# Preparing Your Undergraduate Research Project

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**Bridgette Tonnsen, Ph.D.**

**Assistant Professor of Psychological Sciences, Purdue University**
**contact: btonnsen@purdue.edu**

This manual is intended for use by Dr. Tonnsen's undergraduate research assistants. We welcome opportunities to work with other groups interested in refining these procedures for broader use. For permission to modify and/or use this manual for other purposes, please contact Dr. Tonnsen (btonnsen@purdue.edu).

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## PLANNING YOUR PROJECT AND TEAM

All undergraduate students who are in the lab for both fall and spring semesters are required to be involved with a research project. Students joining the lab in the spring are required to start generating ideas for a research project, to be completed the following year. Students only involved in the fall will support a research team in the fall but may not be an author on the final product, depending on their involvement during the spring term.

### WHAT ARE THE DIFFERENT TYPES OF RESEARCH PROJECTS?

Research projects can take multiple forms:

**Team Project |** Most students initially complete a team project in the lab. The project is led by the "first author," an undergraduate student who has usually previously been involved in a team project. Sometimes, two students may co-lead a project as shared first author. Additional secondary authors on the team play supportive roles, including helping with conceptualization, analyses, drafting, and poster preparation.

**Individual Project |** Students who have been involved with at least one team project (usually as first author) may have the option of completing an individual project, pending approval by Dr. Tonnsen. Individual projects may also be completed to satisfy honors thesis requirements.

**Alternative Paper |** If a project is not making substantial progress, each member of the project may be required to instead write a paper on their topic. The paper is to be 10 pages, double spaced, and completed using APA formatting. Page limits do not include title page, abstract, or references. Papers must be completed independently and submitted by the last day of classes.

### WHAT WILL MY PROJECT BE ABOUT?

Generally, Dr. Tonnsen and the graduate students will suggest a number of broad project topics or datasets that are ready to be explored. It is the responsibility of the first author and his/her team to "hone in" on a research question that uses one of these datasets. Sometimes, undergraduate projects will focus on 2-3 specific research questions that relate to a broader study going on in the lab. For example, a graduate student may be conducting analyses on a longitudinal dataset of language development in infants and toddlers with a number of genetic syndromes. The undergraduate team may choose one language construct (or multiple) to examine across age in a smaller, cross-sectional group of children with one syndrome (versus multiple).

Less frequently, Dr. Tonnsen will agree for advanced students to design their own project. Students may, for example, apply for a summer research grant to code and analyze an unexplored video task. Or, they may design their own parent survey to launch via Qualtrics. Advanced students may design their own task or interview to supplement an ongoing study. This option is reserved for students whom have demonstrated their ability to lead and design a project. Most often, students have submitted a grant to fund their project and time.

### WHO WILL BE PART OF THE PROJECT?

All projects (even individual projects) involve multiple authors. In most psychology research, the **first author** is primarily responsible for the research study design, analyses, result interpretation, and dissemination. If your project is a poster, the first author physically presents the poster at the conference, sometimes with secondary authors standing by to help answer questions. First author presentations and papers are generally viewed most favorably by people evaluating your CV. **Secondary authors** contribute meaningfully to the project (e.g. via writing, running analyses, cleaning data, helping create poster) but do not lead the team or present the final

results. The **senior author** is generally the person responsible for overseeing your project. Your senior author will be either a graduate student or Dr. Tonnsen.

## HOW WILL I DISSEMINATE MY RESEARCH?

Projects can be disseminated (shared with the scientific community) as presentations or publications, generally through one of four ways:

**Presentation at Undergraduate Research Conference (URC) |** Students may present research as either a *poster* or a *conference talk* at an undergraduate research conference. Several conferences are held each year at Purdue, and students may also choose to present their research at regional, national, or even international undergraduate-focused conferences. Travel grants are available to reduce costs of attending a conference. URC's are student-friendly learning experiences designed to help you "get your feet wet" presenting your research. Some even offer cash prizes for the best presentations!

**Publication at an Undergraduate Research Journal** | Advanced students may submit their research projects for publication at an undergraduate-focused research journal. This option is generally best suited for a student who has already presented their project at a conference. Writing up a manuscript for publication (after presenting at a conference) generally takes two additional semesters and extra lab time, so students should only choose this option if they are interested in an intensive writing experience. Consult with Dr. Tonnsen if you are interested in this option.

**Presentation at Mainstream Research Conferences |** Some projects may be suitable for presentation at "mainstream" research conferences that are frequented by graduate students and faculty. Many conferences have specific travel grants and activities for undergraduates.

**Sub-Piece of a Larger Presentation or Publication |** Often times, undergraduate students are engaged in research that complements a larger or broader research project being prepared in the lab. In some instances, students may earn secondary authorship by contributing their work to a larger presentation or even publication. Although being involved in broader dissemination projects is valuable for professional development, contributing to a larger presentation/publication does not satisfy the research project requirement for PSY 390000, as the undergraduate student is not independently designing and completing a research project and is almost always taking a secondary role to other team members.

## HOW DO I PAY FOR CONFERENCE TRAVEL?

You are not required to travel to present your research at regional or national conferences. However, traveling to a conference can be an incredible experience for undergraduate students: you can gain public speaking skills, learn more about research projects in your field, and network with collaborators or potential graduate schools. Notably, though, conference travel comes at a cost. You may have to pay a registration fee to attend a conference, and additional fees related to traveling (mileage, meals, flights, Ubers) may add up. To offset these costs, Purdue has several scholarships and travel grants available for students. Similarly, conferences and prospective organizations often have travel scholarships available.

In some years, Dr. Tonnsen will have funds available to supplement travel. It is expected that if students ask for lab funds, two conditions have been satisfied. First, students must plan reasonable accommodations and travel plans, including by sharing hotel rooms with other students (up to 3-4 same sex students per room), carpooling, and selecting budget-friendly flights. Second, students must have applied for travel funding by at least two other sources before asking for lab funds. Thus, not all students should need to use their funding in any given year. Notably, Dr. Tonnsen is not going to direct your trip: you are responsible for securing and managing funds, booking your travel, and applying for reimbursements. As a paid representative of Purdue, you are expected to attend nearly all conference events (e.g. should not be exploring the city during major keynotes) and act and dress professionally at all times.

For the 2018-19 school year, up to $100 per student is available for any poster author who has been engaged in the lab for at least two semesters to engage in conference travel, and a $200 supplement is available for

project leaders who would like to attend a non-regional OR non-undergraduate research conference. Additional funding may be available on an individual basis.

## HOW MUCH TIME WILL MY PROJECT TAKE TO COMPLETE?

Your project will take far more time than you may think, so please plan ahead! Your timeline is critical to staying on track and "keeping pace." Across the semester, **students may devote up to 20 hours of lab time each semester toward working on their research project in the lab** (assuming 9 hours per week of weekly lab duties, or 3 credit hours). No more than 4 hours can be devoted toward the project in any given week to ensure the lab can "keep the doors open" as deadlines approach. This amount is prorated for students completing fewer credit hours. The 20 hour guideline should be sufficient for a team member who is proactive about their time, collaborates with their peers to meet deadlines (e.g. divides tasks rather than exclusively working together), and works efficiently. Students should always complete their regular, time-sensitive lab responsibilities prior to working on their projects, except in extenuating circumstances. Of course, if students have already completed 20 hours but find they have leftover time in the lab (and have ensured no supervisors need support with any new tasks), they should continue devoting any unspent hours toward research activities.

Please note that as deadlines approach, first authors may need to spend extra time on their projects, given they are ultimately responsible for making sure the project is completed. This possibility should be considered prior to signing up for a first-author research presentation.

