CCHIL Lab Manual

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About the lab

Welcome to the Canine Cognition and Human Interaction Lab!

This lab is led by Jeff Stevens, Susan J. Rosowski Professor in the Department of Psychology and the Center for Brain, Biology & Behavior at the University of Nebraska-Lincoln.

Mission statement

The mission of CCHIL is to use biological and psychological approaches to understand dog behavior with the aim of improving how owners and handlers train, work with, and live with dogs.

CCHIL is committed to robust, transparent, and open science in all of our research endeavors and to disseminating our work to the general public via outreach activities.

Lab priorities

- The safety, security, and well-being of lab personnel, human participants, and animal subjects.
- An inclusive working environment that respects diverse perspectives; seeks empathic understanding of diverse experiences, including discrimination, bias, and privilege; and fosters opportunities for underrepresented students to participate in science.
- The integrity and transparency of data and the replicability of data analyses.

This manual

This lab manual was inspired by several others and borrows heavily from them (e.g., (Mehr 2020); lab manual and this one). It's also a work in progress. If you have ideas about things to add or what to clarify, talk to me (Jeff, the PI).

When you join the lab, you're expected to read this manual and are responsible for its content.

Stevens, J.R. (2023). Canine Cognition and Human Interaction Lab Manual. https://github.com/unl-cchil/cchil_lab_manual. [PDF version]

Part I

Lab policies

1 Roles and expectations

The lab is composed of Principal Investigator (PI) Jeff Stevens, graduate students, undergraduate research assistants, and lab technicians. We also interact with staff in the Department of Psychology, the Center for Brain, Biology & Behavior (CB3), the Institutional Animal Care Program (IACP), and the Institutional Review Board (IRB). All of these people have different roles and expectations about how they interact in the lab.

1.1 CCHIL personnel

1.1.1 Everyone

- Do work that you are proud of. If you're really passionate about your research and you work hard at it, that makes a huge difference.
- Double (even triple!) check your work. Being a little obsessive is essential to good science.
  - Everyone makes mistakes… the difference between a novice and an expert is that an expert acknowledges this and is meticulous.
  - If you do find a mistake, always tell your collaborators as soon as you can (and simultaneously work to fix the mistake). This is important at any stage of a project – even if the paper has already been written, and even if it has already been submitted!
  - We admit our mistakes, we correct them, and we learn from them. And then we move on.
- Fulfill your commitments. Understand expectations for your time in the lab, and ask Jeff if you have questions about them. Then complete those commitments, including attending all experiment appointments and meetings. Let Jeff or other teammates know as soon as possible if you're unable to make and appointment/meeting.
- Be supportive of your labmates. We are a team.
  - Offer help even if you aren't on the project. Help others and you can expect others to help you when you need it.
- Work independently when you can; ask for help when you need it.
- Share your knowledge. Mentorship can take many forms.
- Respect each others' strengths, weaknesses, differences, and beliefs.

- Science is a marathon, not a sprint. Take personal time/vacation when you need it, and cultivate a life outside of the lab. Respect that other lab members also have a life outside of lab.
- Communicate openly and respectfully with other members of the lab.
- If you're struggling, tell someone (feel free to tell Jeff!). Your health and happiness are important. It's OK to go through tough patches (we all do!), but don't feel shy about asking for help or needing to vent.
- If you have an issue with another lab member that cannot be solved by talking with them about it, please talk with Jeff. Tension and hostility in the lab are toxic for the group dynamic. Jeff is here to help with any and all of these issues, and the sooner, the better!
- If you have an issue with Jeff and feel comfortable talking with him about it, please do! If you're not comfortable with that, please reach out to another member of the psychology department who can intervene (this can be a grad student for smaller lab issues or another faculty member for more serious issues). Mike Dodd and Maital Neta have agreed to be resources for lab members to approach.
- Stay up-to-date on the latest research, either by RSS feeds, getting journal table of contents, or following scientists on Twitter/Mastodon.
- Academia may feel different from other types of jobs, but it is still a job. You should treat coming into lab with the same respect that you would treat any other position. There are going to be aspects about the job you like more than others, but all are required.
- Conduct with the PI and other faculty:
  - You may notice that Jeff is often quite casual in speech/behavior. That said, please remember that he is a faculty member and head of the lab, has extensive academic experience, and a Ph.D. In that way, he is 'senior' (meaning in experience and power), and a good general rule is to behave formally with senior folks until you have a good handle on the appropriate level of casualness. Jeff hopes to be friendly with everyone, but his specific role is Lab PI and this will always take priority and precedence over any friend role.
- Conduct with other trainees and students:
  - It is important to maintain a professional, friendly environment. You may not like someone else, but it should not be apparent in the lab! Whether you are more junior, more senior, someone's supervisor, someone's supervisee, etc., you should make a continued and conscious effort to work with others in a productive and collegial way. If you notice someone seems "left out" or uncomfortable, please make an effort to include them. Respect your supervisors, whether they are faculty or a student.
  - A lab can be competitive, where people strive to outdo each other, or collaborative, where people strive to help each other do their best. Labs can be competitive or collaborative with other labs as well. Our lab is intentionally collaborative. Each of us has a finite skill/knowledge set, and working with others gives each of us

access to more information and abilities. So, helping others is important in the lab, and Jeff considers this as an important part of your performance. Other peoples' successes reflect upon you as yours will reflect upon them.

1.1.2 PI

All of the above, plus you can expect me to:

- Maintain a vision of where the lab is going.
- Provide the funding necessary to keep the lab going.
- Meet with you regularly to discuss your research projects. The definition of "regularly" may change over time or over the course of a project.
- Give you feedback on a timely basis, including feedback on project ideas, conference posters, talks, manuscripts, figures, grants.
- Give you my perspective on academia and issues related to professional development, and generally help you prepare for the next step of your career, whether that's grad school, postdoc, faculty job, or job outside of academia.
- Support your career development by introducing you to other researchers in the field, writing recommendation letters for you, providing you with opportunities to attend conferences when finances permit, and promoting your work in talks.
- Care about you as a person and not just a scientist.
- There are going to be aspects of your work that are fun, some that are challenging, and others that are downright painful (e.g., getting a manuscript rejected). I will always do my best to help you weather the ups and downs (and celebrate the ups!), but I will never let you shy away from the hard stuff… that is where the most learning and growth happens. Expect that I will support you but push you.

1.1.3 Graduate students

All of the *Everyone* expectations above, plus you will be expected to:

- Develop a line of dissertation research. Ideally, your dissertation research will consist of at least three related experiments that can be packaged into three chapters of one thesis document.
- Help train and mentor others (lab managers, undergraduate and graduate students) on their research projects – either because they ask or because I ask you to.
  - Work with a team of undergraduate students. This will speed up data collection and give you some experience with managing and mentoring a team.
- Present your work at departmental events, at other labs (if invited), and at conferences.
- Apply for external funding (e.g., NSF GRFP or NRSA). If nothing else, this is a valuable experience. Ask others who have received funding for successful examples.

- Do some soul-searching as to what type of career you want to pursue, e.g., academic jobs that are research-focused or teaching-focused, non-academic jobs like data science or science writing. Research-focused academic jobs are hard. They require a lot of work to prepare for, are rare and competitive to get, and require a lot of work to be successful. You must be super passionate about doing research and willing to work a lot for a long time to have a successful career. If you have qualms about this, you should consider other careers. And you may or may not need a Ph.D. for these careers. Talk to Jeff for help brainstorming ways of making sure you are getting the training that you need.
- Make sure you meet all departmental deadlines (e.g., for your exams and thesis) – even if your peers are missing these deadlines! And make sure Jeff is aware of them! And **you** are responsible for knowing about deadlines. Keep up-to-date with the PhD path.
- Prioritize time for research. Coursework or TA-ing are important, but ultimately your research is what earns you your Ph.D. and prepares you for the next stage of your (even non-academic) career.
  - Talk to Jeff about coursework you're considering (if not required).
- Attend all relevant lab meetings or let Jeff know if you can't.

1.1.4 Undergraduate researchers

All of the *Everyone* expectations above, plus you will be expected to:

- Assist other lab members with data collection or analysis (typically you will be assigned to particular projects), unless you are working on your own independent project under the mentorship of Jeff or another lab member, in which case, you should work on that.
- Work with your research mentor to determine your weekly schedule. If you are not able to come in during your normal scheduled time, you must let the lab manager know with as much advance notice as possible.
- Attend and participate in all lab meetings. Let Jeff or a grad student know if you can't attend.
- If you are earning course credit for research, you must additionally:
  - Write a short essay on your research topic or experiences due by the end of dead week.

1.1.5 UCARE students

All of the *Everyone* and *Undergraduate researchers* expectations above, plus you will be expected to:

- Submit a UCARE proposal, having sent a draft proposal to me at least two weeks before the deadline. Decide whether to participate in the lab during the summer or just the academic year.

- Work on the UCARE project for **10 hours per week** during the academic year and 20 hours per week during summer (if you choose to work over the summer). If you cannot commit to the required effort or if you ability to meet the commitment changes, let Jeff know as soon as possible.
- Meet all UCARE deadlines.
- Present a poster at one conference/meeting during the semester. Typically, this is the Nebraska Research Days in the spring, but it can also be the Nebraska Psychological Association meeting or another appropriate meeting.

1.1.6 Lab technicians

All of the *Everyone* expectations above, plus you will be expected to:

- Fulfill your duties as a lab technician.
- Be in the lab as needed. You may need to work some irregular hours if participating in an outreach event.
- Oversee training of undergraduate research assistants in your area.
- Help new lab members adjust to the lab by answering whatever questions they have that you can answer. If you can't answer, direct their questions to Jeff.
- Maintain the lab paperwork (e.g., protocols, media waviers).
- Maintain the lab calendars, manage the lab shared data folders and check the lab email address.
- Give new lab members access to the lab calendar, lab Git repository, and add their experiments to the lab shared data folder.
- Help to maintain an atmosphere of professionalism within the lab.
- Tell Jeff – as soon as it becomes even a minor issue – if there are any issues with undergraduates who are having trouble fulfilling their commitments to the lab.
- Assist Jeff with the day-to-day running of lab operations, including responding to any requests that Jeff sends along (urgent requests as indicated by Jeff should be responded to immediately).
- Develop with Jeff your own research project if applicable.

1.2 Other personnel

1.2.1 Department of Psychology staff

- David DiLillo—Chair of Department of Psychology. Responsible for managing department personnel, finances, and research and teaching goals. *Responsible person* designee for Title IX issues. (contact at ddilillo2@unl.edu)
- Mike Dodd—Graduate Committee Chair. Responsible for managing department graduate program. (contact at mdodd2@unl.edu)

- Pam Waldvogel—office associate. Responsible for managing non-student employee appointments, onboarding/offboarding, purchases, reimbursements, keycard access to 501 Building, etc. (contact at pwaldvogel@unl.edu)
- Jamie Longwell—administrative technician. Responsible for managing graduate student appointments, onboarding/offboarding, purchases, reimbursements, etc. (contact at jamie.longwell@unl.edu>)
- Melody Scholl-Miller—computer specialist. Responsible for purchase and maintenance of computer hardware and software. (contact at melody.scholl@unl.edu or submit support ticket at psycpchelp@unl.edu)

1.2.2 CB3 staff

- Aron Barbey—Director of CB3. Responsible for managing center personnel, finances, and research goals. *Responsible person* designee for Title IX issues. (contact at abarbey2@unl.edu)
- Kerry Eddy—administrative coordinator. Responsible for facilitating research purchases, reimbursements, travel, copies, room reservations, etc. (contact at kerry.eddy@unl.edu)
- Linda Lynch—office associate. Responsible for assisting CB3 visitors/participants and facilitating room reservations, etc. (contact at linda.lynch@unl.edu)
- Noah Clayton—specialized technology manager. Responsible for managing and maintaining computer hardward and software in CB3 (contact at nclayton3@unl.edu)

1.2.3 IACP staff

- Kelly Heath—Director of IACP and head veterinarian. Responsible for overseeing animal care program, ensuring animal welfare, ensuring compliance with regulations, facilitating IACUC protocol submissions, supporting IACUC. (contact at kheath3@unl.edu)
- Megan Ebbers—Lead IACP Specialist. Responsible for ensuring animal welfare, ensuring compliance with regulations, facilitating IACUC protocol submissions, supporting IACUC, implementing IACUC training. (contact at mebbers2@unl.edu)
- Anna Fitzwater—clinical veterinarian. Responsible for ensuring animal welfare, attending to animal health issues (contact at afitzwater3@unl.edu)

1.2.4 Other staff

- Nate Morris—501 Building Maintenance Reporter. Responsible for reporting facilities and management issues for 501 Building (contact at <nate.morris@nebraska.edu).
- Rachel Wenzl—Associate Director of Research Compliance Services. Responsible for overseeing Institutional Review Board protocols (contact at rwenzl2@unl.edu)

2 Behavior and communication

2.1 Code of conduct

The lab, and the university, is an environment that must be free of harassment and discrimination. All lab members must read and abide by the UNL policies on discrimination and harassment.

The lab is committed to ensuring a safe, friendly, and accepting environment for everybody. We will not tolerate any verbal or physical harassment or discrimination on the basis of gender, gender identity and expression, age, sexual orientation, political orientation, disability, physical appearance, body size, race, or religion (or lack thereof). We will not tolerate intimidation, stalking, following, unwanted photography or video recording, sustained disruption of talks or other events, inappropriate physical contact, and unwelcome sexual attention. Sexual language and imagery are generally not appropriate for any lab venue, including lab meetings, presentations, or discussions. Finally, it should go without saying that lewd language and behavior have no place in the lab, including any lab outings.

Harassment includes offensive verbal comments related to gender, gender identity and expression, age, sexual orientation, disability, physical appearance, body size, race, religion, sexual images in public spaces, deliberate intimidation, stalking, following, harassing photography or recording, sustained disruption of talks or other events, inappropriate physical contact, and unwelcome sexual attention. Harassment of any kind will not be tolerated and will result in the harasser being asked immediately to leave the lab and subjected to any and all university and legal sanctions.

If you notice someone being harassed, or are harassed yourself, tell Jeff immediately. If Jeff is the cause of your concern, then reach out to the Department Chair or another trusted faculty member in the department. See Problems for more resources.

