debriefing from a study on national stereotypes—a potentially sensitive topic. Notes are in *italics*.

[First, thank participants and give them a general idea of what the study was about. Put things as plainly as possible; participants are likely unfamiliar with psychological jargon]

Your participation is now complete. Thank you! This study was an investigation into the function of stereotypes. Many people have national stereotypes. For example, you can all probably imagine a stereotypical image of an English person or a German person or an American etc. Yet these stereotypes are not necessarily always the same in every situation. Sometimes people might vary their national stereotypes as a means of trying to justify their prior discriminatory behaviour. We want to see whether this might be true.

[Next, give a full account of everything that participants were asked to do, and what purpose it served. Remember, if you use a between-participants design participants will be unaware of the conditions they were not exposed to, so make sure everyone understands both what they were asked to do and what other participants were asked to do. Take special care if any deception was involved or if you weren't forthcoming about the true purpose of certain things. Participants should not be left with any misconceptions about your research]

So in this experiment we measured the national stereotypes of everyone and this acted as our main dependent variable. This was achieved by 2 methods. First, everyone completed the questions regarding how representative a list of traits was of a particular group (i.e. English and German). Second, the memory recall task was used to evaluate the extent to which people were activating stereotypes to help their recall. Better recall of stereotype-consistent words compared to stereotype-inconsistent words was taken as evidence of stereotype use. There were 3 simple manipulations in the overall design of the study. These were all included to encourage participants to engage in discriminatory behaviour. First, in all sessions we provided you with false information regarding a made-up study of the allocation strategies favoured by English students from different Universities. Second, in some sessions we gave you the opportunity to show discriminatory behaviour. Finally, in some sessions were asked you to offer an explanation of why English students might favour their own group.

[After describing the method, describe your anticipated findings, and what such findings would demonstrate about human psychology]

We anticipate that participants who showed high levels of discrimination will produce different national stereotypes and activate national stereotypes more compared to participants who

showed low levels of discrimination. If this is true, then our original suspicion regarding the justificatory function of stereotypes might be true.

[Lastly, remind participants who to contact with any remaining questions, and thank them once more]

Please contact [*researchers*] at the following e-mail address [...] if you have any questions regarding this study.

THANK YOU AGAIN FOR YOUR PARTICIPATION!

F Guide to writing a research report

An important aspect of your project is to practice writing a paper according to the conventions of the field of psychology. The aim of a report is to inform the reader about an experiment or study, its procedures, its purpose, and its outcome—or, if you are writing a theoretical paper, to present a broad, coherent, evidence-based argument which synthesizes the existing literature and presents your own interpretation of how a body of work helps us understand a particular phenomenon.

Effective communication is accomplished by being concise and by presenting the report in a standard format. The journal articles you read each week for the lecture, and those you read as you work on your own proposal, will provide you with an idea of the form and content of your report, though you may notice that different journals have different formatting conventions. Your paper should be written according to APA manuscript style. The authoritative source is the Publication Manual of the American Psychological Association (7th edition). All parts of lab reports should be typed double-spaced with 1 to 1-1/2 inch margins all around. Do not justify the right margin. All pages are numbered in the upper right corner of the page header on the same line as a “running head” consisting of a few key words of your title. Include the header and page number even on the title page—though on the title page your running head is preceded by the words “RUNNING HEAD:”; subsequently it is not.

Psychological papers generally consist of these parts in this order:

- Title Page (separate page, numbered page 1)
- Abstract (separate page, numbered page 2)
- Introduction (start on a separate page, numbered page 3)
- Method (no page break after Introduction)
- Results (no page break after Method)
- Discussion (no page break after Results)
- References (separate page after Discussion)
- Tables (each on a separate page, pages numbered sequentially)
- Figures (each on a separate page, no page numbers or headers)
- Appendices (each on a separate unnumbered page)

General tips for clear writing

The goals of conciseness and clarity can only be achieved if you are a patient and careful editor of your writing. Give yourself time to read your work critically and make revisions before submitting. Is the meaning of each sentence clear? Have you omitted any important details necessary for understanding your point? Are there any repetitions that can be omitted without sacrificing clarity? Is the content of each section appropriate? An excellent way to spot awkward or wordy writing is to read the report aloud. Here are some specific issues to keep in mind:

Tone

Sentences in the report should be clear, concise and to the point. Usually a series of simple sentences is preferable to a single complicated sentence. Do not use exotic or complex words if plain words will do.

Ambiguity

Avoid ambiguity in your writing. Make sure that statements made in the same or different sections do not contradict each other. A common error is to refer to data without being specific: “the response rate was high (or low, or moderate, etc.)...” Such descriptions need a referent—high relative to what rate? “These findings were not clearcut...”—what makes findings clear-cut? Make sure the reader knows what you mean!