## WHAT ARE MY DEADLINES?

At the onset of the project, teams will fill out a Project Completion Timeline, which includes guidelines for establishing major deadlines. Students may proactively change these deadlines by contacting their supervisor in advance. However, deadlines should not be adjusted retrospectively (e.g. because students lost track of time, procrastinated).

## HOW WILL MY GRADE BE DETERMINED?

Your project effort will be considered when you are assigned a final grade for your laboratory course. Your final grade also takes into account your general laboratory activities and professionalism, per the syllabus. All grades are assigned by Dr. Tonnsen. Graduate student supervisors may provide input about your performance but have no direct responsibility over student grades.

**Remediation for Teams |** Teams will adhere to their approved timeline, which will be established each fall. If a team misses more than two deadlines (see worksheet), they may be asked to complete the alternate writing assignment instead. As long as the circumstances causing the team to be placed on an alternate assignment are not driven by lack of effort (e.g. there is a problem with the data, someone becomes ill), team members may still be eligible to receive an "A" in the course, pending satisfactory completion of the paper and all other requirements. These decisions will be made on a case-by-case basis.

**Remediation for Individuals |** Students who are not making sufficient progress (e.g. not meeting deadlines, failing to respond to team members) will be provided two warnings, which will each involve a one-on-one meeting with Dr. Tonnsen in which the student will develop a remediation plan. If the student fails to complete the remediation plan after both warnings, he or she will be removed from the team project. To receive a grade in the course, they must complete the alternate paper assignment for a maximum semester grade of a "B." Any evidence of plagiarism or data falsification for any student may result in an immediate grade of "F."

**Getting Support for Rogue Team Members |** If someone on your team is not contributing appropriately, please send an e-mail to your graduate student supervisor or Dr. Tonnsen immediately. You may also request to meet with the graduate student or Dr. Tonnsen in person to talk about your concerns. It is most helpful if you have specific documentation supporting your concern (e.g. three consecutive failed responses to emails). Of course, we expect that all students will approach potential conflicts with professionalism and an open mind.

**Supervision Conflicts |** If your project involves a supervisor other than Dr. Tonnsen, contact Dr. Tonnsen to discuss any issues with supervision. If you have concerns about Dr. Tonnsen's supervision, contact the Director of Undergraduate Studies (listed on Psychology Department web site). Our lab conducts anonymous Qualrics surveys each semester with all students to solicit feedback and suggestions for future improvement.

### WHAT WILL I LEARN?

This project is designed to be an active, hands-on learning experience. As such, the following reactions should be considered completely normal:

- "I love this!"
- "I hate this."
- "I am horrible at statistics."
- "I have no idea what I am doing."
- "I am terrified of presenting this thing."
- "None of my findings are even significant."
- "I am so excited that my roommates are sick of hearing me talk about this project."
- "We are never going to pull this thing off."
- "I'm usually a top student, but this stuff is hard!"

Students' reactions to the research process may help them discern a future in research. For example, a student who despises cleaning and analyzing data may decide he or she doesn't want to pursue a research-heavy PhD in clinical psychology. On the flip side, a student who previously had no research experience may enjoy diving into data, and having been "bit by the research bug," decide to shift their future training goals to align with a post-graduation research career. Whether you love research or hate it – figuring out your reactions to the process now can be invaluable in your future career goals. So, if you learn from your research project that you never want to do research again… you have successfully learned from this academic exercise!

You may also find that you learn about your strengths and learning needs as related to teamwork. Being part of a research team can be an intellectually stimulating, but also sometimes stressful, experience. Now is the time to practice modeling a professional, collaborative work environment. Your graduate student supervisors and Dr. Tonnsen are available to help you navigate any new situations that come up in team-based research.

## ESTABLISHING A TIMELINE

Students' #1 problem in completing their projects is often failure to establish and adhere to a timeline. Each stage of the research project can include unexpected twists and turns that can divert a team's attention and time. As a result, the team often begins submitting drafts and products last minute, and the quality of those drafts rapidly deteriorates. Sticking to a schedule is very important. This guide includes a list of tasks that should take approximately 12 weeks to complete (e.g. one academic semester, including breaks). Your group is responsible for outlining your timeline for completing this timeline in advance. Please note that phases often overlap, and some may take less/more time than anticipated. Your team may adjust your timeline in advance by emailing your supervisor before the first missed deadline. However, adjusting the timeline retrospectively (e.g. due to missing a deadline) constitutes a "missed deadline" and may result in remediation, as outlined previously.

### FALL SEMESTER (12 WEEKS)

**Planning your project and team (2 weeks)** | Students will meet as a team to discuss broad interest areas and leadership preferences. By the end of this phase, the team should have established (1) which variables or constructs will be the primary focus of the project, and (2) who will take the primary lead of the project.

**Getting to know your data (2 weeks)** | Students will get to know which variables and constructs are available to be analyzed. They may be provided with a dataset and codebook, or they may have the option of choosing from a list of datasets available in the lab. By the end of this phase, the team should have opened the dataset and learned what different variables and scores mean. If they are studying a specific measure, they should look at an actual copy of the measure (and maybe fill it out yourself!) to understand its contents/layout. They will also read the measure manual and any other relevant within-lab documents that describe how the measure is being used (e.g. lab procedure manuals, grants, prior papers, manuscript drafts). For task-based variables, the team may watch old assessment videos or observe live sessions. During this phase, the team should also learn about

which participants are in the dataset. What are the ages and diagnoses in your sample? Does each child have one observation/assessment or multiple? Where did the data originate?

**Getting to know the literature (2 weeks)** | Now comes the fun part – figuring out what has been done, and more importantly, what is left to do. During this phase, students will explore their construct in the previous literature. The goal of this phase is to determine (1) what is the "state of the science" regarding this topic – what facts are already "public knowledge," and (2) where are the gaps – what questions remain unexplored and unanswered. Ideally, these questions will become the foundation of the team's research question. During this phase, students should keep an annotated bibliography of previous studies they review. For team projects, students may choose to work together to share their annotated citations, creating a "library" of relevant research projects. By the end of this phase, students will have pooled their research into one annotated bibliography (10-15 citations) and identified a critical "gap" they would like to fill with their research project.

**Designing your study (4 weeks)** | It's time for science! During this phase, students begin to design a research project that will address the core gap in the literature they have identified. This phase has multiple sub-phases, including establishing research questions, generating hypotheses, creating an analytic plan, and running preliminary descriptive statistics. The laboratory will plan at least one workshop to support students in developing their analytic plan, with additional support as needed. By the end of this phase, students will have completed a detailed study planning and statistics worksheet ("Analytic Plan") as well as a 300-word abstract using the supplied template. The abstract should undergo at least one revision (e.g. submit to supervisor, receive edits, integrate edits, resubmit to supervisor) to be considered "complete."

**Planning for dissemination (1 week)** | During this phase, students will start establishing a plan for where they would like to present their project. Although teams will have ideally completed analyses and results prior to applying to present, the rapid nature of research sometimes requires submitting an abstract prior to the study being completed (a completely acceptable practice for undergraduate research conferences that becomes less acceptable for larger field conferences). By the end of this phase, teams will have established 1-2 "outlets" for your research. Teams will have also established a timeline for submitting projects, as well as a budget and plan for covering travel costs, if applicable.

## SPRING SEMESTER (11-12 WEEKS; ADJUST TO PRESENTATION DEADLINES)

**Creating a presentation template (1 week)** | Students will create a template for their final presentation, which most often involves a poster created in Powerpoint. By the end of this phase, your team will have familiarized themselves with the poster guidelines for their intended outlet (often published on the conference web site), looked over previous templates from the lab, and created a "mock up" of their desired poster design. Teams will fill in this template over the course of the semester. Teams will also outline logistics of their presentation.