If you have any suggestions about lab culture, how we do things, or anything at all, you are always welcome to contact Jeff or a graduate student to discuss.

2.1.1 Scientific integrity

Research misconduct

The lab, and UNL, is committed to ensuring research integrity, and we take a hard line on research misconduct. We will not tolerate fabrication, falsification, or plagiarism. Read UNL's Responsible Conduct of Research policy and their Research Misconduct policy.

If you are feeling pressured to succeed (publish a lot, publish in high impact journals), you should reach out to Jeff and we can talk about it – but this pressure is something we all face and is never an excuse to fabricate, falsify, or plagiarize. Also, think about the goal of science and why you are here: you're here to arrive at the truth, to get as close as we can to facts about human and non-human behavior. Not only is research misconduct doing you a disservice, it's also a disservice to the field. And it risks your entire career. It is never right and never worth it. Don't do it.

Open science

Our policy on open science is simple: we share all data, materials, and code upon posting a preprint or publishing a paper, whenever possible. Sometimes there are circumstances where we cannot do this (e.g., we do not own the data, so we are legally obligated to keep it private; or we need to hold off on public sharing until a paper is published to avoid getting scooped). Because of this, you must have explicit permission from Jeff to post data, materials, or code publicly. More details are available in Reproducible research and open science.

2.1.2 Authorship

We will follow APA guidelines with respect to authorship:

> Authorship credit should reflect the individual's contribution to the study. An author is considered anyone involved with initial research design, data collection and analysis, manuscript drafting, and final approval. However, the following do not necessarily qualify for authorship: providing funding or resources, mentorship, or contributing research but not helping with the publication itself. The primary author assumes responsibility for the publication, making sure that the data are accurate, that all deserving authors have been credited, that all authors have given their approval to the final draft; and handles responses to inquiries after the manuscript is published.

We use the CRediT system to specify various types of contributions to a project (e.g., conceptualization, project administration, supervision, data analysis, writing). Authorship will be discussed prior to the beginning of a new project, so that expectations are clearly defined. In

general, I expect that graduate students will be first authors on publications on which they are the primary lead, and I will be the last author. Talk to Jeff right away if you aren't sure if you are first author. Our lab has a pretty liberal policy for including undergraduate assistants as authors. Assistants who take the lead in running projects or contributing above and beyond data collection are often invited to be authors. These discussions and decisions will be spearheaded by the first author, in consultation with Jeff. However, changes to authorship may occur over the course of a project if a new person becomes involved or if someone is not fulfilling their planned role. For example, if a student hands a project off to another lab member, they will most likely lose first-authorship to the new project leader. If a student collects a dataset but does not completely analyze it and write it up, Jeff will re-assign the project (if appropriate) to another person (who will become first author) to expedite publication.

All of these issues will be discussed openly, and you should feel free to bring them up if you are not sure of your authorship status or want to discuss it. Again, these discussions should be addressed with the first author, but Jeff is always happy to help with negotiations should the need arise.

2.1.3 Human subjects and animal research

Because we are engaged in human subjects and animal research, it is of the utmost importance that we adhere to our approved IRB and IACUC protocols. Non-adherence to these protocols can lead to severe consequences for the entire lab (i.e., we may lose permission to conduct any research!). All lab members must read and comply with the IRB consent form and research summary for any project that they are working on. Lab members must also complete the CITI training and be added to the research personnel list before they can work with subjects. If there are any questions about the protocols, or if you're not sure whether we have approval to run your study, please ask the project manager or me for clarification. If necessary, we can file an amendment to an existing protocol or create a new protocol. But you *must not deviate from the protocol* unless you have been specifically instructed to do so by Jeff or your supervisor.

If you encounter any problems in the course of doing research that results in a negative outcome for the participant (e.g., if a participant becomes ill or upset, if there is an accident with the equipment, if there is a breach of confidentiality, etc) or animal subject, you should immediately seek assistance from Jeff or the project manager. If Jeff is not around, you must notify him within 24 hours, preferably as soon as possible. In some cases, we may need to report this information to the IRB, IACUC, and/or our funding agencies.

2.1.4 Confidentiality

All research data and materials in the lab are assumed to be confidential until they are publicly shared and should be treated as such. Our IRB reviews our research practices to ensure that

only approved personnel have access to data. It is your responsibility to ensure that confidential materials are never made available to unapproved individuals. This means, for instance, that you must:

- never share your login credentials to lab resources with outside individuals;
- never distribute passwords, which could compromise the confidentiality of our data and materials;
- never discuss or share any participant information outside the lab, including identifiable information (like people's names or contact information), performance in studies, correspondence with parents, and so on;
- never store confidential materials on personal computers or phones;
- when using data outside the lab, ensure that you delete all local copies after using them, and ensure that no one other than you can view or access data (including videos); and
- never allow unapproved individuals to enter the lab unaccompanied, and if such an individual is in the lab, ensure they cannot access any confidential information.

2.1.5 Photos & videos

We respect the privacy and comfort of lab members by only taking photos or video recordings of them with their explicit knowledge and consent. This is especially important in situations where a lab member would otherwise not be aware of you taking a photo and therefore cannot object if they do not want you to (e.g., using a still from a video while they are participating in an experiment). To avoid ambiguity about when a lab member is vs. is not aware of photos being taken, you must obtain direct consent from lab members before taking photos or videos, and obtain consent again before posting any images on social media.

Note that this also applies to our research participants. Unless a participant explicitly asks you to do so, you may not photograph your participant during an experiment (aside from an official video record of the experiment).

Finally, lab members are not allowed to photograph or video record subjects in the animal research areas. Dog owners may consent to having their dog's photo taken for posting on social media. Dog owners are allowed to photograph their dogs in our lab.

2.1.6 Diversity and inclusion

We hope to make the lab a diverse working environment. We recruit people from a variety of backgrounds who have a variety of perspectives, life and professional experiences, skills, and interests. However, the lab is small enough that all lab members are likely to be an exclusive member of some sort of group, whether other lab members recognize this or not. Sometimes this may be more apparent, if the make-up of the lab group is highly skewed. Highlighting individuals' group membership by asking them to be 'ambassadors' or representatives of their

group (or in some other way) can be tiresome and offensive to an individual so singled out, but ignoring diversity can be equally problematic. Keep this balance in mind as you communicate with each other and about group memberships. Please think of this both in a systemic way (e.g. would a lab where group membership was continually emphasized or ignored be a positive place to work?) and an individual way (e.g. would I want to work in a lab where people seemed to focus on only X about me to the general exclusion of everything else? Or, where people ignored X about me, despite my making its centrality in my life clear?). Even if an individual is not offended, please do not unfairly place a burden on someone by asking them to represent a group and/or correct your problematic behavior. Please try to avoid making broad assumptions about various group memberships (e.g. women are so A, men are so B). Also, consider whether some terms (e.g. 'guys') are really (gender- etc.) neutral and consider alternatives (e.g. folks).

Some group memberships can be less visible or invisible until they become apparent for various reasons (e.g. sexual orientation, religious affiliation, ethnicity, disability, socioeconomic status). Try to avoid making assumptions about individuals, and help ensure that the lab is a positive place for diverse folks. This will make the lab a better place to work, but is also required by the law.

If someone makes a comment you find offensive (whether it is a comment directed to you or your group membership, or someone else's), please make your best effort to work from the assumption that there may be a misunderstanding and that communication is the best way to clear this up. Document the situation by making a note of it somewhere. Approach the person immediately or within the week to let them know (a) what they said, (b) it offended you, (c) why you found it offensive, and potentially (d) what they might say instead. Language norms change over time and from place to place, so individuals might not be aware of what is currently considered offensive and what is currently considered appropriate and respectful. If concerns remain and/or the situation is serious, please bring it to Jeff's attention as soon as possible. Jeff would like to promote a lab environment where folks feel comfortable to communicate respectfully.

2.2 Lab culture

We aim to have a healthy research culture for all lab members. To this end, we follow the "Ten simple rules towards healthier research labs" (Maestre 2019) and add a few more.

1. **Promote the well-being of lab members:** One of the lab priorities is the safety, security, and well-being of lab personnel. We care about you and wish you to be successful. We expect all lab members to be kind and avoid harassment and discrimination. We are sensitive to dealing with lab members' personal, family, and health situations, and we carefully listen to lab members regarding any matter related to their work that can improve their well-being. Lab members don't have to provide details, but please let Jeff or a grad student know if you need time away from the lab.

2. **Foster diversity and inclusion:** One of the lab priorities is to maintain an inclusive working environment that respects diverse perspectives; seeks empathic understanding of diverse experiences, including discrimination, bias, and privilege; and fosters opportunities for underrepresented students to participate in science (See Diversity and inclusion). We do not discriminate based on sex, gender identity, sexual orientation, religious affiliation, ethnicity, disability, socioeconomic status, first generation status. We encourage individuals from underrepresented groups to join and participate in the lab.

3. **Ensure transparent data and replicable analsyses:** One of the lab priorities is to maintain the integrity and transparency of data and the replicability of data analyses (see Reproducible research and open science). We maintain a transparent project workflow from data collection analysis. We share all data, materials, and code upon posting a preprint or publishing a paper, whenever possible. We rely on open access software as much as possible (see Software).

4. **Let people set their own schedules:** Jeff tends to work in his office (or home office) from 8am-5:30pm Monday-Friday and as needed in the evenings and weekends. Other lab members, however, may have different preferences for working hours. Everyone is expected to fulfill their full weekly work time and is welcome to set their own work schedule within the constraints of their tasks (e.g., running human participants or animal subjects at appointed times). However, if your hours differ greatly from the standard 8am-5pm work day, consider how to be trade off work on collaborative projects to avoid losing days of work. Lab members can work remotely when this is appropriate for their project.

5. **Gratitude:** This lab could not function without the help from all of the students and staff. Jeff is extremely grateful for all of the hard work that lab members pour into the lab. If you do not feel like your role is appreciated, please contact him to discuss this. Because you definitely are appreciated!

6. **Treat your lab members as teammates:** Jeff is the PI for the lab, so he sets the vision and research priorities for the lab and has the last say on multiple matters in the lab. But the aim is to have a relatively 'flat hierarchy' where all lab members are treated as valued colleagues. All lab members' opinions and contributions are important, and Jeff would very much like to hear your suggestions for how to improve any aspect of the lab and research (though please do not make changes with out getting permission!).

7. **Create a collaborative environment:** Doing science is a collective endeavor, and we actively foster collaborations within the labs. We do this by requiring attendance of lab meetings where we get updates and feedback on research projects. If you have ideas for projects, please discuss them with Jeff and/or grad students in the lab. We expressly build a collaborative rather than a competitive research environment.

8. **Every lab member is unique:** While comparisons are inevitable, each lab member brings unique skills, ideas, and experiences to the lab. What a boring lab it would be if everyone were the same! When you interview with Jeff before joining the lab, he will ask

about career goals. This is to help tailor your lab experience to your aspirations. If those change or if you see ways that the lab can facilitate your personal goals, talk with Jeff and/or grad students. We want to leverage everyone's unique contributions and focus them toward helping achieve their goals.

9. **Respect working hours, public holidays, and vacations:** While some lab members may choose to work on evenings, weekends, and holidays, typically this is not expected unless there are extenuating circumstances (e.g., urgent deadline, public outreach event). Lab members are encouraged to take vacations. Undergraduate assistants are not expected to work over fall break, winter break, spring break, or summer break, but they can if they would like. Grad students are encouraged to take vacation time during winter and summer break (1-2 weeks), depending on on their funding and research situation. Other vacation times are allowed, too. The important thing is to make sure to notify Jeff and/or grad students in advance of when you will be away.

10. **Give credit where credit is due:** We try to be clear about authorship by deciding on who will be an author early in the research project (see Authorship). Undergraduate assistants and lab technicians can be authors when they materially contribute to the project. Jeff will not be on papers that he does not materially contribute to. Papers and presentations should acknowledge the assistance of lab members who help with projects.

11. **Destigmatize failure and celebrate success:** Projects fail and papers, grant applications, and job applications are rejected. A lot. Rejections are the rule rather than the exception. We will all struggle scientifically—this is not a reflection on us as people. We must learn from rejection and use that to improve our science. We must also celebrate our successes—not just our big successes, like paper acceptances, grants, and jobs, but also smaller successes like submitting a paper and giving a presentation. The road to good science is paved with a lot of small accomplishments, each of which should be celebrated!

12. **Promote the professional development of your lab members:** Members of the lab come from a range of backgrounds and have a range of career goals. We want to help develop you to meet your professional goals. We will try to assign you to projects that helps you toward your goals, and we will try to offer professional development opportunities during lab meetings and other times. Undergraduate assistants can help design and implement studies, as well as analyze and present data. Grad students can gain experience mentoring undergraduate assistants. We financially possible, we will help send students to conferences to present their work. Contact Jeff if you see opportunities to achieve your career goals.

13. **Express your curiosity and critical thinking:** Science is driven by curiosity. We recruit curious people to the lab because we want to answer questions, and curiosity is needed to reveal potential answers to those questions. So we encourage lab members to ask questions, propose ideas, suggest changes, question the status quo of what we are doing. Be bold. Speak up. Challenge us intellectually. Think about things from another

perspective. There are no stupid questions or suggestions. We want to hear your ideas. We may not be able to act on them, but we want to hear them. Your voice will be heard.

2.3 Communication

The key to a healthy lab is communication. So please don't ever feel afraid to reach out to Jeff or any lab members. We would rather you reach out too often than not enough. Here's how we communicate in the lab:

2.3.1 Microsoft Teams

The primary means of communication among lab members is the lab Microsoft Teams workspace. Upon entering the lab everyone should install Teams on their phones and computers. Turn on the notification settings for the channels that you're a part of, and also please regularly check Teams and reply there when needed.

Teams is divided into *channels* that have different members in them. Some of these channels are project specific, and others are just a group of specific individuals (e.g., grad students). Most of the channels are open, so you are welcome to join them to observe or participate in what is going on. Here is some Teams etiquette.