Repetition of terms

For terms that appear frequently in your report, write out the term the first time it is used, followed by the abbreviation in parentheses. You may then abbreviate later uses of the term. (But, no abbreviations should appear at the beginning of a sentence.) Do not, however, abbreviate too many terms in your report. Sentences such as: “The effect of SRI on HTMB may be mediated by SRC” are unintelligible.

Tense

At various points in your report you will be writing about existing, completed research; your interpretation of those existing findings; your future plans for your proposed study; and your interpretation of what your hypothetical findings would mean. Therefore, you will use a mix of present, past, and future/conditional tense.

For much of the Introduction, you will use past tense to describe existing research and its findings:

Brotherton and Son (2020) studied the metacognitive processes underlying factual knowledge and opinion.

In previous studies, conspiracy beliefs have been shown to correlate with uncertainty (e.g. van Prooijen et al., 2013).

However, your own interpretation of things should be put in present tense:

These findings suggest that claims perceived to be true are seen as matters of fact, while claims judged false tend to be seen as opinion.

The Method section, in which you describe the plan for how your study would be conducted, will be largely future tense:

Participants will complete the Generic Conspiracist Beliefs scale.

Likewise, the Results section:

We expect participants in the *Uncertainty prompt* condition to score higher on conspiracist ideation than participants in the *Certainty prompt* condition.

An exception is that you should use the present tense when you make reference to graphs or tables (e.g., Figure 1 shows...). Here you are making a statement about the report that is present at the time of reading and not about the experiment or the analysis you intend to carry out (or already carried out in the past).

The Discussion, like the Introduction, will involve a mix of past-tense summarizing of prior research, conditional-tense speculation about your future hypothetical findings, and present-tense interpretation of what it all means.

If the findings are consistent with the hypothesis it will suggest...

This would fit with the existing findings showing a correlation between...

Overall, this research would suggest that people's beliefs about political conspiracies are open to influence.

Basically, use your common sense and try to write in a way that gives an accurate impression of what has already happened and what is as-yet hypothetical.

Style

When you write a psychological report, you are a scientist. Scientific writing is descriptive, and personal memoirs are inappropriate. Pronouns are almost always inappropriate unless you are telling personal story. The fact that you personally are involved in the enterprise is not directly relevant to the scientific merit of the discussion.

This tone may lead to the frequent use of passive sentences. But this use is stylistically objectionable when too many such sentences are strung together. Often a little thought will permit you to avoid both first person (I, we) and the passive voice. Consider:

Poor:

Participants will be administered twenty trials in a session.

Better:

A session will consist of twenty trials.

Found, observed, showed are almost always inappropriate. “Uncertainty impaired discrimination” is preferable to “uncertainty was found to impair discrimination.” Obviously, if you know this result, somebody found it. Unless you want to emphasize history about the process of findings, the result is important, not the process.

Sections of a Lab Report

Title Page

The title page is the first page of the lab report. It contains the title, author, institution, and running head.

Title. The title is centered between the left and right margins in the top half of the title page. A good title includes no more than 12 words. The first letters of all major words of the title are capitalized. In general, titles are detailed enough to distinguish one article from another. The title should reveal the central point of your experiment (the topic being studied, the key variables you are looking at, or the hypothesized outcome). The research you read for your literature review will provide appropriate examples.

Your name (as author) should appear centered and double-spaced directly below the title. Double-spaced and centered underneath your name appears the institution with which you are affiliated—in this case, Barnard College. Running Head. The running head can be up to 50 characters long, including spaces and punctuation. It is entirely capitalized and typed flush left at the top of the title page, preceded by the words “Running head,” followed by a colon. On subsequent pages, the words “Running head” are omitted. Page Numbers. Each and every page (including the title page) of your manuscript 1111 should have the page number in the

upper right corner, in addition to the left-aligned running head. Use the header function in your word processing program to have this appear at the top of each page in your paper. Number every page of text, including the title page and any tables that your report might include. Figures appear on pages that are not numbered.

Abstract

The second page of the paper is the Abstract. Use the page or section break feature of your Word processor; do not just keep hitting Enter/Return until you get to the next page. This will minimize things moving around as you edit your paper.

The Abstract is a single-paragraph capsule version of the paper. The abstract is short (100-200 words), but it should reflect material from each part of the report. The general topic and gist of previous research should be mentioned, the main aspects of your method must be presented, and your important anticipated results must be stated, together with an interpretive statement that summarizes your discussion. Usually you will write the Abstract last.

When typing the abstract page, the word “Abstract” is centered and bolded at the top of the page, with the text beginning two spaces below. Unlike other sections of the lab report, the first word of the abstract is not indented. The abstract appears on its own page, immediately after the title page.