**Learning about statistical software (1 week) |** Students should plan to spend at least one week simply orienting to statistical software (most often SPSS). Specific activities are included in this manual. By the end of this phase, your team will have read tutorials and watched videos about your software program and any planned analytic techniques.

**Pre-registering your hypotheses and analytic plan (2-3 weeks) |** Leveraging the hard work you completed during the fall semester, your team will take a "deep dive" into your hypotheses and analyses, finalizing your plan for how to complete your project across the rest of the semester. By the end of this phase, your team will have completed a statistical plan / pre-registration worksheet, which draws heavily from past steps you have completed in this manual.

**Running and refining your analyses (2-3 weeks) |** Often the most daunting phase for novel researchers, teams will now run their planned analyses. Steps of this process often include opening the dataset in the statistical software, generating primary analyses, interpreting primary analyses, and conducting any follow-up analyses necessary to solidify the research storyline. Teams will also generate tables and figures that help organize and clarify findings. By the end of this phase, the team will written a results section that describes key findings, as well as generated core tables and figures that depict primary effects.

**Crafting your poster/presentation (3 weeks) |** At this point, your team will begin to craft your poster or presentation, including the introduction, methods, results, discussion, and references. By the end of this phase, you will have created a complete poster draft for evaluation by your supervisor and Dr. Tonnsen. You will check your poster for completeness using the enclosed checklist.

**Preparing to present (2-3 weeks) |** Now it is time to start learning how to present your research – and setting aside time to practice, practice, practice! You will attend meetings about presentation "tips and tricks," present your poster to your team mates, and practice presenting the poster within the lab. By the end of this phase, you will have completed multiple rounds of practice presentations, as outlined in this guide. You will also present your poster (don't forget to take a picture!).

**Final documentation check-in |** You will close out your presentation by uploading your final documents and feedback, as outlined in this guide. You will also have the opportunity to provide anonymous feedback about your experience through a separate Qualtrics survey that will be distributed toward the end of the semester.

# FALL SEMESTER ACTIVITIES

## Fall semester planning. Date Submitted:

**Instructions:** Complete the following planning guide in conjunction with your team and supervisor.

**Topic:**

**Lead(s):**

**Team Members:**

**Supervisor(s):**

**Biweekly meeting time:**

**Timeline:**

Your team will complete the following sections this semester. Each section includes a "check in" section that is to be completed on the following pages. Continuously save your updated workbook on the share drive where your supervisor and/or Dr. Tonnsen can monitor progress.

| FALL SEMESTER | DUE | COMPLETED |
|---|---|---|
| **Planning your project and team (2 weeks)** | | |
| Look at previous presentations stored on the share drive. | | |
| Send check-in to supervisor. | | |
| **Getting to know your data (2 weeks)** | | |
| Meet as team to look through dataset with supervisor | | |
| View relevant materials, including: literature on syndrome medications, literature on syndromes themselves, the data set and prevalent medications used | | |
| Send check-in to supervisor | | |
| **Getting to know the literature (2 weeks)** | | |
| Develop plan for compiling annotated bibliography as a team | | |
| Complete annotated bibliography with 10-15 references | | |
| Complete check-in worksheet and send to supervisor | | |
| **Designing your study (4 weeks)** | | |
| Meet with your supervisor to develop your research questions and discuss hypotheses. Summarize in your check-in section | | |
| Fill out the analyses and statistics worksheet | | |
| Meet as group to complete your preliminary descriptive statistics. | | |
| Create your 300-word abstract that will be subsequently modified for conference submissions | | |
| **Plan for dissemination (1 week)** | | |
| Meet as a team to identify potential plans for conference dissemination and fill in check-in | | |
| Send final check-in to your supervisor. | | |

## Planning your project and team.

Date Submitted:

**Instructions:** Describe your team's broad interests in 2-3 sentences.

## Getting to know your data.

Date Submitted:

**Instructions:** Answer the following prompts with 1-2 sentences each.

- Describe the core measure(s) or methods used in your dataset.
- Who are the participants in your dataset?
- What are the core demographic (age, sex) characteristics of your participants?
- What questions do you have about your data?

## Getting to know the literature.

Date Submitted:

**Instructions:** Insert annotated bibliography here (10-15 sources).

## Designing your study.

Date Submitted:

**Instructions:** Complete each section of the Analytic Plan Worksheet, repeating sections as needed until you have outlined your primary analyses necessary for your abstract.

# Analytic Plan Worksheet

**Choose Variables |** For the first step of your analytic plan, list any variables you might be interested in studying. Think about variables you are primarily focused on (e.g. those that measure your major construct of interest), as well as variables that may affect how you interpret your construct of interest (e.g. age, sex). Choose at least one categorical variable and one scalar variable.

| Category Type | Categorical Variables | | Scalar Variables | |
|---|---|---|---|---|
| | **Nominal** | **Ordinal*** | **Discrete*** | **Continuous** |
| **Definition** | Variables with no meaningful order | Variables that are ordered but do not have a "true" value. | Integer variables that are inherently meaningful | Variables that can assume any value |
| **Examples** | Sex, syndrome group, autism diagnosis, whether a person endorsed YES or NO | Response to a single Likert-scale item (e.g. "how satisfied were you?") | Number of depressive symptoms, number of services | Age, height, minutes of therapy per week, CGG repeat length |
| **Variables:** | | | | |

***When deciding whether a variable is ordinal or discrete, a helpful litmus test can be to ask yourself whether the number three is inherently meaningful. If someone responds "3" to a Likert item, we do not necessarily know what 3 means. However, 3 depressive symptoms or 3 special education services is inherently interpretable.

**Brainstorm Research Questions |** Next, you will brainstorm some different research questions that integrate different categories of variables. For now, restrict each question to **TWO** variables that could be examined in a cross-sectional dataset (e.g. a dataset with one observation per participant).

| | Categorical | Scalar |
|---|---|---|
| **Categorical** | **My Example:** How does the likelihood that a child is diagnosed with autism by age 5 differ across syndrome groups?<br><br>**Your Example:** | **My Example:** How do repetitive behavior severity scores differ across sex within Angelman syndrome?<br><br>**Your Example:** |
| **Scalar** | **My Example:** How does the likelihood that a child is diagnosed with autism by age 5 differ according to autism symptom severity?<br><br>**Your Example:** | **My Example:** How does severity of autism symptoms vary across age?<br><br>**Your Example:** |

**Choose a Primary Question (For Now) |** In the space below, write the primary question you would like to address in your analyses. You can add details and/or context to your question in later steps, but for now, stick to two variables (can be any combination of categorical and/or scalar). Circle your two primary variables.

**Question:**

For most research designs, you will have an independent variable (IV) that is manipulated, varied, or controlled, and a dependent variable (DV) that you measure as an outcome or endproduct. This terminology is geared toward experimental and/or predictive designs. If your research question fits these designs, label your IV and DV in your research question above.

**Reduce your Dataset |** Most laboratory projects use datasets that are much larger than needed. Sometimes, we use terms such as "long" and "wide" to describe our data. The "length" of our dataset generally refers to rows, whereas the "width" refers to columns. For most of our measures, each row includes a different observation or assessment. These assessments are differentiated by their "assessment ID" (AsmtID). Notably, because our studies are longitudinal, many participants can have more than one assessment in a dataset. So, you will often see the same participant ID (ChildID) more than once. Here, we will talk about how to reduce your dataset to include the rows and columns most important to your analyses.