- Use Teams as a positive forum. Do not post potentially offensive material.
- Important messages can be pinned so that they are saved.
- You can use bullet points (to combine posts) by starting a line with `*` and a space then hit `Enter` to start a new line without posting the message.
- You can attach multiple files to one message rather than sending separate messages.
- You can direct message lab members. Jeff **cannot view these messages**. However, this software is run by UNL, therefore the ITS folks have access to everything that we post in Teams. So assume your post is being monitored.
- Messages in public/shared channels can be viewed by people who join the channel after the messages are posted.
- Don't post to the `General` channel unless it needs to go to **everyone** in all of the labs (this should rarely be used by anyone but Jeff).
- Feel free to use the `random` channel to post (appropriate) jokes or other random things.

2.3.2 Communication types and timing

Outside of Teams, email is Jeff's preferred mode of communication. Feel free to prompt him via email if he doesn't respond via Teams after a day (sometimes Teams doesn't send notifications properly, or he reads the notification when he is not able to respond and then forgets about

it). If something is urgent or difficult to communicate over Teams or email, feel free to call Jeff. Text is the least preferred method of communicating with Jeff.

2.3.3 Meetings

Usually, Jeff meets with grad students weekly to keep up-to-date with projects and to offer a regular opportunity to get feedback. If you would like to meet at other times, just contact Jeff over Teams to see when he is available. When meeting, it is often useful to give a quick recap of the project before discussing issues/questions that you have. There are a lot of different projects going on in the lab, and it can be difficult to remember exactly what is going on with each one. It is often useful for the student to take notes during the meeting to ensure that everything is accounted for.

2.3.4 Problems

Open communication is the key to preventing or resolving problems in the lab. If you are having problems with other students or lab equipment/materials, contact Jeff or a grad student. If you are having problems with a grad student, contact Jeff. If you are having a problem with Jeff, contact Jeff. If you're not comfortable contacting Jeff, you can contact other faculty (Mike Dodd and Maital Neta have agreed to be available for lab members to contact), the Department Chair (David DiLillo), or the Graduate Committee Chair (Mike Dodd). If these parties cannot resolve the issue, a formal grievance can be submitted to the Department Chair or directly to a member of the department Grievance Committee (see instructions in Department Bylaws). For sexual harassment or misconduct issues, contact the UNL Title IX Office.

3 Onboarding and offboarding

3.1 Onboarding

Congratulations for joining the lab! Now there are a number of steps you must take to actively participate in the lab.

1. Send Jeff a CV/resume. It doesn't need to be thorough or up-to-date. It must be submitted to IACUC when adding you to the protocol, so it just needs to be something that we can upload.
2. Install Microsoft Teams on your phone and computer and log in via your UNL credentials. Turn on notifications for the `#cchil` channel straight away. Add your photo to your Teams profile.
3. Go to the IACUC training page to:

    a. Complete online CITI IACUC General Regulation Training (GRT) (**Working with the IACUC- Investigators, Staff, and Students- 1 Basic Course**).
        - Make sure to select Basic Course not Refresher Course
        - Send Jeff a PDF of the Completion Certificate when completed.
        - If you have already completed IACUC training at UNL, go to My Records and save a PDF of the Completion Certificate.
        - If you have previously completed IACUC CITI training through another (not UNL) institution, you should log into your existing account on the CITI website and click on "Add Affiliation." This will allow CITI to link your completed courses across institutions and ensure that you do not repeat trainings unnecessarily.

    b. Complete the OHS form.
        - For "campus mail address, supervisor, department, building or facility", enter "B83 East Stadium, Jeffrey Stevens, Psychology, CB3"
        - On page 1 (Part A- Occupational and Environmental Risk Factors- Animal Contact), check "I have contact with animals in teaching or research through a university approved animal care and use protocol."
        - Under Species and Type, check column 4 (Research/Teaching) for Dog
        - Page 3, Part A, Section II, "Hazards Associated with Animal Contact", there is a list of agents with a column of check boxes. Answer "no" for all of them.
        - Submit the form electronically (do not send it to Jeff, as it has personal health information).

c. If you receive an email from the IACP folks about the General Regulation Training (GRT), Occupational Health and Safety (OHS) form, and the Facility Orientation, you can ignore it. This email goes out if I add you to the IACUC protocol before you complete the online version of the GRT or before you submit your OHS form. And there is no facility orientation for the dog lab.

4. Complete CITI IRB training for **Basic Course for Social/Behavioral Research Investigators and Key Personnel**.
   - Make sure to select Basic Course not Refresher Course
   - Send Jeff a PDF of the Completion Certificate when completed.
   - If you have already completed IRB training at UNL, go to My Records and save a PDF of the Completion Certificate.
   - If you have previously completed IRB CITI training through another (not UNL) institution, you should log into your existing account on the CITI website and click on "Add Affiliation." This will allow CITI to link your completed courses across institutions and ensure that you do not repeat trainings unnecessarily.
5. Send Jeff a photo and a short blurb about yourself for the CCHIL website. Please make sure that the photo can allow a square crop, and please write the blurb in third person rather than first person (check the website for examples).
6. Send Jeff your NUID number for lab keycard access. NOTE: If you are new to UNL and do not have your physical NCard yet, you will need to pick it up at the NCard office and activate it (instructions for activation come with the new card) before you can be given keycard access to buildings/rooms.
7. Read over this lab manual (at least chapters 1-4).
8. Read any IACUC protocols and IRB protocols associated with the projects you'll be working on. Jeff will attach those to an email.

3.2 Training

Prior to joining the lab, you should complete CITI training for IRB and/or IACUC to learn the basic principles of conducting research on humans and/or other animals. Once you join the lab, training occurs to different extents and by different people depending on which project you are working on. Often a graduate student or lab technician will be involved in training undergraduate researchers. However, sometimes, an experienced undergraduate may train a new undergraduate researcher. Training is super important, and if you feel like you do not know what you should be doing, please ask questions and request help. We would rather you ask a 'silly' question (very few questions are silly) than not ask the question and make a mistake. If you feel you have not been properly trained, please contact Jeff.

3.3 Offboarding

While we're sorry to see you go, leaving is an inevitable part of working in a research lab. We have a few requests when you leave the lab.

- Please clean any areas you have been working in and return any equipment that you have been using. Any equipment and materials purchased by the lab are property of UNL and must be returned to the lab (this includes computer equipment such as laptops, monitors, external hard drives, etc.).
- Please archive all lab materials appropriately. This is very important for data. Please ensure all data are archived on OneDrive or the appropriate data storage area. Ensure all data analysis scripts and documentation are archived to OneDrive and/or the appropriate Git repository. Please take the time to carefully document the experimental methods, data collection, and data analysis. If possible, please explain the documentation and materials to another lab member.
- Note that any data collected, obtained, and/or generated in the course of a research project conducted at the University are property of the University of Nebraska. As such, they must be fully transferred to Jeff upon leaving the lab. See the University of Nebraska Research Data Policy for more information.
- Please delete files or securely dispose of documentation of lab credentials (e.g., experimental computer passwords, Qualtrics passwords, social media account passwords).

If you have participated meaningfully to the lab and not violated any of the lab principles, we will move your name to the 'former members' section of the lab website. Note if you are in the lab less than a semester, we will not list you as a former member.

We will also deactivate your Teams account to reduce the number of active members. But we still want to hear from you, so please keep in touch via email and let us know how you are doing!

4 Logistics

4.1 General lab policies

- Research is a meticulous business. Please make sure to take your time and do your jobs well. Attention to detail is critical for our research.
- Keep the lab tidy. Clean up messes. If you're using lab equipment, put it away when you're done.
- Close/lock the doors to the lab if no one else is around, even if you're stepping out for a short break (e.g., to get coffee).
- Arrive to lab at least 15 minutes before you have any human subject experiments scheduled, so that you will be there to greet the participants.
- Show up to all meetings, show up to run your participants, show up for any other commitments (classes, lab meetings).
- You are expected to meet any and all deadlines set by Jeff (or agreed upon among collaborators). If you are going to miss a deadline, you must give advance notice along with a reason and a proposed new deadline that must be agreed upon by all parties.
  - If you are hoping to submit an abstract to a conference, you must inform the members of the project team (including Jeff) no less than 2 weeks prior to the abstract deadline, and you must complete a draft of the abstract no less than 1 week prior to the deadline.
  - For posters, a draft must be completed two weeks prior to the conference in order to facilitate feedback from the team (first) and then the wider group (lab and other colleagues in the department/CB3).
- If you're sick, stay home and rest. Because you need it and because others don't need to get sick. Notify your supervisor if you will be out, either due to illness or vacation. If you are sick and you had experiments or meetings scheduled that day, notify your participants or collaborators and reschedule.
- You are not expected to come into lab on staff holidays. If you are being paid, then you are expected to come into lab during university breaks (except for staff holidays or if you're taking your paid vacation time).
- The dress code in academia is generally casual. My only request is that you look semi-professional when interacting with participants and when presenting your work. Jeans are fine, gym clothes and pajamas are not. Scrubs are available for you to use.

- Personal protective equipment (PPE) is currently a moving target. Follow Jeff's guidelines on whether masks and gloves are required in the lab.
- Food and drink are allowed in the dog lab, but please keep them in the office or food-preparation area and clean up any spills.
- Well-behaved dogs are allowed in the dog lab and the CB3 bullpen when they need to be on campus for research or educational purposes (e.g., human-animal interaction study, training for HAI study, dog destressing event, outreach activities, guest lectures). Dogs are not allowed in university buildings (including CB3) if they do not fall under one of Jeff's IACUC protocols. Check with Jeff before bringing your dog into a university building. Note that it is super important not to jeopardize the lab's ability to bring dogs into campus buildings for research and educational purposes. Therefore, to protect this ability, Jeff will report violations of the campus animal policy.
- We have shared-use lockers in B71 and in the B-level bullpen for secure research materials (e.g., signed consent forms, equipment, participant payment). Contact Jeff to get access to those lockers.

4.2 Lab space

4.2.1 CB3

The lab has exclusive and shared space in three locations. Jeff's and grad student office space is in the Center for Brain, Biology & Behavior (CB3), which is located in the southeast corner of Memorial Stadium. Anyone without a UNL parking permit will need to park in the metered parking south of Memorial Stadium or the Memorial Drive parking garage on the southwest corner of the stadium. Enter the doors with the NCB3 sign above it, and proceed to the reception. Upon entering CB3, you can ask Linda at the reception to give you directions to Jeff's office or, if she is not available, take the elevator (just around the corner from her desk) to level B (press BR on the panel to open the doors closest to his office).

Jeff's office is B83 East Stadium, and grad students have desks in the bullpen on level B down the hall. We currently have exclusive access to B71J and shared access to other rooms in B71 for human computer-based testing. There is also meeting space on the B and C levels that can be scheduled through Linda Lynch (contact at linda.lynch@unl.edu). CB3 is open from 7:45am-5pm Monday-Friday. If you need access to the building outside of those hours, contact Jeff.

4.2.2 Canine Cognition Lab

The Canine Cognition and Human Interaction Lab (CCHIL) is located in room 3 in the basement of the 501 Building. You can pay to park in the Memorial Drive parking garage on the southwest corner of the stadium. CCHIL is in the northeast corner of the 501 Building

in the basement. Keycard access is required at all times to enter CCHIL. Contact Jeff for keycard access.

CCHIL has a waiting area, testing area, office space, and food-preparation area. If no one is using the space for research or educational purposes, you are welcome to hang out or work there. But please keep the space orderly and be prepared to vacate it if the space is needed for other purposes.

4.2.3 Keycard access

To gain access to most of our space, you need permission granted to your NUID (keycard). Only Jeff can request this permission, and it can take a few days to go through, so contact him as soon as possible if you need access. And *always* bring your NUID with you when you are coming into the lab. It is possible to call the police to let you in to space that you should have access to, but this is not advised. And don't leave your NUID in the research space. Keep it with you at all times. Finally, do not let someone that you do not know into any of the research spaces. If you are uncomfortable with the situation call the UNL police (402-472-2222) and report the incident to Jeff or a grad student.

4.2.4 Visitors and photos

Visitors are allowed in CB3 during regular business hours. If you would like to bring visitors to CB3 outside of regular hours or to CCHIL, contact Jeff.

Do not take photos of participants or dogs without their explicit permission. For CCHIL, participants must sign a media release for us to take and use photos of them and/or their dogs for research, educational, or promotional reasons. Contact Jeff or the CCHIL lab manager for media release forms.

4.3 Meetings and events

4.3.1 Lab meetings

We typically have lab meetings in the dog lab and/or via Zoom. Usually, the first half of the lab meeting involves students and lab managers giving an update about the status of the research and/or subjects. The second half of the meeting tends to be more focused on professional development, so we may discuss a research paper that we read or listen to one of the students give a practice talk/poster or someone may present about a professional development topic (e.g., applying to grad school). Unless you have a class conflict or are ill, all lab members are expected to attend and participate in lab meetings.

4.3.2 Seminars

All lab members are encouraged to take advantage of the many opportunities to learn about our field by attending the seminars presented in the department or at CB3. During the school year, we typically alternate between weekly CABIN and CB3 Club meetings at 12:30pm on Mondays in B60 CB3 or via Zoom (in the summer, only CB3 Club runs). CABIN is a brownbag that tends to have research proposal or research summary talks. CB3 Club is more of a journal club with research article discussions, practice talks, or professional development tutorials. Again, all are welcome, and feel free to offer suggestions of speakers or topics for either.

4.4 Funding

Different parts of the lab are funded differently. For instance, the lab wrapped up a National Science Foundation grant to cover almost all expenses associated with impulsivity-related projects. The lab has a few small grants and some private donation funds that allow us to purchase small things as we need them.

The lab can provide grad students with a desktop computer, monitor, and external hard drive for research purposes, but it cannot provide laptops. All lab-purchased equipment must stay with the lab when the student leaves.

4.4.1 Supplies, copies, and reimbursement

Let Jeff know if the lab needs any supplies or materials. You shouldn't have to pay for lab supplies yourself. Jeff will pay for printing/copies for the lab and for posters for presentations.

You can get reimbursed for purchases, but check with Jeff before buying anything. If you make purchases for reimbursement, do not include personal items in the same purchase and bring Jeff your receipts as soon as possible.

4.4.2 Grant opportunties

If eligible, undergraduate students can apply for UCARE or McNair Scholars to cover a small stipend for conducting research in the lab.