Keywords appear after the abstract paragraph on a new line, indented and preceded by “Keywords:” in italics. The keywords themselves are not italicized, should be lowercase, and separated by commas. They don’t have to be in alphabetical order. Keywords address essential paper elements, such as the research topic, population, method, and/or application of results.

Introduction

The Introduction begins on a new page following the Abstract (p. 3). Again, use the page break feature of your Word processor; do not just keep hitting Enter/Return until you get to the next page. The title of the report is centered at the top of the page (this section is not labeled “Introduction”), and text begins below with the first line indented. The Introduction should contain background information about your project. It defines concepts described in the study and gives the reader the theoretical bases for any predictions or hypotheses you propose.

Begin by making a general statement about the broad field of inquiry. Is there a relevant real-world example that can introduce your topic? What makes this an important topic of investigation? You should be citing other sources of information to explain the logical basis for your research question. More often than not, your research is an outgrowth of prior studies, whose findings you are attempting to extend, validate, disprove or replicate. Therefore,

you should mention the specific contributions of related studies. In your introduction, build a logical argument that will lead your reader to the hypothesis of your experiment. Your introduction should provide the reader with an understanding of the reason this experiment was performed.

In the closing paragraph of the introduction you should state the specific goal of your study. At this point, your reader should clearly understand the variables you are examining and why. Provide a statement of your hypothesis. Clearly indicate what results were expected and what they will mean. This is a critical part of the report. which links the Introduction to the Method and Results sections.

Citations

References are cited in the Introduction and throughout the paper. In research reports, it is unusual to quote the writing of other scientists directly. Most often, the methodology, results, and conclusions of other research reports are described in your own words and then the research report is credited by citing the authors using this format:

According to a 2015 poll, 71% of Americans believe in miracles, 42% believe in ghosts, 41% believe in extrasensory perception, and 29% believe in astrology (Van der Linden, 2015).

If you are describing the history of a particular line of research, question, or controversy, it may also be appropriate to use the following format, which places greater emphasis on the author.

Hofstadter (1964) argued that conspiracy theories are a constant feature of American politics.

When an article with two authors is cited in parentheses in the text the names are separated by an ampersand (Jolley & Douglas, 2017). When the citation is directly in the text and not parenthesized, the authors' names are separated by "and":

In a study of anti-vaccine conspiracy theories, Jolley and Douglas (2017)...

When there are more than two authors, only the first author is mentioned, followed by "et al." (indicating "and all").

When several different experiments are referred to as a group, it is customary to include an alphabetical list of the authors' names, as well as the dates of publication within the parentheses, separated by semi-colons. It can also be appropriate to include more than one parenthetical citation in a sentence, so that it is clear which cited study produced each finding:

Conspiracy theories can lead to social and political disengagement (Butler et al., 1995; Jolley & Douglas, 2013) and may help to foster political extremism (Bartlett & Miller, 2010)...

Method

Start the Method section with a Level 1 heading immediately following the end of the Introduction; do not take a new page. The Method section describes the proposed conduct of the study. It should provide the reader enough information to reproduce your research. The Method section generally has the following four subsections, each with a Level 2 heading (though in the published papers you read the format may vary depending on the research and authors' preference):

Design

Here you give a brief, technical statement of the design of your study. This states the psychological constructs of interest, whether they are independent or dependent variables in your study, and whether any independent variables are manipulated between- or within-participants. For example:

A 2x2 between-participants ANOVA design will be used. The first independent variable will be participants' behavior (cheat vs. no-cheat); the second independent variable will be participants' treatment (respectful vs. disrespectful). The dependent variable will be participants' perceived fairness of their treatment.

You don't need to explain how you operationalize the constructs here—you will do that in detail in the materials and/or procedure subsections.

Participants

Here you will explain how many participants you require for your study (based on the concept of statistical power explained in Appendix C). You should also state any special inclusion/exclusion criteria, e.g. if your study requires only adults, children, college students, if you're seeking participants with certain characteristics, comparing nationalities, etc.

Materials

Here you will explain how you will operationalize all your constructs of interest. For each scale or task you will have participants complete, give all the information that would be required for another researcher to do the same study. For questionnaire scales, give the full wording of questions and response scales. For longer scales with many questions, give two or three example items and put the complete scale in an Appendix. You should also explain any videos, images, or other materials that your participants will encounter (include images as Figures in the text, or in Appendices). If you plan to administer several different measures, you can use Level 3 subheadings for each. You should also briefly explain why your chosen operationalization is appropriate; e.g. has it been used in previous research and shown to be valid and reliable? Or,

if it is a scale you have designed yourself, what advantages does it have over existing scales and how can you be sure it measures what you intend it to measure?