This worksheet assumes that if your data originated from more than one database, you are currently working with a "merged" file. In other words, each AsmtID is on a separate row, and no AsmtID appears twice. If your database includes more than one measure, the variables from each measure should appear next to each other in the header row. Double check you are using one merged dataset before proceeding. If you need help creating a merged dataset, talk to your supervisor.

| | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Gender | Study | ChildID | Age | AsmtID | cbcl56a | cbcl11 | cbcl_help | cbcl49 | cbcl14 |
| 2 | M | EPS-AS | 1071 | 33 | 1071_1 | 0 | 1 | 0 | 1 | |
| 3 | M | EPS-AS | 1101 | 20 | 1101_2 | 0 | | | 0 | |
| 4 | M | EPS-AS | 1111 | 46 | 1111_4 | 0 | | | 0 | |
| 5 | M | EPS-AS | 1111 | 34 | 1111_3 | 0 | 0 | 0 | 0 | |
| 6 | M | EPS-AS | 1111 | 28 | 1111_2 | 0 | 0 | 0 | 0 | |
| 7 | M | EPS-AS | 1111 | 22 | 1111_1 | 0 | 0 | 0 | 1 | |
| 8 | F | EPS-AS | 1121 | 38 | 1121_2 | 0 | 0 | 1 | 0 | |
| 9 | F | EPS-AS | 1121 | 27 | 1121_1 | 0 | 0 | 0 | 1 | |
| 10 | M | EPS-AS | 1131 | 45 | 1131_1 | 0 | 0 | 1 | 1 | |
| 11 | M | EPS-AS | 1131 | 69 | 1131_3 | 0 | 0 | 1 | 1 | |
| 12 | M | EPS-AS | 1151 | 42 | 1151_4 | | | | 2 | |
| 13 | M | EPS-AS | 1151 | 30 | 1151_3 | | | | 2 | |
| 14 | M | EPS-AS | 1151 | 24 | 1151_2 | | | | 2 | |

Variable

Three assessments from ChildID 1151 at ages 24, 30 and 42

Your original dataset will include a lot of extra width and length. Before you summarize your dataset, it will be helpful to "trim" these excess pieces. Remember, you should **never** work with an original dataset – you should always be manipulating a dataset that has been copied and pasted into your independent project folder.

**Longitudinal → Cross Sectional.** Unless your study is longitudinal, you will need to remove multiple observations so that each ChildID is only represented once. Most of the time, the first step is to prioritize the assessment with complete data. In other words, if you are interested in the CBCL and the child was only administered the CBCL at two of his four assessments, you will start by deleting the assessments where the CBCL was not administered. Next, you will need to choose between assessments with available data. Sometimes, there is a theoretical reason to choose either the earliest assessment or latest assessment. Other times, the "fairest" way to proceed is to choose an assessment randomly. You can do this by adding a column to your dataset and generating a random number by typing =RAND() into a cell, then systematically choosing the participant's row with highest (or lowest) random number.

**Restricting the Range.** Sometimes you will also want to restrict the range of your dataset. You may choose a specific age range, a specific sex, or a specific subset of clinical groups. **Note:** If your design involves multiple groups, you may also need to "match" the groups by age, sex, or another variable. For example, if you are comparing children with Prader Willi versus Angelman and the age ranges are 13-60 months and 4-24 months, respectively, you may restrict all groups to be 13-24 months. Talk to your supervisor about how best to match.

**Reducing Variables.** For your own sanity, you will also want to reduce the number of columns on your data to focus on variables involved in the analyses. Always retain Gender, Study, ChildID, Age, and AsmtID. However, any other variables can be deleted if they are not of use to you.

**Below, summarize the steps you will use to initially trim your data. You will likely adjust this plan as you work on your analytic plan and identify patterns in your data.**

**Next, describe what your dataset should look like before and after trimming**

| | Before Trimming | After Trimming |
|---|---|---|
| Number of observations (rows) | | |
| Clinical groups included | | |
| Clinical groups excluded | n/a | |
| Number of AsmtID per ChildID (usually one unless longitudinal) | | |
| Age range | | |
| Final columns | n/a | Gender, Study, ChildID, Age, and AsmtID (list others): |

**Deconstruct your Variables |** Next, we will focus on your individual variables that you plan to analyze. For each variable, list the database/measure where your variable is located, the variable type, and the possible as well as the range of possible values you could observe in your dataset. If you have "trimmed" the range of values in your dataset, use the currently trimmed ranges. Finally, look at each column from start to finish, and calculate the proportion of cells in that column with missing data (e.g. the cell may be blank or contain a ".").

| | Sample | Variable 1 | Variable 2 |
|---|---|---|---|
| **Construct** layman's term for what variable measures | Child Age | | |
| **Variable Name** dataset column name | Childage | | |
| **Original Source** dataset or measure | Demographics | | |
| **Variable Type** | Continuous | | |
| **Range in Dataset** scalar only | 3-60 | | |
| **Possible Values** categorical only | n/a | | |
| **Missing Data %** | 0% | | |

**(1) How many participants have complete data on both variables?** In other words, if you are interested in looking at autism symptoms and sex, how many participants in your dataset have values listed for both?

**(2) How many participants have incomplete data on either main variables?** In other words, how many participants in your dataset are missing at least one variable?

If your dataset includes missing data, think about whether you can sample other observations from you participants instead of the observations with missing data. If no other data are available, you can either (1) keep participants in your dataset or (2) remove the participants from your dataset. There are also some more complex options, such as imputing missing data, but we will not use those methods here. Talk to your supervisor about how to handle missing data.

**Describe your final sample |** Write 1-2 sentences about your sample. These sentences should be similar to what you would write in the "Participants" or "Methods" sections of a journal article or poster abstract.

**Example:** "Participants included 109 children with WS (n=50), AS (n=40), and TD (n=19) who completed both the CBCL and IBQ-R between 7-18 months of age. When multiple observations were available, we took participant's earliest observation given our focus on early features of problem behaviors in these groups.

**Write your sentence here:**

If there is missing data, add a sentence about how you addressed missing data. Here are some examples.

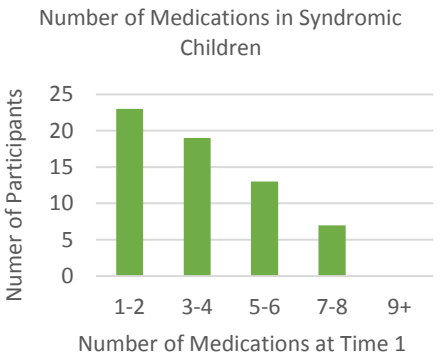
**Example 1 (Participants Excluded):** Fifteen additional children completed PEPS in this age range but were excluded because they had incomplete IBQ-R data. These participants are not depicted in figures and tables and are not discussed further.

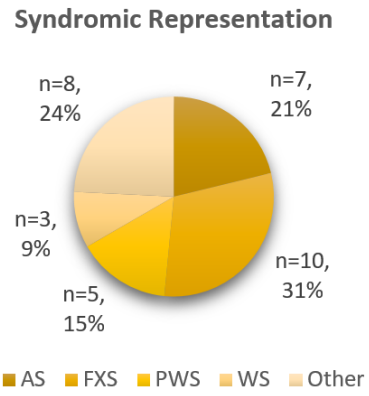
**Example 2 (Missing Data Retained):** Out of these 109 children, 2 children with WS and 1 TD control were missing data for at least one variable of interest.