Grad students are encouraged to apply for funding throughout their graduate career. Here are some possible funding sources

- NSF Graduate Research Fellowship Program funds (first or second year)
- NIH National Research Service Award fellowships
- UNL Graduate Fellowships
- Animal Behavior Society Student Research Grants

- Buffett Early Childhood Institute Graduate Scholars fellowships

4.5 Computing in the lab

4.5.1 Hardware

The lab has desktop computers in CB3 and the dog lab. CB3 has data collection computers in B71J as well as data analysis computers in the B-level bullpen. Students are allowed to use these computers for research or educational purposes, with priority given to people who need them for research purposes. The lab also has external hard drives for backing up data.

4.5.2 Software

The lab works with two computer operating systems. Most computers run Windows 10/11 but some also run the latest long-term support version of Ubuntu (some computers run both operating systems). It is important to keep operating systems and applications up-to-date, so please facilitate this. Do not install applications on lab computers without Jeff's approval.

Cloud storage

Currently, most of the lab's data is stored or backed up on Microsoft OneDrive. In general, all raw data should be uploaded to cloud storage as soon as it is generated. See Data management for more details.

File management and version control

We use GitHub as for file management and version control. See Data management and Version control for more details.

Experimental data collection

We use Qualtrics as our web-based survey software. Contact Jeff for log in details to the lab account. For more complicated designs that cannot be implemented in Qualtrics, we use PsychoPy or OpenSesame, which are open source programs for creating experiments.

Data analysis

The lab primarily uses R Statistical Software to analyze data, using RStudio as a user interface. Undergrads may also use JASP for a GUI-driven stats package. We do not use SPSS, SAS, Stata, etc.

Communication

The lab uses Microsoft Teams for all lab communication. See Teams for more details.

Literature and bibliographies

To keep track of literature and to build bibliographies for papers, the lab uses Zotero. Better BibTeX is a useful plug-in that helps integrate Zotero with R Markdown documents.

Other software

We use other open source software as well:

- GIMP—image editing (free version of Adobe Photoshop)
- Inkscape—scalar vector graphics editing (free version of Adobe Illustrator)
- VLC—media player
- OpenShot—video editing

AI use

Our lab does not use generative artificial intelligence to generate research ideas, conduct literature reviews, design experiments, analyze data, generate images, or write/edit text for manuscripts. **Never** upload data or sensitive information to a generative AI system.

4.5.3 Passwords

Please do not send passwords over email or Slack/Teams. Either transfer them verbally or via an encrypted program such as Signal. Store them in a secure location like a password manager (e.g., LastPass). Passwords stored on LastPass may also be shared securely from one LastPass account to another using LastPass's sharing feature.

Part II

Lab projects

5 Experimental protocols

This section is primarily written for project leaders, so lab assistants can skip it.

5.1 Recruiting and scheduling participants

5.1.1 Finding lab assistant availability

1. Have all lab assistants block out their available times on the cchil.unl@gmail.com Google calendar Dog lab availability. For some projects, it will be most efficient to ask everyone's 'regular' weekly availability for the semester rather than updating their availability every week or month. Be clear about what time period you are requesting availability for and who to tell if changes need to be made to the calendar.
2. Look for blocks of time in which at least two lab assistants are available. These will be the "open" times on the Calendly Calendar in which owners can sign up for appointment slots.

5.1.2 Setting up Calendly Calendar

1. Log into the lab Calendly account (contact Jeff for login information).
2. Once on the account dashboard, find the event called 'Study Template'

- Click on the gear icon on the upper right corner of the event card
- Select 'clone' from the menu. This will make a copy of the template event for you to edit.

3. What event is this? (Click on the section to expand and edit)

- Use this section to name the event, set a location, give a brief description, set the url for the event, and choose the display color. The event name is what the participants see, so make it understandable for them but also signals to us what the project is (in case more than one project runs at a time). The location should be In-person meeting and enter 501 Building, room 3. Give a short description to remind the participants what the appointment is. The event link is the URL that will direct people to the booking page for this event. The URL will automatically start with calendly.com/cchil-unl/ so you are just picking an identifier for this specific study to put at the end of the URL.

4. When can people book this event?

- Use this section to set the time slots available.
- The template event defaults to showing owners times they can book up to 21 days in the future.
- If the study will only be running for a set amount of time or availability will need to be manually updated on a weekly/monthly basis, use the *Within a date range* option under *Date range* and select the dates study date range.
- Under *Duration* you select how long the study session will last (often 1 hour).
- To set times I usually use the *Set custom hours* option.
  - Then select which days you want to be available and fill out the time table based on when enough RAs are available.
  - If you need multiple time ranges on one day you can use the + symbol to add another range (e.g., 9:00-11:00 am and 1:00-3:00 pm).
  - All availability is automatically recurring on a weekly basis unless otherwise stated.
  - To change availability on individual days (non-recurring changes), click on the *Add a date override* button to the right. Then select on the day you want to customize the times for.
- If there is a certain day you want no availability, but you don't want all those days unavailable (e.g., you want Wednesday, Jan. 4 to be available but not Wednesday, Jan 11), then click on *Add a date override*, select the date, and then hit the trash can symbol.
  - This will make that day unavailable without altering the rest of the weeks.
- At the bottom of this section you can select to add time before or after your events.
  - Add 15 minutes before the event to prepare the room.
  - Add 30 minutes after the event to give us time to clean/reset before the next dog.
  - Calendly will automatically remove the affected time slots to give you this extra time.
- Under *Additional rules for your availability*
  - You can select what increments you want your sessions to be posted in (30 minutes is probably best).
  - You can also alter the scheduling conditions to set a limit to how soon before the appointment they can schedule as well as the maximum allowed events per day. We usually set it so they cannot schedule within 1 or 2 days of the appointment to give time to send all the confirmation emails and make sure all RAs were informed.

5. Invitee Questions

- Calendly automatically asks for their Name, Email, and if there is anything they want to share

- The template event also includes a "What is your dog's name?" question that is set as required. This helps make sure the owner was bringing in the correct dog in the instances where an owner has multiple dogs.
- Under this section, you can also add other questions to ask. Some studies may want to ask for additional information from the owner in this section.

5.1.3 Finding participants in the database

1. **The CCHIL participant database has personally identifiable information (names, email addresses). Therefore, you can only access the database on UNL-owned computers. For most purposes, this means the desktop computer in the dog lab. *Do not access the database from your personal computer.***
2. Log into the Dog Lab dashboard with the username and password that Jeff gave you and click the option *Continue to run a report or search.*
3. Click on the "All Eligible Dogs (+ Owner Contact)" and save the spreadsheet file on the C drive of the computer.
4. Open the spreadsheet file in Excel and save it as an .xlsx file. This allows you to sort, filter, and color code the file.
5. Once you have sorted and filtered down to the correct records, check eligibility status by confirming:

- The dog is not aggressive towards people.
- The rabies vaccination is up to date (given within 3 years of appointment date).
- Any other requirements (e.g., weight minimum).

6. Once the dog's eligibility is confirmed, the owner may be sent an invitation email (see Sending email invitations).
7. If you want to search for a particular owner or dog, type the owner's last name into the search bar at the bottom of the dashboard page.

5.1.4 Sending email invitations

1. Pick out the participants from the spreadsheet that you want to contact. A good rule of thumb is selecting twice as many participants as you have open slots in the calendar.
2. Access the CCHIL UNL shared email account (unl_cchil@unl.edu) delegated to you by Jeff (instructions for accessing shared accounts in Outlook).
3. Compose a new email and click on the three horizontal dots, then click My Templates, and select the appropriate template for this study email.
4. It works best to send a separate email to each participant so that you can specify which dog is invited. This is especially important for studies with requirements like minimum weights.

5. Once the invitation email is sent, the participants can select a time in the Calendly calendar that works for them. When they book an appointment, Calendly will send an email to the UNL CCHIL email account, so keep an eye on that account.
6. After an appointment has been made in Calendly, send a Teams notification to the lab assistants assigned to the session to notify them of the new appointment. You can also then send a confirmation email to the participant with any additional information they will need.
7. It is useful to send reminder emails to participants at the beginning of the week.
8. The UNL CCHIL account also has templates for registering new people into the database and asking them to update their vaccination records.

5.2 Before testing sessions

1. Have lab assistants arrive at least 15 minutes before appointment time to ensure enough time for set up.
2. Turn on the camera computer and live-streaming TV by flipping the large orange power switch on the power strip.
3. Make sure an empty SD card and charged battery are in the GoPro camera.
4. Turn on the computer in the office area and pull up the Parking Portal website (saved in favorites).
5. Turn the white noise machine (located next to the door to the experimental room) onto the highest setting.
6. Prepare the tablets or laptop with the appropriate data sheet.
7. Fill the water bowl by the door with fresh water.
8. Bring treats and any other necessary materials (e.g., lab notebook) into the experimental room.
9. Five minutes before the appointment time, send one lab assistant outside to wait for/greet the dog and their owner.

5.3 During testing sessions

5.3.1 After participant arrives

1. After the owner and dog enter the room, close the door and ask them to let their dog off leash so the dog can explore the area. Let the owners know they can hang their coats on the coat rack by the door (in the winter) and leave their belongings on the chairs.
2. While the dog is exploring, ask the owner if the dog has any food allergies or food preferences.

- If the dog has food allergies/sensitive stomach, feel free to use any treats the owner brings with them. Often, these treats will need to be cut into smaller pieces, about the size of the training treats that are normally used.

3. Ask the owner if their dog has any separation anxiety from them.

- If owner says yes and study requires dog to be away from the owner, run the separation anxiety protocol (see Separation anxiety protocol).

4. Explain experiment to owner.

- Take the owner and the dog into the experimental room with lab assistants and shut the door.
- While one lab assistant explains the experiment to the owner, the other lab assistant will play with/interact with the dog to better acquaint the dog with the room and watch for signs of separation anxiety.

5.3.2 Training and testing

1. Provide study-specific training.
2. Allow a break between training and testing.

- Allow the dog to be off leash in the experimental room, but do not provide access to treats during the break.
- If needed, bring the water bowl into the experimental room and allow the dog to get a drink water before starting testing.
- At the end of the break, have one experimenter start the room cameras recording:
  - Right click anywhere on the screen.
  - Click on *Manual record*.
  - Hit *Ok* (the username should be admin, and you do not need a password).
  - Click the *All* box and click _All on". The red recording symbol should appear in the corner.
- Start the GoPro camera recording:
  - Hold the power button on the side of the camera until the screen turns on.
  - Place the GoPro on the tripod in the experimental room and make sure everything you need is in frame.
  - Press the button with a red circle on the top of the camera and recording should begin.

3. Begin study-specific testing.
4. After the test session is complete, stop recording.

- GoPro camera
  - Press the red circle button on top of the camera to stop recording.
  - Hold the power button on the side of the camera to power the GoPro off (do this immediately, as it is easy to accidentally press buttons on the touch screen while moving around and videos may accidentally get deleted).
- Room cameras:
  - Right click anywhere on the screen.
  - Click on *Manual record*.
  - Click the *All* box and click *All off*. The red recording symbol should disappear in the corner of each camera screen.

5.3.3 Owner wrap-up

1. Once the dog has finished testing, take them off leash and allow them to return to their owner.
2. Inform the owner that the experiment has ended. Remind the owner that there is no "right or wrong" or "good or bad" results, our goal is to simply measure dog behavior.
3. Present the owner their dog's Certificate of Achievement.
4. Obtain consent from the owner to get a picture of their dog in front of the lab sign to post on our Facebook and Instagram by having them sign our Media Release form.

5.3.4 Parking validation

1. Open the UNL Parking Portal (bookmarked as *Parking Validation*) in Google Chrome on the office computer.
2. Scroll to the very bottom of the home page and click on *Validation Provider Management*, which should take you to https://unlpts.t2hosted.com/ppa/auth.aspx.
3. Log into the Validation Account (the username and password should autofill).
4. Select *SD 100% off (100% off)* as the validation discount.
5. Place cursor in the text box under *Enter Permit/Ticket*.

- Using the magnetic strip reader, swipe the parking garage ticket. The ticket number should auto-fill in the text box.
- If the swipe does not work, type in the ticket number (gray numbers on back of ticket).

6. Click *Create Validation*.
7. You should get a message at the top of the screen saying that the validation was created.
8. Give the ticket back to the participant and inform them that the arms of the parking garage should open when they put the ticket in.

9. Thank the owner for their time and participation. Ask them if they need any help finding their way out.
10. Parking validation is only for dog owners. Do not use this system to validate your own parking.

5.4 After testing sessions

5.4.1 Shutting down cameras and backing up videos

1. GoPro camera:

- Open the chamber on the side of the camera (the side without the power button).
  - Remove the SD card and place it in the pill organizer in the chamber that corresponds with the day of the week.
  - Remove the battery and place it back on the charger (double check that the charging light comes on, otherwise the battery will not charge).
- Return the GoPro to the black case.

2. Room cameras:

- Right click anywhere on the screen.
- Click on *Video backup*.
- Select the date of the video you want to backup (on the *Search time* row), then click *Search*.
- The videos from that session should appear - click the box next to each video you want to download and click *Backup*.
- You will get a message saying *To backup this record?* - click *Yes*.
- When you get a message saying "USB storage is not found!" unplug the mouse and plug a flash drive into the USB port. The videos should start downloading automatically.
- When the videos are done backing up you will get a message saying the backup was successful. At this time you can unplug the flash drive and plug the mouse back in.
- If you are done backing up the videos you are good to turn the cameras off (just turn the power strip off that is to the right of the computer).

3. Back up both the GoPro and room camera videos on the desktop computer in the project-specific folder. Make sure all videos are saved on the desktop computer hard drive before deleting them from the SD card or USB drive.

5.4.2 Cleaning

1. Sweep the experimental room (including the mat) with the rubber broom and/or vacuum.
2. Spray the experimental room with a light mist of disinfectant (PREempt) using the backpack container (be sure to hold the wand as high as possible to ensure a light layer of spray otherwise the floor will get sticky). If the backpack container is empty, refill it with the PREempt solution at full strength from the bottles in the supply closet.
3. Take the water bowl to the bathroom to dump/rinse out.
4. Make sure all treats are put away (open bags in the refrigerator) and turn all lights off when leaving.

5.4.3 Updating database

1. Log into the Dog Lab dashboard and select *Continue to add study data to database*.
2. In the drop down box, select *Record of dog participation in study*.
3. Fill in the required information (Dog's name, Owner's Phone Number, Study Name, and Date) and click *Submit*.