Procedure

Lastly, the procedure subsection provides a step-by-step description of what participants will be required to do as they take part in your research. Mention the order of tasks, any key instructions that will be delivered either in writing or verbally by the experimenters, and any other information along these lines that you haven't already fully explained in the Materials subsection. Remember that, as a whole, the Method section must give the reader all the necessary information to run your proposed study themselves, so you shouldn't leave anything up to guesswork. It may be useful to have a friend who isn't familiar with your work read this section and tell you anything that remains unclear.

Results

The Results section appears immediately below the Method section with no page break between sections. In published papers, the Results section describes statistical analyses that have already been carried out on the data. Your Results section will describe the intended analytical treatment of the data verbally, including anticipated numbers and illustrative figures. If you plan to perform several analyses looking at different questions, it may be helpful to use subheadings in the Results section to clarify presentation of your findings.

If you plan to manipulate the data in some way, for example by calculating an average of several different questions, begin by explaining that process. A verbal description of the expected pattern of findings (e.g. Group A is expected to score higher, on average, than Group B) should always be presented first. Then you will describe your planned inferential test (i.e. performing a t-test, ANOVA, or correlation). As you describe each anticipated finding in the text, it may be helpful to refer the reader to a figure that shows the expected trends in graphical form. Always tell the reader what to look for in tables and figures and provide sufficient explanation to make them readily intelligible. Figures and Tables are numbered consecutively and are placed after the References section at the end of your research report. Refer to figures and tables by number in the text of your report.

Discussion

The Discussion section should begin by reintroducing the general topic and hypothesis to your reader, followed by the conclusions that may be drawn from the results. Your statements should interpret the expected results and relate them to the questions raised in the Introduction. Be sure to focus the discussion on the major effect(s) found in the experiment. However, all results mentioned in the Results section should be discussed here. Be sure to describe your results as they relate to the hypothesis you developed in the Introduction section. You must also relate

your findings to the wider literature which you reviewed in the Introduction—how do your findings fit with what has been found before, and what implications do your results hold for the theoretical background reviewed in the Introduction? Suggestions for further research (or for improving the present research) may be mentioned but should not be the major focus of the discussion.

After considering what it would mean if your results work out the way you expect, you should consider the other possibility—what would it mean if the data did not support your hypothesis? You may want to describe characteristics of the data or procedure that may account for the unusual findings. A discussion of unexpected results should be an occasion to propose further research to clarify the causes of surprise. If your data did not support your hypotheses, it is your job to fully consider reasons why that was the case. Perhaps your study was flawed in some way and thus failed to find the expected trends, or perhaps your study was fine and the trends you expected just don't exist. When considering limitations, it is important to justify why something may be a limitation. You may even argue that an apparent limitation probably didn't affect your results. So for example, if you are studying political beliefs and your data had more Democrats than Republicans that might be a limitation, but you need to make a reasoned case why that characteristic would (or wouldn't) have affected your findings. The most common flaw of Discussion sections is failing to consider your own findings in relation to the existing literature reviewed in the Introduction. You should mention most of the ideas and findings mentioned in your Introduction again in the Discussion, but you shouldn't merely repeat the same thing as before. Rather you will reevaluate those ideas in the new context of your own potential findings.

References

The Reference section begins on a new page, with the title “References” as a Level 1 heading. Only include books or articles that you have cited in the text of your paper; the References section should not contain anything not mentioned in the text. Conversely, everything you do cite in the text should have a corresponding entry in the References section.

Each journal article reference should include author's name, year of publication, title of article, journal name (*italicized*), volume number (*italicized*), pages on which the article appears, and the article's DOI (digital object identifier). Book entries contain author, title (*italicized*), publisher name and city, and year of publication. References are alphabetized by authors' last names and initials. Book and journal titles are *italicized*, but article titles are not. Only the first letter of the first word of book and article titles is capitalized. Journal titles should not be abbreviated. The first line of each entry begins at the left margin, and subsequent lines are indented (use the “hanging indent” feature of your word processor). Page numbers should be included for journal articles and for a chapter in an edited book.

Examples

- An article in a journal:

Brotherton, R., French, C. C., & Pickering, A. D. (2013). Measuring belief in conspiracy theories: The generic conspiracist beliefs scale. *Frontiers in Personality Science and Individual Differences*, 4, 279. <https://doi.org/10.3389/fpsyg.2013.00279>

- A book:

Brotherton, R. (2015). *Suspicious Minds: Why We Believe Conspiracy Theories*. New York, NY: Bloomsbury.

- A section, chapter or essay in a book:

Brotherton, R., & French, C. C. (2017). Conspiracy theories. In D. Groome & R. Roberts (Eds.), *Parapsychology: The Science of Unusual Experience* (2 edition, pp. 158–176). London: Psychology Press.