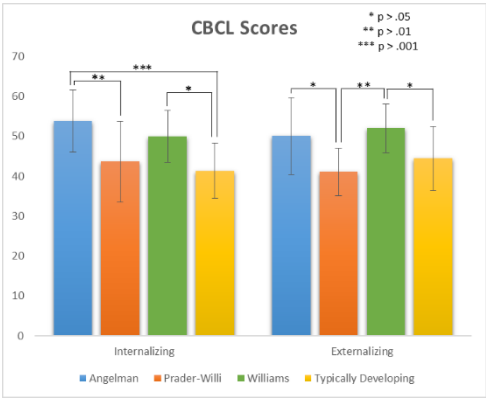
**Describe your missing data here:**

**Plot Each Individual Variable |** For each variable, your next step will be to plot your data. These plots can each be constructed in Excel. Your plot will help you understand the "shape" of your data, spot any errors or inconsistencies (e.g. a value of "7" when the scale should be 1-5), and determine next steps for analyses. For **scalar variables**, you will create a **histogram** of your data. A histogram shows the relative frequency of each potential "bin" of values. For **categorical variables,** you will make a **pie chart** (if looking at proportions of a whole) or **bar chart** (if looking at relative frequency of different responses)

| Histogram | Pie Chart | Bar Graph |
|---|---|---|



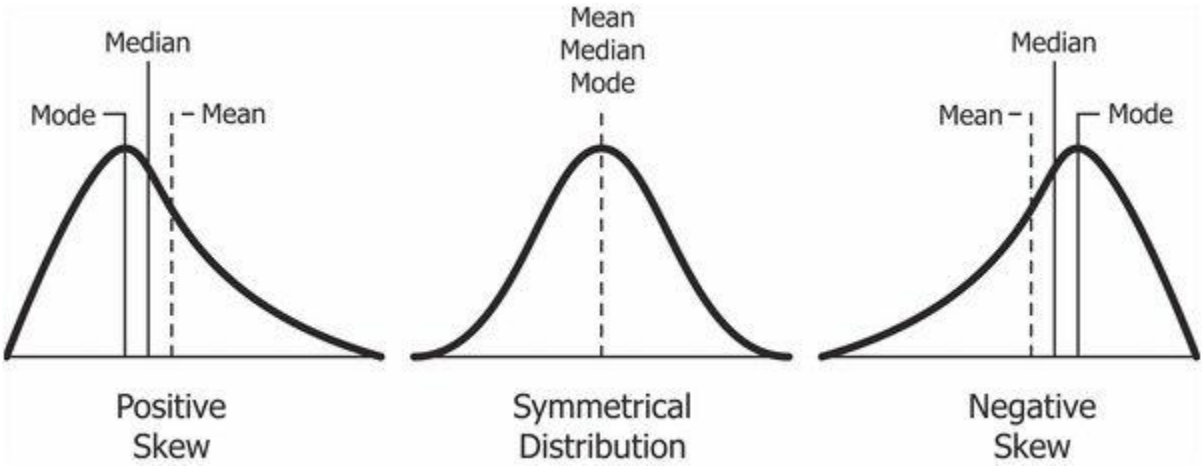




Bar charts and pie charts are relatively straightforward to create in Excel (Google tutorials as needed!). However, histograms can be a bit trickier. A histogram plots the frequency of responses across "bins." For example, if the range of a measure is 30-90, the histogram may plot the number of responses that fall between 30-39, 40-49, 50-59, … resulting in 6 vertical bars. So, you can create a histogram by dividing the range of your data by 10, recoding responses by which bin they fall into (e.g. 1, 2, 3, 4 .. 10), and then graphing the frequency of responses by bin. Another option is to use SPSS or SAS to create your histogram. Here is a tutorial for SPSS. The "Option 2: GRAPH" section describes how to create a histogram using a point-and-click interface: https://www.spss-tutorials.com/creating-histograms-in-spss/

**Copy and paste your graphical depiction of your two variables here:**

**Are Variables Normally Distributed? |** Now that you have plotted your data, you will want to pay attention to how the data are distributed. For categorical variables, you will want to pay attention to whether there are similar numbers of responses in each category (e.g. are the number of males similar to the number of females). For continuous variables, you will want to pay attention to whether the "shape" of your data are normally distributed. Normal distribution means that your data roughly follow a "bell curve," where the most frequent responses cluster around a mean, with less frequent responses as values deviate from the mean.

Here is what a normal distribution looks (middle) compared to a skewed distribution (left and right panels). As you can see, when the distribution is symmetrical/normal, the mean, median, and mode are similar. For skewed distributions, these different metrics vary. Determining whether your variable is normally distributed will help you later decide how to analyze your data.




From https://www.quora.com/What-does-SKEWED-DISTRIBUTION-mean

**Describe the distribution for each of your variables.** For categorical variables, comment on the relative sizes of each category or bin. For continuous variables, comment on whether your data look normally distributed, or whether there seems to be some skew.

**Consider Transforming Variables |** Sometimes, you can transform a variable to make it more normally distributed. There are various types of transformations that might help. Talk with your supervisor about whether transforming your data makes sense, or whether it is better to use a statistical test that does not require normally distributed data. You can read more about data transformation here:

http://abacus.bates.edu/~ganderso/biology/bio270/homework_files/Data_Transformation.pdf

**Look for errors |** Now is a good time to look through your dataset for any obvious errors and/or broader issues that need addressed (e.g. groups are uneven sizes, one participant has an implausible score, one participant has a plausible score however it is far higher/lower than typical scores for that group [outlier], etc.). Adjust your dataset accordingly. Make sure you document any changes to your dataset below so you can remember these changes later:

**Changes to dataset** (ex: “Participant 1511 had wrong age listed, adjusted in dataset and notified WSN” or “Raw score for PSI #6 was out of possible range for Participant 2226).

**Calculate Descriptive Statistics |** Once you have a clean dataset, it is time to start describing your data. Descriptive statistics will help you understand the general patterns of your data. Create a nicely formatted table that provides the following basic statistics:

**Continuous variables:** mean, median, standard deviation, min, max

**Ordinal variables:** median, min, max

**Nominal variables:** mode, % each response

**Decide on a Statistical Method |** Now that you have developed a better sense of your data, it is time to decide how to statistically address your research question. The following table will help you decide which test best fits the type and shape of your data.

| Dependent Variable | Independent Variable | Parametric | Non-Parametric |
|---|---|---|---|
| Scalar | Nominal (2 categories) | Independent T-Test | Mann-Whitney Test<br>Wilcoxon Rank Sum |
| Scalar | Nominal (2+ categories) | One-Way ANOVA | Kruskal-Wallis Test |
| Scalar | Scalar | Pearson's Correlation | Spearman's Correlation |
| Scalar | Any | Linear Regression | NONE (Transform) |
| Nominal (2 categories) | Any | Logistic Regression | NONE (Transform) |
| Categorical | Categorical | Chi-Squared | Fisher's Exact Test |

**Which statistical test best fits your data?** Look up and view one web-based video or written tutorial on how to conduct the statistical test. **Provide a link to your tutorial here.** If you're feeling brave, try it out! You will learn more about statistical software and conducting your analyses next semester.

**Add Complexity, If Needed |** Sometimes, two variables cannot tell the full story. For example, you may wonder how the association between autism symptoms and age (Scalar x Scalar example above) differs according to syndrome group. For example, this association may differ in boys and girls. **Are there any moderators that might influence and/or explain the associations you discovered? List these variables here.**

Talk with your supervisor about how to expand your analyses to account for these variables. We will provide additional training on covariates and multivariate statistical tests in future sessions.

**Start Drafting an Abstract |** For the purposes of your project, your next step will be to draft a 300-word abstract that describes your study. Your abstract must include the following sections: Introduction, Research Questions, Hypotheses, Methods, Analytic Plan, Anticipated Impact. This abstract will be the foundation for your conference submission next semester.