5.4.4 Social media posts

1. Log in to Meta Business Suite.
2. Click on *Create/Make Post*.
3. **Make sure both Facebook and Instagram are selected.**
4. Type the message you want for the study, typically "Thank you, NAME!".
5. Add the photo you want.

- You will probably have to edit the picture for it to post to Instagram (choose the square option).
- Add alt text to both Facebook and Instagram photos. Describe the dog and owner (if applicable).

6. Click *Post*.

5.5 Separation anxiety protocol

1. Apply this protocol if the dog is showing signs of anxiety after being in the lab after 10-15 minutes. Signs include heavy panting, drooped ears, urinating, pacing, drooling, licking lips, red nose, staying near owners/near the door, whining, and barking.
2. Inform the owners that their dog is showing signs of anxiety, so instead of running the experiment right away, you want to use the appointment time to allow the dog to further acclimate to the room and experimenters.

- Inform the owners that it is very important for them to ignore their dog (i.e. no petting or talking to dog) while running the anxiety protocol. This way, the dog will realize they only get attention/treats from the experimenters and will gravitate towards them more.

3. For 10 minutes, allow the dog to walk freely between the experimental room and the lobby. Have only the experimenters give the dogs treats when they are in the experimental room. The dog should not get any treats while outside the experimental room.
4. For 5 minutes, have the dog, experimenters, and owners in the lab room with the door closed.

- Owners should still be ignoring their dog while experimenters continue to be the only ones giving the dog attention and treats.

5. With the owners still in the room, alternate between having the dog on leash and off leash for a minute at a time over the span of 6 minutes. Continue to offer occasional treats.
6. Have the owner return to the lobby. For 15 minutes, keep the dog in the experimental room, alternating between being off leash and on leash for a minute at a time.

- If the dog has shown improvement, begin training and attempt to collect data from the dog the same day.
- If the dog does not show improvement, thank the owner for their time and allow the dog to leave. Inform the owner that we will keep them in our database for future studies that will not require the owner to be separated from the dog.

5.6 Cleaning protocol

If dog has an accident on lab carpet:

1. If owner is present when dog has accident, ensure them it is not a problem.
2. Get Nature's Miracle spray and paper towels from the table in the back of lab.

- Apply the spray to the accident area, wait 15 minutes, and then blot area well with paper towels.
- If there is an "extra" lab assistant, have them handle the accident cleanup so the study can proceed while the Nature's Miracle spray sits on the accident area.
- Be sure that the dog does not mess with the sprayed area while it sits!

5.7 Safety protocol

5.7.1 Dog bite

IN CASE OF A DOG BITE OR AGGRESSIVE DOG:

1. Ask the owner/dog to leave the lab at this time.

- "For the safety of our staff, we need to stop the study at this time and let you take your dog home."

2. If needed, get the injured individual to the emergency room ASAP. Otherwise, get the first-aid kit in the clear bin hanging over the table in the back of the lab and apply first-aid, if needed.
3. Notify Dr. Stevens right away (all contact information is located on the left cabinet in the lab office room). He will submit the required incident report. He will need to know exactly what happened, when, where, and with whom, as well as what was done afterwards.

5.8 Emergency protocol

Report all emergencies: UNL Police 402-472-2222 or 911

5.8.1 Smoke or fire alarm

EVACUATE

- Pull nearest fire alarm
- Assist participants
- Ensure dogs are leashed
- Use nearest exit (stairs just outside door)
- Do not use elevators
- Take belongings if near
- Move to safe distance
- Re-enter only if directed

5.8.2 Tornado warning

SHELTER

- Stay in basement, including participants and dogs
- Get low
- Cover back of head
- Monitor news
- Stay in shelter until warning expires

5.8.3 Shooting or violence

RUN, HIDE, FIGHT

- RUN - if you know where the danger is and it is safe to go
- HIDE - if it is unsafe to escape, hide in a secure space
- FIGHT - if hiding is not an option, fight as if your life depends on it

5.8.4 Gas leak

Follow instructions to EVACUATE or SHELTER.

5.8.5 More info

- https://emergency.unl.edu
- 911
- UNL Police 402-472-2222

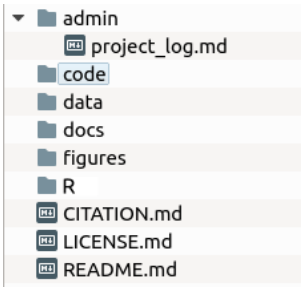
6 Project and data management

6.1 Project management

6.1.1 Project directory structure

The lab uses a consistent project management style to facilitate collaboration across members and to facilitate the open dissemination of our work. To participate in data analysis or manuscript preparation, you will need to organize the files on your local computer with a particular structure to match the lab's structure. If you do not have one already, you should create a `projects` or `research` or `CCHIL work` directory on your computer. We highly recommend creating this directory with your Microsoft OneDrive folder on your computer.

Once you have an overall projects directory in place, you can create a subdirectory for the current project. Within the project directory, you will want to use the following subdirectory structure:



- `admin` This is the administrative directory that should contain information about IRB protocols, IACUC protocols, pre-registration documents, experimental protocols, and other files associated with the logistics of the project. It also has a file called `project_log.md` that is a log of the event associated with the project.
- `code` This is the directory for the computer code that is used to collect data. For example, there might be Python, PsychoPy, or OpenSesame code here. Not all projects have a code directory.
- `data` This is the directory that stores the project data. Often there is a subdirectory called `raw_data` for raw data.

- `docs` This is the document directory that stores the files for manuscripts and presentations (posters and talks). This is where most `Rmd` files go. We do not place administrative documents here—only documents for disseminating our results.
- `figures` This is the directory for hand-drawn and script-generated figures.
- `R` This is the directory that contains the data analysis scripts. In general, there should be a data processing script and a data analysis script.
- `CITATION.md` This file gives the citation for the published version of the project (e.g., journal citation).
- `LICENSE.md` This file describes the license under which the project is published (e.g., Creative Commons Attribution 4.0 International Public License).
- `README.md` This file give a short overview of the project and is the landing page for the project on GitHub.

In general, use subdirectories to organize the main directories and limit the files in the main directories to just the core files. We will often create `old` subdirectories to move old or irrelevant files into.

6.1.2 Existing projects

Most projects in the lab already have project directories, and they are available to collaborators in the lab. These directories are available as Git repositories (repos) at GitHub, a website that stores, backs up, and version controls code. Git is a very powerful tool for tracking changes that happen to files, and GitHub is a great way to facilitate online collaboration. Briefly, GitHub allows you to clone (install new) existing repos from the remote GitHub source to your local computer, pull changes from a remote repo to update your local repo, and push changes you make locally up to the remote repo. Check out Github's glossary for more definitions. To learn more about working with Git, check out the Version control section.

So if you want access to the project directories, you need to create a GitHub account and send Jeff your GitHub account name. Once you're added to the lab team as a contributor, you can clone the repo locally to your own computer and start working on the files.

Note that GitHub does not automatically sync your computer with the remote repo. This is done for two reasons: (1) multiple people can be working on a file at a time, which can cause conflicts and (2) project manager may want control over what changes are accepted and rejected. Therefore, you must manually pull changes from the remote repo that other people have pushed there. **Please always pull from the remote repo everytime before you start working on a project.** Also, when you make changes to files on your local repo, you must manually push them to the remote repo. In some cases, your pushes will be automatically accepted. But in other cases, your pushes must be reviewed by the repo maintainer to make sure that they are acceptable.

6.1.3 RStudio Projects

Because most of our analyses and documents are done in RStudio, we use RStudio Projects for our projects. Creating an RStudio Project sets the working directory in RStudio to the project's root directory. This is useful because when you open an RStudio Project, you always know what working directory you are using. Combined with the functionality of the `here()` function of the `{here}` package, you will not have to spend any time worried about setting directories with an RStudio Project.

RStudio Projects also will automatically open the documents that were opened last time that you used the Project. Finally, you must work in an RStudio Project to be able to use version control via Git in RStudio.

So you should create an RStudio Project for every project that you will be using RStudio for. To open the RStudio Project, double click on the `.Rproj` file in your project root directory (do not open RStudio through the app menu).

6.2 Project workflow

The way in which we manage our project workflow can (1) maintain consistency and facilitate collaboration across the lab, (2) ensure more robust scientific practices, and (3) encourage open science and facilitate publishing our work in a reproducible way. Therefore, the lab uses consistent tools and steps to maintain a reproducible project workflow. In general, our lab

1. pre-registers our studies,
2. collects data in an open manner (using open-source software when possible),
3. archives raw data without alteration,
4. uses R to process that raw data,
5. generates 'working data sets',
6. uses R to analyze working data to calculate descriptive statistics, conduct statistical tests, and generate figures,
7. uses R Markdown to produce manuscripts and presentations to disseminate our work,
8. posts our data collection materials, working data sets, R analysis scripts, and R Markdown documents with our published articles.

This workflow needs to be in place for all CCHIL lab members. However, the workflow is not immutable—if you have suggestions on ways to improve it, let Jeff know. Though imposing our structure on collaborators is not feasible, we will try to maintain our project workflow as much as possible with people outside of the lab.

6.2.1 Pre-registration

One way to improve replicability of our studies is to pre-register them (Nosek et al. 2019). Pre-registration means that you write down and post your plan for methods, data collection, data processing, and analysis **before starting data collection**. Pre-registration forces you to think about how you will analyze your data before you have any. This both helps in designing your data collection tools and limits the degrees of freedom available for p-hacking at the analysis step.

There are a number of different ways to pre-register a study. This simplest is to complete the nine-question form at AsPredicted.org. Alternatively, the Open Science Framework pre-registration system provides a more thorough avenue to pre-register your study. I highly recommend using the `{prereg}` package to create your pre-registration in R Markdown before submitting. However you choose to do so, you will need to pre-register your studies before starting data collection.

6.2.2 Data collection

When designing data collection tools (e.g., Qualtrics surveys, PsychoPy scripts, etc.), it is important to think about how the data will be used downstream in the work flow. So before designing data collection, make sure to understand the rest of the workflow and think carefully about how the information you collect will be used in the workflow. Take the time to carefully design these tools to facilitate easier data analysis.

Standard practices for data files

- Organize data files logically and separate them into subdirectories if appropriate.
- Save data files as `csv` (comma-separated value) files. In general, use plain text files (`txt`, `md`) as much as possible. Avoid using Excel and Word files when possible.
- Name files consistently. In general, 'snake_case' (that is, lower case with an underscore between words: `response_time`) works best. Avoid uppercase letters and spaces in file names. If possible, use a script to automatically name files consistently. If appending a date, use proper ISO standard dates: YYYY-MM-DD (e.g., `my_file-2020-05-22.csv`)
- Within data files, use descriptive variable names written in snake_case. Abbreviations are acceptable, but make sure that they are readable and understandable. Do not use upper case letters or spaces in variable names.
- Think carefully about how the data values should be labeled, considering how you will be working with those values in R. For instance, avoid using spaces in value labels (use snake_case when possible). For example, do you want to use words (e.g., Yes/No, LL/SS) which are more descriptive or numbers (e.g., 1/0) which can be used to calculate proportions directly?

- Use the proper ISO standard for dates and times: YYYY-MM-DD hh:mm:ss (e.g., 2020-05-20 09:48:00) or just YYYY-MM-DD for dates.
- Avoid collecting identifiable data when possible. And ensure that you are only collecting data that you have IRB permission to collect. For instance, in Qualtrics, unless you requested permission to do so, you must disable the recording of particpant IP address (*Survey Options > Security > Anonymize Response*).

Data security

In addition to attending to the structure of data collection, take the time to ensure data security.

- Only store data files on password-protected computers. If you must use shared computers, transfer the data files to OneDrive, double check that they are all uploaded to OneDrive, delete them from the shared computer, and empty them from the trash. **You cannot store data with personally identifiable information on personal computers. They can only be stored on lab computers.**
- Do not leave publicly accessible computers unlocked. For example, if you are working in the B71 bullpen or the library or a coffee shop, do not leave your computer unattended and unlocked. Lock your screen.
- Do not share any lab passwords outside the lab, and do not leave passwords visible to others.
- Do not upload data (especially participant-related information) to any cloud storage systems besides OneDrive (e.g., not Google Drive). We only have permission to store data in OneDrive.
- Do not make or use public GitHub repos until all data analyses are public, and the PI has authorized making the repo public.

6.2.3 Raw data

All raw data should either be automatically saved to a cloud storage service or should be moved there as soon as possible. Currently, the lab uses OneDrive to store all raw data, and each project should have its own OneDrive folder that is shared with all of the project members. Note that OneDrive raw data folders do not necessarily have to be synced onto your local computer.

Note that we are using OneDrive as an archive for all raw data. That means that **all** raw data need to be archived on OneDrive, even if it is a 'bad' data file (e.g., incomplete data, interrupted session, wrong subject/date entered, etc.). If necessary, a subdirectory for 'bad' data can be created and these files can be moved there. But every data file created must be archived on OneDrive.

Because this is an archive of the data, **we do not EVER alter the raw data files, including the file names**. Any changes that need to be made to data must happen downstream in the R scripts. Raw data should never be changed. If changes need to be made, they need to be entered into the `project_log.md` file and a separate notes file (if desired).

OneDrive files are versioned (meaning it saves previous versions) and authored (meaning we can see who made changes). So we can revert to previous versions, but this should not need to happen. Do not change raw data files.

6.2.4 Data processing

In the lab, all data processing occurs transparently via R. **Never change any data files in Excel.** While Excel saves the changes that you make to files, it does not save the *process* of that change. Our lab prioritizes making the entire data analysis workflow transparent, and Excel does not allow transparency, so it is not allowed to be a part of our workflow.

To achieve this, we usually have a single R script called something like `data_processing.R`. This script inputs the raw data and processes it to generate the working data set that will be published with the article.

- Fix some of the problems with data files that occurred at data collection (e.g., fix wrong subject number/date).
- Combine separate subject-specific files into single data set.
- Remove unnecessary columns and rename and reorder existing columns.
- Recode data values.
- Convert dates into ISO if not recorded that way.
- Pivot data into tidy format (if that is appropriate).
- Merge different data files into single file.

Note the only aim of this script is to generate a publication-ready working data set. **There should be no analysis conducted in this script.** Every statistic in the manuscript should come from the analysis script. While the data processing script does need to be commented and documented, it does not need to be as polished as the analysis script.

6.2.5 Working data

The working data set is the data file (or files) that will be posted with the published article. As such, it needs to be clean and polished. Ideally, there is only a single working data set, so try to merge different data sets together in the data processing script. If that is not possible, multiple working data sets are acceptable, but try to minimize the number of working data sets.

Characteristics of working data sets:

- These files should only include the columns that are relevant to the subsequent data analysis.
- Include dates and times when possible.
- Make sure that the column names are both human and R readable—meaning they are understandable to people but are easy for R to work with (e.g., snake_case).

6.2.6 Data analysis

There should be a single data analysis script for one article manuscript (that will be published with that manuscript). If multiple scripts were created during data analysis, they should be combined into a single script. It should contain the code for **all** of the analyses in the manuscript. If there are analyses that cannot be run in R, this should be made clear in the manuscript. It should not contain code that is not contained or referenced in the manuscript. Save unused analyses in other scripts.

In general, the analysis script should use the tidyverse system of working with, analyzing, and plotting data. The data analysis script should contain the following in this order:

- A header that includes the name of the script, the purpose of the script, the author(s) of the script, the date that the script was started, the date of the current version of the script, the license under which the script is published, notes on how to run the script, a list of data files, and a description of all of the columns in the data files.
- A list of packages to load at the very beginning of the script. In general, it is recommended to order the scripts alphabetically unless function masking necessitates another order (e.g., `{here}` should go last and `{tidyverse}` second to last). For packages with a single use or only a few uses, include this in a comment after loading the package. Minimize the number of packages loaded for your script.
- A list of custom-coded functions needed for your analysis. Name your function using tidyverse style: "Ideally, the name of your function will be short, but clearly evoke what the function does. … Generally, function names should be verbs, and arguments should be nouns."
- Import the working data file. If you are using an RStudio project (which you should be!), the `{here}` package is useful for setting working directories properly in RStudio. Use the `here` function when setting the path to import your data.
- Calculate descriptive statistics of participants/subjects, such as age, gender/sex, and other demographic variables. For human participant studies, this should generate a demographic information table for the supplementary materials.
- Calculate inferential statistics. Typically, we calculate and report frequentist statistics, Bayes factors, and effect sizes. We also report the key means ± 95% confidence intervals (either between- or within-subjects) and place the model assumption checks here.
- Plots can either be carved out as a separate section or integrated in with the inferential statistics. Having a separate section is often nice because someone can run the rest of the script without saving new plots, which changes the files and requires them to be staged

and updated in the Git commit. Use `{ggplot2}` or `ggplot` extension packages to make plots when possible.
- Create a separate section at the end for supplemental tables and figures.

High-computation analyses

Sometimes, our analyses can require extensive computations that can take a long time to run. While working through the data analysis, I will often have these scripts write their output to a data file. Then I will comment out the high-computation code and simply import the data file. This will greatly speed up the sourcing of the full R script.

For the final version of the script, however, you will need to uncomment the code and remove the write and read commands. I usually add a comment before the high-computation code warning the user that the code will take a while to process.

6.3 Reproducible research and open science

The lab's policy is to generate reproducible research—that is, we provide the experimental code, working data, R analysis script, and manuscript file used to generate the final document. This allows other researchers to rerun our studies, rerun our code, or reanalyze our data. While it can be scary to put our work out there for public scrutiny, this is what science is about. It can be uncomfortable to have others scrutinize our work. But the benefits of having someone detect an error and correcting the scientific record is more important than our individual egos. We need to be comfortable saying that we were wrong.

6.3.1 Coding

We should write our code assuming that someone else will be reading it. This is guaranteed to happen when future you revisits the code after taking a break. But we should also assume that a different person will be looking at the code.

Coding principles

- Write the code as concisely and simply as possible.
- Break your code into logical sections. RStudio allows you to create sections in R scripts with `ctrl+shift+R`.
- Use functions to automate repetitive tasks. As `{tidyverse}` author Hadley Wickham recommends, you should write a function if you have to do something three or more times (Wickham and Grolemund 2017).

- Use comments **a lot** and comment as you are writing the code. Don't wait to comment afterwards. I tend to use comments as subsections to describe conceptually what a block of code does as well as after almost every line to specify the function of that line.
- Use version control to maintain updates of code.

Here are some R-specific coding principles:

- Use `<-` as assignment operator.
- Use short but descriptive variable names.
- In variable names, separate words with _ or . (e.g., `my_vector`).
- Don't use functions as variable names (e.g., `c`, `mean`).
- Use blank space between all objects, operators (`*`, `=`, `==`), and after all commas
- Write out `TRUE` and `FALSE`.
- Use indents to separate nested components. Highlighting text and pressing `ctrl+I` will automatically indent code properly.

6.3.2 Documentation

In addition to commenting code, documentation is important to maintaining reproducible research.

First, creating and updating a project log is important. The `project_log.md` file in a project's `admin` folder is the best place to start for this (here's an example project log). The log simply comprises a date and a description of the what happened in the project that day. Entries for these logs can include IRB/IACUC approval dates and protocol numbers, experiment start/pause/stop dates, experiment assistant start/stop dates, anomalous data descriptions (e.g., "program stopped while subject was running, so I restarted it and labelled it subject 102b"). While it may seem tedious, and you may forget to add entries, updating the project log is critical to keep track of issues that may be relevant to data analysis and interpretation, especially months or years after the issues occurred. The project log should be used from the inception of the project, through data collection, data analysis, and manuscript preparation. It can be closed upon final publication.

Second, README files are important for documenting the structure and process of a study project. There is a `README.md` in the root directory of every project. This file should include the project name and overview, a list of specific aims and research questions, and a project protocol describing the structure of the project and the expectations for working on the project. This should be updated to include the citation and abstract of the accepted manuscript when the project is published. This file is what shows up on the main page of the GitHub repo for the project.

Once a project is ready for submission, there should also be a `README.md` file added to the reproducible research folder. This file should include the author(s) and creation date of the file, a request for a citation of the manuscript, the license under which the script is published, notes

on how to compile the file/run the script, a short summary of the data and data processing, a list of data files, a description of all of the columns in the data files, a list of R scripts.

6.3.3 R Markdown/Quarto

Though it is the worldwide standard and it has some advantages such as track changes, Microsoft Word has limitations for reproducible research because you cannot embed R code into the text to show how statistics are calculated. R Markdown allows the inclusion of R code into manuscripts and can produce beautiful documents. A key benefit of this is that, if your statistics change (because you have altered the R script), you do not have to change them by hand in the document. R Markdown will automatically update them. **The standard for the lab is to use R Markdown for all publications**. There may be cases in which we do not use R Markdown (e.g., working with collaborators outside of the lab), but it should be the default method for writing manuscripts. And I highly recommend using `{papaja}` to format APA style manuscripts.

To use R Markdown, you will edit a plain-text `.Rmd` file that uses Markdown syntax to format text and R code chunks to embed R calculations. In RStudio, you can then compile this file using the `{knitr}` package to generate a PDF of your document. It takes a bit of time to learn Markdown and R Markdown syntax, but the time invested is worth it to generate elegant, reproducible, updatable manuscripts. You can find example R Markdown files on the lab's publications page and check out R Markdown: The Definitive Guide (Xie, Allaire, and Grolemund 2018).

Quarto is the next generation of R Markdown. While it's great for presentation and websites, there currently isn't a robust template for making APA-formatted journal articles, so I don't recommend using it for manuscripts just yet.

6.3.4 Dissemination

To disseminate our reproducible research, we must collect all of the relevant files in a cohesive way. Therefore, we need to create a subdirectory in the `docs` directory called `rr` or `osf` or `dryad`. Within this directory, we need to place the following:

- Data files (`.csv` files)
- R scripts
- R Markdown files for manuscript and supplementary materials
- Bibliography and style files used by R Markdown files
- README file

We usually do not start formally collecting these files until after data analysis and manuscript preparation are complete. But it is important to keep this in mind as you build and work on the project.

Open Science Framework

Once the reproducible research files are in place, they can easily be uploaded to an Open Science Framework (OSF) project, which provides a permanent place to archive the files. OSF projects need to include the major authors as collaborators. The lead author should write a description of the project, choose a license, and add the citation, abstract, and keywords to the project wiki. Then the following components should be added: *Data and R script*, *Figures and tables*, and *Preprint.* Then, upload the data file and R script to *Data and R script*, primary and supplementary tables and figures to *Figures and tables*, and the PDF and R Markdown files for the manuscript and supplementary materials to *Preprints*. Separating the files into different components allows us to (1) allow differential public access and (2) create separate DOIs for different parts. For example,

Figures

When you publish figures in your journal articles or books, the publisher owns the copyright to those figures and may require written permission for others or you to republish them. To avoid this, I recommend publishing the figures yourself first under a license that allows anyone to reuse the figures as long as they cite the source (e.g., Creative Commons Attribution 4.0 International Public License). One way to publish your figures is to create a component in your Open Science Framework project for figures and tables, post your figures and tables there under an appropriate licence, and create a DOI for that OSF component. Then create a citation to this component (e.g., Goh, F. W., Jungck, A. C., & Stevens, J. R. (2020). Payment method effects on tipping: Figures and tables. Open Science Framework. https://doi.org/10.17605/OSF.IO/6FMVS) and add something like the following to the end of each figure caption in your manuscript: "Figure used with permission: Goh et al., 2020; available at https://doi.org/10.17605/OSF.IO/6FMVS under a CC-BY4.0 license".

Preprints

The lab strives to produce and post preprints of manuscript prior to submission to journals. Posting preprints makes your information public much sooner than waiting for journal publication. While it may seem scary to post your work before it has been peer reviewed, this allows you to get feedback early, gives you credit for work early, and makes your work open and accessible to anyone. You can (and should) update your preprints as changes are made to the manuscript. Check with a journal's preprint policy before submitting to them. Most journals are fine with preprints (some even allow you to submit to them directly from the preprint server). But some have weird policies. Do not submit your manuscript to journals that do not allow preprints.

For our purposes, there are two primary preprint servers. PsyArXiv focuses on psychology-related content and is associated with the OSF. In fact, you can import files directly from your

OSF projects. BioRxiv focuses on biology-related content and has direct connections to many biology journals.

7 Version control with Git

Git is a version control system that tracks changes in computer files and stores multiple versions of those files. The lab uses Git to maintain version controlled documents, data, and code. For shared projects, the version controlled repositories are hosted on GitHub in private and public repositories.

There are lots of Git resources including:

- Happy Git and GitHub for the useR
- Dr. Bourke's tutorial
- Git Guide
- Software Carpentry's Version Control with Git
- DataCamp's Intro to Git
- Pro Git
- git/github guide

7.1 Installing Git

You will install Git in different ways depending on your operating system.

Linux (Ubuntu)

In a terminal, type `sudo apt install git`.

MacOS

Go to https://git-scm.com/download/mac to download and install Git.

Windows

Go to https://git-scm.com/download/win to download and install Git.

7.2 Ignoring files and directories

Git will automatically use version control on all of the files that are in the repo. But you can give it a list of files or directories that you want it to ignore and not track.

- Create a `.gitignore` file in your repository directory.
- Add directory names (e.g., `data`) and/or file types (e.g., `*.log`)—one per line.
- Find default ignore files at https://gitignore.io.

7.3 Using to GitHub

Using GitHub is fairly straightforward, and there are lots of help resources on GitHub's website.

Create a GitHub account

- Go to https://github.com and click on Sign up.
- I **highly** recommend enabling two-factor authentication for your GitHub account.
- Send me your username when you have created an account, and I will add you to the shared lab group.

Connect your repo to your account

There are two ways to connect securely to GitHub. The first (and easiest) is to use HTTPS. This requires no special work on your part, but you must create and use a GitHub personal access token that is stored on your computer. This is the preferred method for interfacing with GitHub. The second is to use SSH, but this is not recommended unless you really know what you are doing.

This information is drawn from GitHub's personal access token help page.

Personal access tokens (PATs) are an alternative to using passwords for authentication to GitHub when using the GitHub API or the command line. Create a PAT by going to Settings > Developer settings > Personal access tokens. Generate a new token, name it, optionally set an expiration date and limit the scope. Save the generated token in your password manager (e.g., LastPass).

When you log into the GitHub website, use your GitHub password. When you are interfacing with GitHub through GitHub Desktop, Git, RStudio, etc., use the PAT. Instead of having to log into GitHub with your PAT every time you push or pull, you can store your GitHub credentials/PAT in Git by using the GitHub CLI or Git Credential Manager. If you using Linux, you can manage GitHub credentials from R.

7.4 Using Git commands

Git is command-line driven software, so it is useful to know how to use a command line for your operating system. To open a command line terminal in Windows, click *Start*, type `cmd`, and select *Command Prompt*. For Macs, open *Spotlight*, type `terminal`, and select *Terminal*. For Linux, type `Ctrl-Alt-T`. Next, if you're not familiar, you need to learn about working from the command line.

Create a local repository (repo)

- Open a terminal.
- Change directories to the directory in which you want to create the directory (e.g., `cd projects/this_project`).
- Type `git init`. This creates a hidden directory on your computer call `.git` that stores all of the Git files. You have to be able to view hidden files in your operating system (Windows and MacOS) to see this folder.

Clone a remote (GitHub) repository locally

To clone a repo means to copy it from GitHub to your computer. Cloning will create a directory for you, so you don't need to create a project-specific directory before cloning. To clone the repo, change directories to the main directory where you want the new repo to be and type:

```
git clone [insert SSH/URL info from remote repository]
```

Add a local repository to GitHub

If you have already created a repo locally and want to put it on GitHub, you first need to create a new, empty repo in GitHub. Then, copy the URL (either HTTPS or SSH) from GitHub and type:

```
git remote add origin [insert GitHub repo URL]
```

Update GitHub from local repository

After you've put your repo on GitHub, you'll want to update it when you make changes locally. To do this, you need to `push` the local changes to the remote repo by typing:

```
git push -u origin main
```

The term `origin` refers to your local version, and the `main` refers to the remote branch.

Update local repository from the server

If changes are made on the remote repo, you'll want to download them to your local repo. For this, we `pull`.

```
git pull
```

Preserve current state of local repository (commit)

Version control saves the current state of a project (or subset of files). To do this, you first need to 'stage' the changes, which just means select the files that you want to save. After staging, you must 'commit' the files to actually save the files that you've staged. For each commit, you should include a message that describes what that commit does.