In graduate school and beyond, most abstracts will include your fully analyzed data. However, as an undergraduate, it is perfectly fine to create abstracts that describe your data (e.g. "Average PSI Total Scores were in the "clinical" range for X% of participants. Our final analyses will use Fisher's exact tests to determine whether the proportion of "clinical" scores differs between AS and WS."). Of course, if you have the chance to integrate inferential statistics into your abstract, this added step will only make your abstract stronger!

Below, draft a first pass at your 300-word abstract. After this pass, send your abstract to your supervisor and Dr. Tonnsen for feedback. Then, use their feedback to draft a second abstract below. Leave both abstracts in this document so you (and we) can see your project progress!

**First Draft of 300-Word Abstract:**

**Title:**

**Authors:** (Place a * by first authors, and be sure to list your supervisors and Dr. Tonnsen)

**Introduction:**

**Research Questions:**

**Hypotheses:**

**Methods:**

**Analytic Plan:** (Integrate descriptive statistics and/or results here, as available)

**Anticipated Impact:** (Add a sentence about why your study matters beyond this project)

**Second Draft of 300-Word Abstract:**

**Resources:**

**Geert van den Berg, R. (2018). *Creating histograms in SPSS*. Retrieved from https://www.spss-tutorials.com/creating-histograms-in-spss/**

http://abacus.bates.edu/~ganderso/biology/bio270/homework_files/Data_Transformation.pdf

## Planning for dissemination.

Date Submitted:

**Instructions:** Write out your plan for disseminating your project. If your plan involves conference deadlines and/or travel, outline a timeline for submitting and planning the trip. If your dissemination plan requires funding, review lab policies for conference travel (see previous sections) and provide a detailed budget and funding plan here. For example, include total anticipated costs and your plan for covering those costs, including requesting lab funding if applicable. Once you have completed your plan, email this completed workbook to both your supervisor and Dr. Tonnsen. All workbooks must be submitted before the first day of final exams for full credit.

# SPRING SEMESTER ACTIVITIES

## Spring semester planning. Date Submitted:

**Instructions:** Complete the following planning guide in conjunction with your team and supervisor.

**Topic:**

**Lead(s):**

**Team Members:**

**Supervisor(s):**

**Biweekly meeting time:**

**Timeline:**

Your team will complete the following sections this semester. Each section includes a "check in" section that is to be completed on the following pages. Continuously save your updated workbook on the share drive where your supervisor and/or Dr. Tonnsen can monitor progress.

| SPRING SEMESTER | DUE | COMPLETED |
|---|---|---|
| **Creating a presentation template (1 week)** | | |
| Determine key formatting requirements set by conference | | |
| Create "mock-up" template to be filled in during semester | | |
| Send check-in to supervisor | | |
| **Learning about statistical software (1 week)** | | |
| Complete statistical software learning plan | | |
| Complete independent learning activities outlined in your plan | | |
| Send check-in to supervisor | | |
| Meet with supervisor to talk about plan | | |
| **Pre-registering your hypotheses and analytic plan (2 weeks)** | | |
| Complete statistical plan pre-registration worksheet | | |
| Send check-in to supervisor | | |
| Meet with supervisor to go over plan | | |
| **Running and refining your analyses (2-3 weeks)** | | |
| Run your initial analyses and write up results | | |
| Meet with supervisor to determine next steps | | |
| Complete secondary analyses | | |
| Send check-in to supervisor | | |
| **Crafting your poster/presentation (3 weeks)** | | |
| Create leadership plan for presentation | | |
| Complete first full draft of presentation | | |
| Send final check-in to your supervisor | | |
| **Preparing to present (2 weeks)** | | |
| Fill out and complete steps of practice checklist | | |
| Send check-in to your supervisor | | |
| **Final documentation check-in** | | |

## Creating a presentation template. Date Submitted:

**Instructions:** Summarize the key formatting requirements for your presentation below. Review sample posters from past conferences in the "Posters and Presentations" dissemination folder on the shared drive. Create a new folder with your conference name and date (e.g. "Butler Conference 2018"). You will store your final dataset, syntax, abstract and poster in this folder. Do not use this poster to store drafts or outdated versions of your project – this folder is reserved for final documents so that we can easily trace how the final presentations were constructed (e.g. in case we have questions a few years later about an effect or procedure).

**When is your abstract due?**

**What are the formatting details for the abstract?**

**How do you submit your abstract?**

**What is the format for your presentation (poster, talk, other)?**

**What are the relevant formatting details provided by the conference?**

**Have you created your presentation folder on the drive, as described above?**

**What questions do you have for your supervisor?**

## Learning about statistical software. Date Submitted:

**Instructions:** This statistical software learning plan will provide a customized roadmap to learning how to use statistical software. Please note that most students choose to complete their projects using SPSS, which includes a user-friendly "point and click" interface that does not require the student to learn or apply programming code. Other students choose to write a statistical analysis program ("syntax"), which enables them to quickly reproduce their analyses without having to re-select each of their options by hand each time. Your supervisor can answer questions about each option.

# STATISTICAL SOFTWARE LEARNING PLAN

| | |
|---|---|
| Which statistical software program do you plan to use? | |
| Where will you access this software? | |
| Look back at your analytic plan from fall semester. Which statistical tests did you propose you would use? | |
| Will you be using a "point and click" interface or syntax? | |

Now, complete the following learning plan sections for each statistical test (copy/paste as necessary). You may use any resource that suits your team, including web pages, YouTube videos, library books, or ebooks. The laboratory also has a number of "how to" books that may be helpful such as *The Little SAS Book* (https://www.sas.com/storefront/aux/en/splsb/65423_excerpt.pdf).

| **Statistical test name** | |
|---|---|
| List and complete three readings and/or tutorials to learn about this test. | |
| List and complete two readings and/or tutorials to learn how to conduct the test in your statistical software | |
| What did you learn from these readings and/or tutorials? | |

**What questions do you have for your supervisor?**

**References:**

https://www.sas.com/storefront/aux/en/splsb/65423_excerpt.pdf

## Pre-registering your hypotheses an analytic plan. Date Submitted:

**Instructions:** Now, you will finalize your hypotheses and "pre-register" your plan for testing these hypotheses. This page provides more information about these two steps.

### FINALIZING A SET OF GOOD HYPOTHESES.

In the fall, you generated preliminary ideas about hypotheses that you would test through your project. Now, you will refine and test those hypotheses through a detailed analytic plan. A hypothesis is a prediction about what you expect will happen within your data. Here is an example of a good hypothesis.

"In children with fragile X, higher average pitch, as measured during the AOSI at 9 months of age, will predict greater autism symptom severity, as measured by the ADOS Continuous Severity Score at 24 months of age."

A strong hypothesis is clear, testable, and specific. "Vet" your hypotheses for these characteristics:

**Clear |** Your hypothesis should be worded in simple, straightforward language. All key terms and parameters should be defined and easy to interpret. An unclear example could be: "In fragile X, higher average pitch will predict more autism." In this example, the reader does not have enough detail to thoroughly understand the associations being tested. In what ages? In what contexts?

**Testable |** Perhaps obvious, but your hypothesis should be testable using your available data. An untestable example would be: "In children with fragile X, the AOSI will provide a good context for testing whether pitch is associated with autism outcomes." In this example, it is unclear how "good" will be evaluated – it is unclear how "good context" would be evaluated, and it is unlikely the "goodness" of the context can actually be tested.