- Stage all changes with `git add .` and individual files with `git add [insert path/filename]`.
- Commit changes with `git commit -m "[Insert message here]"`.
- There is no set rule on when/what to commit, but it is useful to commit fairly frequently, and different file changes can be added to different commits.
- Commit messages should be active declarations of what changes are in the commit. They should almost always start with a present tense imperative verb (e.g., "Add Cronbach's alpha analysis", "Remove redundant plots", "Replace frequentist t-test with Bayesian t-test"). Additional details can be given if committing in RStudio or other GUIs, but command line commit messages should be short. It takes a bit of practice to learn How to Write a Good Git Commit Message.

View remote URL

To see the remote URL for a particular repo, type:

```
git remote -v
```

Change remote URL

To change the remote URL for a repo, type:

```
git remote set-url origin [Insert URL here]
```

Force pull to overwrite local changes

Sometimes, we fall behind in pulling from the remote repo or we make local changes that we don't want to keep. To overwrite the local changes with what is on the remote repo, type:

```
git fetch --all
```

```
git reset --hard origin/main
```

When things go wrong

When things go wrong, check out Oh Shit, Git!?!.

7.5 Using Git via GUIs

Though Git was developed as a command-line app, there are numerous graphical user interfaces (GUIs) that you can use to run Git commands. For Windows and MacOS, you can use GitHub Desktop, which obviously integrates well with GitHub (Linux users must install a fork). Also, some folks like Git Tower or GitKracken. In addition, RStudio has some core Git features baked in if you use RStudio Projects. It is fairly straightforward to stage, commit, push, pull, and view your history from RStudio. While you should be able to get by with GUIs 95% of the time, there will be times when you need to use the commands in a terminal, so it make sense to be familiar with using the commands.

7.6 Git sandbox

The lab has a Git sandbox on its GitHub account. Feel free to go play around with Git there.

Part III

Resources

8 Writing

Writing is a key part of academia. We communicate our ideas via manuscripts, books, reports, grant proposals, and blogs. We also make presentations and poster to disseminate our findings. Here we review some tools and tips for writing and presenting our work.

8.1 Software for writing

Though Microsoft Word/PowerPoint and Google Docs/Slides can be convenient, they do not make reproducible outputs. A reproducible alternative is Markdown, which is a markup language that allows you to write plain-text in a text editor and include special syntax to control formatting. Markdown files get passed to Pandoc, which can process the syntax and convert the file to a formatted output file such as HTML, PDF, or DOCX. This contrasts with Word/PowerPoint where the formatting is shown to you in the app (What You See Is What You Get or WYSIWYG).

A key benefit of Markdown is that you can see exactly what syntax is generating the output. This concept was pushed further with R Markdown and Quarto. These packages allow you to directly embed R (or Python, Julia, or Observable in Quarto's case) code into the Markdown document. When processing the R Markdown or Quarto file, an additional step runs the R code and embeds the results into a Markdown file before it is passed off to Pandoc. Thus, you have a file with both Markdown syntax showing the formatting and R code showing the calculations. It's totally reproducible!

Markdown syntax is pretty simple. Here are some quick examples:

Code	Output
`_italics_`	*italics*
`**bold**`	**bold**
`~~strikethrough~~`	~~strikethrough~~
`^upper^case`	upper^case^
`~lower~case`	lower~case~
`* bullet`	• bullet
`# Header 1`	**Header 1**
`[link](https://dogcog.unl.edu)`	link

Check out the Markdown Guide for a full reference guide on Markdown syntax. It's quite powerful and can include figures, tables, bibliographies, cross-referencing, footnotes, math symbols, etc. And Markdown can be used to create documents, books, presentations, and webpages.

8.1.1 Bibliographies

Citing our sources requires keeping track of all of the articles, books, websites, and dissertations that we use as resources. Zotero is a "free, easy-to-use tool to help you collect, organize, annotate, cite, and share research". There are two key functions of Zotero.

Source organization

First, Zotero organizes all of your sources. It keeps track of authors, titles, DOI, URLs, etc. so you can search through your "collection" to find sources. Critically, it also stores PDFs of each source, so it is a great way to organize PDFs.

How do you get sources into Zotero? It's easy. There are extensions for all of the major web browsers. When installed, there is a little button that, if you press it while on a source's webpage, will automatically extract the relevant meta-information (author, year, title, publisher, DOI) from the page and save a PDF (if available). You can also import meta-information either from other bibliography software (e.g., EndNote, Mendeley) or from a file with that information formatted appropriately.

Within Zotero, you can create 'collections' or subfolders that include specific sources relevant to a particular topic. So instead of sorting through my 10,000 (!) sources, I can go straight to the `dog_inhibition` collection to see the relevant sources. In addition, you can share collections with other Zotero users either directly via their usernames or you can create Zotero Groups to share and collaborate on collections of sources.

Formatting bibliographies

Another key feature of Zotero is that it can automatically format references to your sources. For instance, if you have a collection full of sources for a paper, you can export those references, choose a formatting style, and Zotero will create a completely formatted bibliography for you. So you don't have to remember if APA style italicizes the volume number or uses a colon or comma after the issue number. There are thousands of style files already created for most journal styles. This is especially useful if you need to quickly change styles—it just takes selecting a different style type.

What's more, you can even use special code to enter sources directly in your document as in-text citation. When you do this and compile the document the in-text citations and the

bibliography are automatically formatted to the style you choose. If you add or remove sources, the bibliography is automatically update. It's amazing! No more typing out bibliographies. Use Zotero.

8.2 Writing lots and well

Before we get to specific types of writing, it's important to remember that writing isn't easy for most of us. Writing is hard. Which means that we need to write a lot (meaning often) and revise a lot (meaning much of the writing). Motivating writing can be difficult, so folks often use strategies such as scheduling a certain amount of time each day to write. Or require yourself to write a certain number of words each day. Find a good time of day that works for you, and reward yourself after writing with something that you enjoy.

But writing a lot isn't enough. You also need to write well to effectively communicate. First, that means know who your audience is. Are they novices who know nothing about your topic? Or are they experts in this area? I usually assume my audience is smart people who know nothing about my work.

The two key things to keep in mind when writing are to **write simply** and **write concisely**. Writing *simply* means using simpler words that more people know.

- Avoid using jargon or thesaurus words.
- *Use* simpler words instead of *utilizing* more complicated ones.
- Write short sentences. Longer sentences with lots of phrases are hard to parse. Split long sentences in two.
- Imagine your grandparent is reading your text. Would they understand? If not, simplify.
- Check your readability with readability checkers.

Writing *concisely* means using as few words as possible to convey your meaning.

- Avoid unnecessary phrases that convey no real meaning. Here are two big ones that I cut out every time I see them.
  - "In order to" can just be "To" over 90% of the time.
  - "Research shows that" can also almost always be removed. Just state what the research shows!
- Avoid passive voice when possible. Active voice tends to use fewer words and is clearer.
- Read each sentence separately and check whether each word is necessary. Be brutal and cut anything that is not necessary to convey your meaning.

8.3 Journal articles

The primary currency of productivity in the behavioral sciences is publications, with a strong emphasis on peer-reviewed journal articles. The expectation of the lab is that most of the work that we do should be published in journals. Even if the results don't turn out as we expect, if we don't have methodological errors, we will aim to publish our results in journals. So the expectation is that people who take the lead in projects will write up the work in journal article form. Publishing journal articles can take months or years, so even after you leave the lab, we need your help in writing, revising, and responding to reviewer questions.

There are two ways that lab members' contributions to projects are signaled in journal articles: authorship and acknowledgments. Authorship signals a substantial contribution to the project (see Authorship section). Assistants who contribute less substantially are highly valued and appreciated and included in the Acknowledgment section of the paper. If you are interested in being an author on a paper, contact Jeff early to discuss ways that you can contribute to the paper in way to merit authorship.

8.3.1 Journals

Before the writing process gets started, it is useful to think about what potential journals we would want to submit to. We want to think about this early because it can greatly shape the scope, direction, and length of the paper (especially the Introduction and Discussion). Talk to Jeff about potential journal venues. In general, Jeff has a preference for diamond open access journals, which are journals that publish papers without charging authors to publish or readers to access. These are often society-governed journals run by academics instead of for-profit publishing companies that have higher profit margins than the major tech companies and are built on the free labor that academics provide through peer review. Other journals may be appropriate for some papers, but Jeff has a strong preference for open access options and not to publish in Elsevier journals.

Some of our favorite diamond open access journals include:

- Animal Behavior & Cognition
- Comparative Cognition and Behavior Reviews
- Human-Animal Interactions

8.3.2 How to write a journal article

Here are some tips for writing journal articles.

Things to think about before writing

- Why are you writing a scientific article?
- What will be the scope of this article?
- Who is your audience?
- Where will you submit the article?
- Who should be a co-author, and what will be their roles?
- How will you collaborate on writing?

The structure

Research articles are fairly formulaic. They do not need to be especially long to get your point across. In fact, the fewer words required to communicate your point, the better. My own view about the structure of a paper fits nicely with that of Claus Wilke, and he has some very helpful pointers for writing a paper in four easy steps. I usually write them in the order Methods, Results, Discussion, Introduction, Abstract (or switch Introduction and Discussion).

Abstract

- Abstracts can be difficult to write. Write your abstract for a high-school educated person with no knowledge of your research program who will not read the rest of your paper. Hook them, so that they want to!
- Some journals and fields have specific subsections to fill out: Background, Objective/Aim, Methods, Results, Conclusions. These structured abstracts can be a useful templates even if the journal does not require it, because they generally improve readability (Hartley and Sydes 1997; Hartley 2004).
- Do not ever say "X, Y, and Z are discussed". Write your abstract in active voice as much as possible and give your conclusions rather than just say some topic is discussed.
- Feel free to copy and paste sentences from the rest of your paper (since this is likely written last), but know that you will likely have to heavily edit them to make them accessible to your audience.
- After writing a draft, consider running it through a readability scorer to see how accessible it will be.

Introduction

Introductions should be relatively short—they do not need to be full literature reviews if you are writing an empirical paper. Quickly cover the relevant literature.

- First paragraph
  - Try to start with a specific, catchy example that gives the reader a visual experience to remember during the rest of the paper. Check out some of our previous work for examples (e.g., Duque et al., (2020) or Goh et al., (2020)).

  - Next, try to expand to explain the big picture very quickly. What is the big question that this paper addresses, and why is it important?

- Middle paragraphs
  - In the next few paragraphs, unroll a more specific story that conceptually motivates your project and places it in the theoretical foundation of your area.
  - Move from background literature to the focus of your paper.

- Final paragraph or two should be about the current study
  - Describe your overall research question(s).
  - Give a short description of your approach to answering the research questions.
  - End with your hypotheses and/or predictions.

Methods

- Participants/subjects
  - Describe the source and demographics of your participants.
  - Describe *when* your data were collected.
  - Describe why and how many participants/subject were excluded.
  - Give information on IACUC/IRB approval for the project.

- Materials
  - Describe the materials, apparatus, location.
  - Often including a diagram of the experimental set-up is useful here. This can be either an image (remember, images of animal experiments must be vetted by the IACP before being made public) or a graphic you create (e.g., preferably an SVG graphic created in Inkscape).

- Procedure
  - It is usually best to describe the full procedure in detail here. It is easier to cut extraneous details than have to go back later and remember details to add.
  - This will likely be the longest section of the Methods.
  - Don't forget to include information on training/warm-ups, etc.

- Experimental conditions
  - Sometimes it's nice to have a separate section describing the experimental conditions, especially if they are detailed. But sometimes it makes sense just to move this as a subsection of Procedure.
  - Again, illustrations (either images or graphics) of experimental conditions are very helpful. I recommend adding them whenever possible.
  - Use good, descriptive names for experimental conditions (such as ostensive and non-ostensive rather than treatment and control) and use them consistently through the paper

- Data analysis
  - Cite R and the R packages that you use (this is done easily in R Markdown with the `{papaja}`).
  - Describe where data, code, and supplementary materials can be found (e.g., Open Science Framework)
  - If applicable, describe that the document is a reproducible document written in R Markdown.
  - Describe the statistical analyses used. I find it useful to walk through the R script and describe what happens to the data.
  - If using Bayes factors, give a short description of what they mean, the thresholds that you use, and the priors (if needed). If you are estimating them from BICs, include the formula $e^{(BIC_{null}-BIC_{alernative})/2}$. Good citations include Wagenmakers (2007) for BFs generally and the BIC formula and Wagenmakers et al. (2018) for thresholds.

Results

- Each major result/hypothesis should have its own section (or at least paragraph). Start with building the figure for the section, then write a paragraph about it.
- Within each section, start with a reminder of what the hypothesis/aim is, followed by a very brief description of how the data were analyzed.
- Then move into describing the results, using objective descriptions of what the statistical test show. Do not draw inferences or discuss conclusions from the data. Describe it in terms of your dependent and independent variables rather than the broader concepts that you are inferring from those variables.
- If using frequentist statistics, give the test statistic, p-value, and effect size. Describe the effects, but **do not use the word *significant***.
- For Bayesian hypothesis testing, give the Bayes factor, and describe the results in terms of evidence for hypotheses.

Discussion

- Start with a paragraph giving a quick summary of the results.
- Next, spell out the implications of each of your results (in the order presented). This is where you relate the results to your hypotheses, connect them to previous literature, and give conclusions about what they mean and why they are important.
- It is important to include limitations of your study. But don't go overboard here, and don't waste time with sample size as a limitation. It's almost always a limitation.
- Sometimes this is integrated with limitations, but it is nice to point to future directions. What are the next questions/projects that logically follow from this one?
- Finally, it is usually nice to end with a conclusion. This summarizes the findings, highlights the key implications, and ends with a strong conclusion that can be drawn from the study.

Acknowledgments

- Make sure to acknowledge funding sources, assistants who helped collect the data, and people who gave advice or reviewed the manuscript. Notice there are only two 'e's in Acknowledgments (in American spelling).

Pro tips

- Keep the presentation of hypotheses/research questions consistent throughout Methods, Results, and Discussion
- To minimize passive voice, read your paper backwards looking specifically for passive voice.

8.3.3 Before submitting journal articles

There are a few things to consider and do before submitting our papers. We will want to post all data and analysis scripts to publicly via Open Science Framework and/or GitHub and include links in our papers. Also, in most cases, Jeff will want to submit a preprint of the article to a preprint server (e.g., PsyArXiv, bioRxiv, or OSF Preprints) before submit the article to a journal. We also need to write a short cover letter and think about potential reviewers to suggest (going through the bibliography is often useful for generating reviewer ideas).

8.4 Grant proposals

The structure

Specific aims

- First paragraph
  - Opening sentence–attention grabbing, relates to funding agency mission, provides general research area
  - Important knowns–establish state of field and set up gap in knowledge
  - Gap in knowledge–obvious extension of knowns
  - Framing gap as problem–gap prevents this step from being taken
- Second paragraph
  - The *long-term goal* of this research program is to… *(addresses agency mission).*
  - The *overall objective* of this application is to take a major first step towards that long-term goal, namely to… .

  - The *central hypothesis* of this project is tha… *(directional hypothesis that conveys my best bet as to what explains the phenomenon that I will be investigating. Needs to be objectively testable. Then include why this is best bet (pilot data, etc.)).*
  - The *rationale* for this study is that we expect to… *Why are you doing this? What will be possible after research is completed that is not possible now?.*

- Third paragraph
  - We will test the central hypothesis with the following *specific aims*:
    1. Specific aim 1: *Should be an objective (e.g., identify…) activity with indeterminate end (e.g., study, explore). Working hypothesis: Testable hypothesis not a 'look-and-see'*
    2. Specific aim 2: *Working hypothesis:*
    3. Specific aim 3: *Working hypothesis:*

- Fourth paragraph
  - This study is *innovative* because it… .
  - This will provide an important *positive impact* because… *summarize what comes next in Significance paragraph. How will the funding agency benefit?.*
  - Our team is especially *well qualified* to conduct this project because… .

Background and significance

- Significance of the proposed research
  - Opening sentences–Despite the widely appreciated magnitude of this problem, there is still a critical gap in the knowledge base that centers on how . As an outcome of the proposed investigations, we expect to have determined the mechanism of/distinguished between/overcome the problem of .
  - The research proposed in this application is significant because .
    * Validate statement of significance with a credible list of benefits

- State of research
- Preparatory work

Research design

- Specific aim 1:
  - Introduction. The objective of this aim is to . To attain the objective of this section, we will test the working hypothesis that . We will test our working hypothesis by using the experimental approach of . The rationale for this aim is that successful completion of the proposed research will . When the proposed studies for aim 1 have been completed, it is our expectation that . Such a finding would be of importance because it would allow, for the first time, the development of novel and much needed approaches to .

- Experimental design.
  - Study 1:
    - Justification of need to do the study
    - Approach to be used
    - Method(s) required
    - Key equipment required
    - Numbers of subjects and how these numbers were derived
    - Statistical analysis needed
    - Controls to be performed
    - Replicates that will be needed
    - Detailed expectations
    - Time required to complete the studies
    - Other considerations
  - Study 2: [Repeat]
- Expected results.
  - Summarize first outcome and its importance
  - Summarize second outcome and its importance
  - Conclude with how outcomes collectively attain the aim's objective
- Anticipated problems and solutions.
  - Problem: invalid working hypothesis
  - Solution:
  - Problem:
  - Solution:

9 Presenting

Presenting talks and posters is a key part of academic life that offers you the chance to disseminate your ideas and work to a larger audience. Mostly, these presentations will be at academic conferences and workshops. Grad students may attend national conferences to present, and undergraduates may attend regional conferences or the UNL Student Research Days. But sometimes we present to the general public, which would involve different issues than described here.

9.1 Conferences

There are **lots** of different conferences and workshops to present at. Here are a few that folks in our lab may present at:

- Comparative Cognition Society Conference
- Canine Science Society Conference
- Canine Science Forum
- Animal Behavior Society Conference
- International Society for Anthrozoology Conference
- Nebraska Psychological Society Conference

9.2 How to give a talk

Things to think about before starting

- What will be the aim of this talk? Are you giving a tutorial, job talk, research overview, or a deep dive into a particular study or set of studies? Or do you want feedback on an upcoming project?
- Who is your audience?
- How much time do you have? How much time do you have/want for questions?

The slides

Presentation files

- If you don't need to embed videos, consider using PDFs instead of PowerPoint slides. Even if you do use PowerPoint, save a PDF version and have your video files available just in case.
- Find out if your projector/screen is 4x3 or 16x9, and set up your presentation to match (use 16x9 if possible)
- Have your presentation on a USB but also email it to yourself to have an easily accessible copy. Don't rely on Box or other cloud services because logging in may be tricky.
- Embed your fonts in your PowerPoint file.

Structure and content

- General
  - Outline your talk into sections before you start making slides.
  - For study-based talks, organize them into Introduction, Methods, Results, Discussion/Summary.
  - Use consistent ordering of content throughout your presentation. If you introduce topic/hypothesis A, B, and C in the introduction, present them in order A, B, C in the methods, results, and discussion.
- Preliminaries
  - Title slides should not be too cluttered but should have the title, your name (possibly co-authors, but they can be on another slide), affiliation, and social media handles (especially Twitter—to allow the audience to tag you in any tweets during the talk)
  - Consider having your acknowledgments slide next. This (1) makes clear from the start that it is a group endeavor (2) gets this item out of the way early so if you run out of time, you've been able to acknowledge the group, and (3) prevents the gap from your conclusions to questions that would occur if you have them at the end. **Note:** Do not belabor the acknowledgments and read off every person and/or funding agency unless there are just a few. Use funding agency icons rather than writing out their names.
  - Consider having an outline slide, though this may not be necessary for short talks.
- Introduction
  - The introduction to your presentation should **briefly** cover the basic background of your topic. Just give the audience the *minimal introduction* needed to understand the motivation for your talk. And focus on why the audience should care about your talk rather than exhaustively reviewing previous literature. Your introduction should be about 15% of your total talk time.

  - Citing literature in your introduction is acceptable, but keep it to a minimum and consider putting citations at the bottom of the slide instead of embedded in sentences (footnotes work well for this).
  - Include one or more slides with the research question and the specific hypotheses explicitly written out.

- Methods
  - The methods section also does not need to be exhaustive. The audience does not need to be able to replicate your work, just understand what you've done.
  - Include images or videos of the procedure.

- Results
  - The bulk of your presentation should focus on your results. Take your time carefully explaining your results.
  - Use graphs rather than tables when possible.
  - End subsections with summary slide.

- Discussion
  - Keep discussion relatively short. Start with overall summary of results. Next, discuss implications. Limitations are usually not necessary in a presentation, but they can be useful sometimes. Consider describing future directions. End the discussion with a *Take Away* slide that reiterates the 1-3 points that you want the audience to walk away with.
  - On the final slide, include all of your contact info: name, email address, social media handles. This is the slide that you leave on the screen when answering questions. You don't need a slide that says Thanks! or Questions?

Style

- Text
  - Limit the amount of text on a slide. There is no need to write in full sentences.
  - Use **LARGE**, readable fonts. All text should be at least 18 point and anything you actually want people to read should be at least 24 point.
  - Don't use red fonts. Ever.
  - Use abbreviations sparingly. People forget what abbreviations mean unless they are standard (e.g., DNA). Almost all abbreviations you might use **are not standard**, so don't use them. Unlike in a paper, if an audience member misses when you define an abbreviation, they cannot go back to find what it means.
  - Use consistent labels/words throughout the presentation.

- Figures
  - Make your graphs large, preferably 1-2 per slide. Use large fonts for the x and y axes and legend labels.

  - If you use color to distinguish data, use color-blind safe color palletes. Also, distinguish different data with different symbols or line types.
  - Use consistent sizes, aspect ratios, labels, and colors for graphs. If red and blue mean female and male in one graph, don't use them to mean Condition 1 and Condition 2 in another graph.

- Slides
  - Consider color-coding different hypotheses/topics in your talk.
  - If you are talking about your published work, put a citation of the work on the bottom of each slide that refers to the work.

The presenter

Audience

- Typically, you want to assume your audience is smart people who know nothing about your topic.
- Face your audience!
- Talk slowly and clearly and maintain a consistent volume that people in the back of the room can hear.
- Do not read your slide text.

Kick-off

- Do not start your talk by reading your title. Feel free to summarize what you're covering in different words, though (e.g., "Today, I'll talk about…").
- Practice what you'll say on your first slide. Otherwise, it can sometimes be awkward.

Slides

- Every time you have a new set of x and y axes on graphs, explain the axes. Consider starting with a blank graph to describe the axes and explain predictions before revealing the data.
- Do not put massive tables or graphs on a slide and say "I know you can't read this, but…". If the audience cannot read a table or graph, don't use it.

Extras

- If you're nervous and are using a laser pointer, use two hands to point the laser—it will steady the laser.
- If you're using a slide advancer, do not repeatedly apologize for pushing the wrong button. One apology is more than sufficient.
- Have a glass or bottle of water at the podium and don't be afraid to take a moment to take a drink.

- If you have technical difficulties and a video does not play or the presentation freezes. Do not apologize and get flustered. We've all experienced this. Simply work on trying to fix the technical problem.

Questions

- Defer to your host as to whether you field the questions or someone else does.
- Do not interrupt when someone is asking a question. Let them finish speaking before you start to answer.
- Repeat the question back to the questioner to make sure that you understood it and to ensure that others have heard it. If they ask multiple questions, feel free to ask them to repeat questions that you may have forgotten.
- Try to answer succinctly and pay attention if you start to ramble. Pay attention to how much time you have and shorten answers as you get closer to the end of your time.
- Feel free to ask if you have answered their question.

Resources

- Ten simple rules for short and swift presentations
- Ten simple rules for making good oral presentations
- How to give a great scientific talk
- How to give a good talk
- Ten secrets to giving a good scientific talk

9.3 How to give a poster

I prefer to use the #BetterPoster approach to posters, which greatly minimizes text and provides a single-sentence take-home message in huge font.

Things to think about before starting

- What will be the scope of this poster?
- Who is your audience?
- How much space do you have?
- Will posters be available for viewing when you are not there?

The structure

Title

- Write attention grabbing title.
- Use ENORMOUS, easy-to-read font.

Introduction

- Just a few bullet points offering the *essential* information needed to motivate your poster.
- If you want to include references, make them small.
- End with the Research Question or Hypothesis clearly labeled and set off in its own box.

Methods

- Just a few bullet points offering the *essential* information on your methods.
- Do not give details.
- Give examples when possible.
- Use images/graphics as much as possible.

Results

- This should primarily be large graphs.
- Add test statistics to graphs if desired.
- Use simple labels for axes.
- Use *HUGE* fonts for axes.
- Use large symbols and line widths.
- Consider including a summary statement of results for each graph or overall.

Discussion/Conclusion

- Just a few bullet points summarizing finds and giving implications, limitations, and/or future directions.

References cited

- Make this small font and out of the way.

Acknowledgments

- Acknowledge funders.

Contact info

- Make sure your email address is on the poster somewhere.
- Add a QR code for the paper or lab website.

Presenting the poster

- Practice a 1-minute elevator pitch that quickly describes what you've done. Don't be too detailed unless people ask questions.
- Assume people know nothing about your topic unless they say otherwise. You can ask if they know about your topic to start with, but don't assume any knowledge.
- Watch for feedback that people are getting bored or don't understand. If they're bored, get straight to the conclusions. If they don't understand, ask them if they're following what you're saying.
- Don't use jargon or abbreviations/acronyms. Speak simply using words everyone (i.e., non-experts) know.
- Make eye contact with your visitors. Don't just stare at the poster while talking. Use it as a reference rather than a crutch.
- Speak loudly and clearly, facing your visitors. It can be loud in a poster session, making it hard to hear presenters.
- Bring something to take notes on in case visitors have good questions/points that you want to remember. Also, they can write down their contact information if they want you to reach out or send a copy of the poster.
- Take breaks if you need to. Grab a drink or ask a peer to get you something if you don't have any breaks in visitors.
- Take some time at the end to go see other posters.
- Have fun!

Pro tips

- Keep presentation of hypotheses/research questions consistent throughout Methods, Results, and Discussion.
- Make sure your institution or lab names are clearly visible.
- Print a few color copies to hand out.

Resources

- Ten simple rules for a good poster presentation
- #BetterPoster approach

References

Hartley, James. 2004. "Current Findings from Research on Structured Abstracts." *Journal of the Medical Library Association* 92 (3): 368.

Hartley, James, and Matthew Sydes. 1997. "Are Structured Abstracts Easier to Read Than Traditional Ones?" *Journal of Research in Reading* 20 (2): 122–36. https://doi.org/10.1111/1467-9817.00025.

Maestre, Fernando T. 2019. "Ten Simple Rules Towards Healthier Research Labs." *PLOS Computational Biology* 15 (4): e1006914. https://doi.org/10.1371/journal.pcbi.1006914.

Mehr, Samuel. 2020. "How to... Write a Lab Handbook." *Biologist* 67 (2): 26–28.

Nosek, Brian A., Emorie D. Beck, Lorne Campbell, Jessica K. Flake, Tom E. Hardwicke, David T. Mellor, Anna E. van 't Veer, and Simine Vazire. 2019. "Preregistration Is Hard, and Worthwhile." *Trends in Cognitive Sciences* 23 (10): 815–18. https://doi.org/10.1016/j.tics.2019.07.009.

Wagenmakers, Eric-Jan. 2007. "A Practical Solution to the Pervasive Problems of p Values." *Psychonomic Bulletin & Review* 14 (5): 779–804. https://doi.org/10.3758/BF03194105.

Wagenmakers, Eric-Jan, Jonathon Love, Maarten Marsman, Tahira Jamil, Alexander Ly, Josine Verhagen, Ravi Selker, et al. 2018. "Bayesian Inference for Psychology. Part II: Example Applications with JASP." *Psychonomic Bulletin & Review* 25 (1): 58–76. https://doi.org/10.3758/s13423-017-1323-7.

Wickham, Hadley, and Garrett Grolemund. 2017. *R for Data Science*. O'Reilly Media.

Xie, Y, J J Allaire, and G Grolemund. 2018. *R Markdown: The Definitive Guide*. Chapman and Hall.