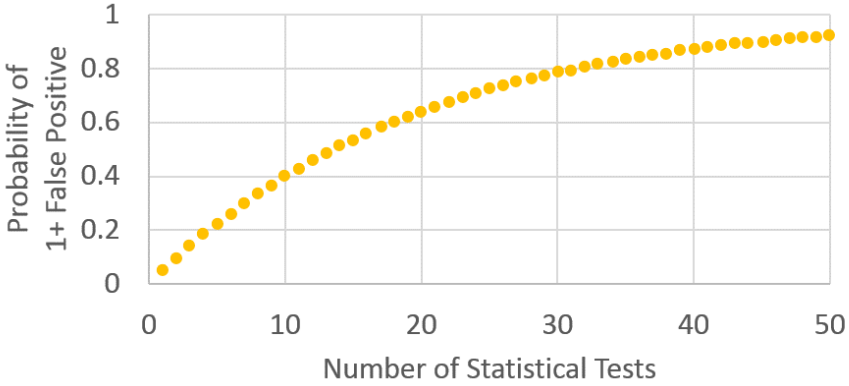
**Specific |** Your hypothesis should not only specify associations, but also the directions of these associations. For example, you should include whether associations are positive (higher levels of Variable 1 = higher levels of Variable 2) or negative (higher levels of Variable 1 = lower levels of Variable 2). You should also indicate which specific variable will be used. For example, autism severity can be evaluated using categorical (e.g. presence or absence of diagnosis; score above versus below clinical cutoff) or continuous (e.g. ADOS CSS score, other screening tool) metrics. An example of a non-specific hypothesis would be: "In children with fragile X, pitch will be associated with autism." In this example, it is unclear how each variable will be measured, and which direction of association (positive or negative) the researcher anticipates.

### PRE-REGISTERING YOUR HYPOTHESES AND ANALYTIC PLAN.

It is important that we are transparent and ethical when testing our hypotheses. Planning your hypotheses and analytic plan in advance help protect against "fishing expeditions," a lay term used to describe the process of "mining" all available data until a researcher finds something significant or exciting to talk about. This process is unethical because it inflates Type I error, the likelihood that a researcher will obtain a false positive (a result that is statistically significant but is not "real").

For example, most researchers interpret an effect as "significant" if the p-value < .05. In this example, the researcher has specified that the acceptable probability of detecting a false positive ("alpha" or α) is 5%. However, the actual false positive rate exponentially increases as more statistical tests are conducted. Specifically, whereas the probability of a Type I error of one statistical test is equal to α, the probability of a Type I error of multiple statistical tests is $1 - (1 - \alpha)^m$, where m=the number of tests. This graph depicts the exponential increase in the probability of detecting a false positive result (y-axis) as the number of statistical tests increases (x-axis). For example, whereas one statistical test confers

5% probability of Type I error, ten statistical tests confer a much higher probability: $1 – (1 - .05)^{10}$, or 40%. In other words, the researcher conducting 10 tests has a very high (40%) probability of detecting a "significant" but non-real result, simply based on probability alone.




Specifying your hypotheses up front reduces the likelihood that you will inadvertently "over-mine" your dataset out of curiosity and/or desperation to find your storyline.

How do we correct for issues of multiple comparisons? This question is complicated and heavily debated in the literature (see http://daniellakens.blogspot.com/2016/02/why-you-dont-need-to-adjust-you-alpha.html for fun commentary). Here are some solutions:

1. Use pre-planned, hypothesis-driven analyses that are carefully outlined in advance.

2. Adjust your α when repeating analyses across a "family of tests." To do so, simply divide your intended α (probability of Type I error, generally .05) by the number of tests in the family. This correction is called a **Bonferroni Correction** and, although generally considered to be overly conservative, protects against inflated error rates. For example, if you are examining group differences across 5 subscales of the CBCL, only interpret $p < (.05/5)$ or $p < .01$ as significant.

3. Consult with your supervisor about other types of corrections that may be useful, such as the **Holm-Bonferroni** method. This method is considered more powerful and less conservative than Bonferroni however is more difficult to calculate.

4. Focus on effect sizes or alternative statistical strategies that are not wed to significance testing.

To help protect against over-mining data, more scientists are migrating toward **pre-registration**, a process whereby scientists outline their analyses and planned comparisons in advance, often on a public forum. We will discuss the debates and motivations for pre-registration during an upcoming lab meeting. In advance of this meeting and before starting your project, read more about preregistration here: https://www.psychologicalscience.org/observer/research-preregistration-101

Pre-registering ensures that you are ethically progressing through your analytic plan and are minimizing risk for Type I error. In the "real world," pre-registration occurs through a platform such as Open Science Framework (OSF; http://osf.io). Although your team may choose to register your study on such a platform (with support from your supervisor), actual registration is not required for your semester project. Instead, you will complete a worksheet that mimics the pre-registration process so that you can critically think through your plan in advance.

## A NOTE ON POWER AND EFFECT SIZES.

Like many clinical research groups, our laboratory often faces issues related to statistical power. In research, **statistical power** refers to the likelihood that you will detect a true effect in your data, assuming the effect actually exists. Generally, researchers attempt to design their studies so they retain at least 80% power to detect "real" effects in the data. In other words, the probability of correctly detecting a true effect is .80. Adequate power protects against Type II error. Whereas Type I error (which was discussed previously) refers to a "false positive," Type II error refers to a "false negative," or a situation when a researcher fails to detect an effect that is actually present in the data. For example, if a medication for fragile X is actually effective "in real life," an underpowered study (e.g. due to a small sample) may erroneously conclude that the drug did not have an effect, committing a Type II error.

Power is influenced by a number of factors, including your predetermined α, the size of the effect you are trying to detect, and your sample size. Thus, studies with small sample sizes may fail to find a "true" effect due to low power. For example, a researcher comparing autism severity in 10 children with Angelman syndrome and 10 children with Williams syndrome may fail to find statistically significant difference, despite general field consensus that autism symptoms are higher in Angelman syndrome population. Notably, other signs may point to a real group difference -- the data may look noticeably different to the naked eye, and the mean differences between groups may be quite large. However because of the association between power and significance testing procedures, the analyses will not produce significant results. Thus, it is important that the researcher **not** over-interpret the findings by saying that "the groups were not different" – or worse, that "the groups were the same." **Prior to reporting non-significant effects in small samples, researchers must determine whether they had adequate power to detect an effect in the first place.**

To ensure we have at least 80% power to detect "real effects" in our data, it is customary to run a power analysis. Running a power analysis is beyond the scope of your semester project, however advanced students may choose to independently examine power (with the support of their supervisor). The most common tool for calculating power in simple analytic designs is G*Power, a freely available software tool (http://www.gpower.hhu.de/). There are a number of tutorials and webinars devoted to conducting power analyses in G*Power. Consult with your supervisor if you would like to try one out.

Another complementary approach to determining the potential impact of Type II error is to go beyond statistical significance testing (which relies heavily on power) and simply describe the effects in your data in a meaningful way. Here, we use **effect size**, a standardized metric that describes the magnitude of an association or group difference. When comparing groups, for example, a researcher may compute *Cohen's d,* the standardized mean difference in scores across groups (difference between two means divided by the standard deviation of the data). Like most effect size metrics, Cohen's d can be interpreted using a specific set of interpretation guidelines. For example d=.2 is considered a "small effect," d=.5 is "medium," and d=.8 is "large" (Cohen, 1988). Thus, if a researcher finds a nonsignificant group difference despite an effect size that is quite large, there is reason to consider whether power may have been an issue.

Your statistical software can often compute effect sizes for you, and some of your statistical analyses will inherently produce indicators of effect size (Pearson correlations, for example, indicate correlational effect size). You may also calculate effect sizes using a freely available calculator such as: https://campbellcollaboration.org/escalc/html/EffectSizeCalculator-ESTypes.php . **You are expected to integrate discussion of effect sizes into your semester projects.**

# PRE-REGISTRATION WORKSHEET

**Presentation Title:**

**Presentation Authors:**

**Presentation Date:**

**List your hypotheses here:**

1.

2.

…

## METHODS:

In this section, you will describe your study methods in as much detail as possible. Some of these details may be pulled directly from your fall worksheets and activities.

**Describe each primary variable in your analyses, including how they are collected (e.g. which measure and/or task) and quantified (e.g. continuous severity score, categorical). Note whether you transformed any variables, and if so, why.**

**Describe any moderators or covariates:**

**Describe your sample. What were the inclusion/exclusion criteria?**

**What are the basic biological characteristics of your sample (age, sex, genetic status)?**

**If you trimmed your data, how did you systematically select which observations to include or exclude?**

**How are you handling outliers and missing data?**

**How will you (or did you) match your groups)?**

**Briefly describe the study procedures that were used to collect your data.**

**Describe any key procedural elements that promoted rigor and reproducibility (the likelihood that another study could replicate your study and find the same result). For example, did coders and/or assessors know the diagnoses of their files? Were data verified for accuracy when entered? Were specific procedures used to ensure reliability?**

## ANALYSES:

In this section, you will describe your study analyses in as much detail as possible. Some of these details may be pulled directly from your fall worksheets and activities.

**Will you use significance testing? If so, how will you know if your results are significant?**

**Is power a concern for your study? In other words, do you have enough participants to detect an effect that is actually present in your data? Although a power analysis is not required for your semester project, some groups may choose to conduct one with the help of their supervisor.**

**Are your data vulnerable to issues of multiple comparisons? If so, what are you doing to prevent inflated error?**

**Describe, step-by-step, how you will conduct your analyses. If your analyses include interactions and/or covariates, be sure to clarify how you will test significant associations and/or "probe" your effects. For example, if you expect sex to interact with group, how will you statistically explain a significant interaction?**

**What questions do you have for your supervisor?**

**References:**


https://www.psychologicalscience.org/observer/research-preregistration-101
https://osf.io/
http://www.gpower.hhu.de/
http://www.gpower.hhu.de/

## Running and refining analyses. Date Submitted:

**Instructions:** Your next step is to leverage what you have learned about statistical software to put your pre-registered statistical plan in motion. Use this space to write a detailed summary of your results, which should directly follow your previously outlined statistical plan. These results do not need to be written up in “manuscript format” but should be described in complete sentences. Include at least 3-4 graphs or figures that depict your results. This section will be the base for the results section of your poster or presentation.

**Insert your results here, expanding as needed:**

**What questions do you have for your supervisor?**

## Crafting your poster or presentation. Date Submitted:

**Instructions:** It's time to create your presentation! Use the content of this packet to fill in the poster or presentation template you previously completed. Complete the following checklist to ensure your poster is including all necessary components:

**Broad Structure**

- ☐ Poster appropriately credits all team members and/or contributors, including complete and accurately ordered author list, acknowledgment of participants and other key contributors (e.g. coders), list of grants/funding, lab contact information
- ☐ Poster includes all key sections including Title, Abstract (if required by conference), Introduction, Methods, Analytic Plan (unless collapsed with results), Results, Discussion, References
- ☐ Poster has been spellchecked and proofread by all team members
- ☐ Poster contains minimal text and maximizes subheadings and/or graphics to enhance intelligibility
- ☐ All visual components (e.g. shading, boxes, fonts, font sizes, alignments) are consistent
- ☐ All tables/figures are clearly labeled and are referenced in text
- ☐ Permissions are on file for all photographs, images have been purchased for use
- ☐ Font sizes and colors are selected so that a person standing 3-4 feet away can read everything (e.g. 72 point title, 40 point headings, 28 point text, 24 point captions)
- ☐ No more than 2 fonts are used

**Introduction** includes the following:

- ☐ Brief description of previous literature that motivates your study
- ☐ Clearly articulated research questions
- ☐ Clearly articulated hypotheses
- ☐ Definitions for any constructs or groups that are central to the poster (can place in call-out boxes for added emphasis)

**Methods** includes the following:

- ☐ Brief description of parent study, if applicable (e.g. "Data were drawn from the Purdue Early Phenotype Study, a remotely administered longitudinal study of early development in children with rare neurogenetic syndromes")
- ☐ Inclusion/exclusion criteria
- ☐ Participant characteristics, which are often summarized in a table, including both demographic features (income, race, sex, etc.) and study-related variables

**Analytic Plan and/or Results** includes the following:

- Description of analyses
- Effect size and/or power considerations
- Results in APA formatting
- Figures (e.g. bar charts, scatterplots)

**Discussion/Conclusion** includes the following:

- 2-3 primary take-home points from the results (do not simply redescribe results!), including whether your initial hypotheses were supported
- How your study advances the field
- Limitations of your project
- Next steps/future directions

**What questions do you have for your supervisor?**

## Preparing to present. Date Submitted:

**Instructions:** Now that your poster is complete, it is time for you to present! Please answer the following questions and read these resources to prepare a dynamic presentation. First, read the checklist provided on this web site and watch the videos.

https://cirt.gcu.edu/research/developmentresources/tutorials/posterpresent

You should prepare two types of presentations. First, you will want to prepare a 30 second "elevator pitch" that describes your study and your key take-home point succinctly. Second, you should prepare a 3-5 minute verbal presentation during which you walk your audience through your poster. You should **not** read your poster to your audience. Rather, your poster should provide a visual prop and resource as you navigate your presentation.

Leave ample time to practice your poster – alone, with peers, and in front of the lab. Use this worksheet to determine a concrete plan for your presentation.

### POSTER PRESENTATION CHECKLIST

**When will you present your final poster?**

**Who will be your audience?**

**Which team member(s) will present? If multiple, clarify how the presentation will be structured.**

**Who will print the poster? How?**

**Who will bring the poster to the event? Are pushpins provided?**

**Outline your plan for practicing your poster, including dates and audiences.** You should plan to practice at least 5 times by yourself before practicing with peers. You should plan to practice at least 3 times with peers before practicing in front of the lab. You should plan to practice at a lab meeting with your supervisor and Dr. Tonnsen at least 1 week before your presentation. Describe these steps here:

**If you had to describe your study in 30 seconds or less, write out what you would say:**

**What questions do you have for your supervisor?**

**References:**

https://cirt.gcu.edu/research/developmentresources/tutorials/posterpresent

## Final documentation. Date Submitted:

**Instructions:** You did it! Submitting this completed document is required to obtain your course grade. Your packet must be submitted before the start of finals week. Only one packet must be submitted per group. Check to ensure the following steps are complete:

1) **Ensure all pages of this packet are complete.**

2) **Save your final poster (.ppt and .pdf versions) in your "Presentations" folder (not your "Lab Projects" folder) along with all other final documentation**. These documents include your abstract submission, syntax/output/analyses information, and this packet. This folder will be saved in future years, whereas Lab Projects folders are eventually deleted. Please note that you should not have multiple drafts of your poster and/or analyses saved in the "Presentations" folder – those documents should instead remain in your "Lab Projects" folder.

3) **Copy and paste a picture (or more!) of your group presentation here:**

4) **Insert your APA-style poster presentation citation(s) here:**

5) **If you won any awards (grants, travel awards, presentation awards) while presenting your poster, list them here:**

6) **Copy and paste a screenshot of your poster onto the following page (oriented horizontally).**

**Feedback (Optional):** You will be given the opportunity to submit anonymous feedback about your experiences during this lab project. However, please feel free to provide additional feedback here. We always want to know what went well, as well as what could have gone better!

**When you are finished with all of these steps, send this completed packet to your supervisor and Dr. Tonnsen via e-mail, with all group authors included in the "cc" field. Congratulations on completing your year-long research project!**

**[Insert poster screenshot and/or JPEG on this page, maximizing space as much as possible]**