Task 5:

Specify your Methods

Deliverables for this Task

a. A written Methods section ***with all the parts*** :
   -Participants, Materials, Procedure
   -Appendix A: Background questionnaire
   -Appendix B: Consent form
   -Appendix C: Stimuli
   -Appendix D: Testing materials

c. A full List of APA-formatted references for any research that you cited in your Methods section.
   For example, sources of your materials, experiments with similar techniques, standardized tests, etc.

d. Your Data Collection Script [separate from your Methods section]

Step by step

Overview

By this time you have chosen a research question to study and have reviewed the research literature to determine what is already known about your question. In Task 4, you also specified, in general terms, which and how many experimental conditions you will have – that is your experimental design.

Now you need to specify the nitty-gritty details of your data collection and data analysis methods. These are described in the Methods section of your research paper so that other researchers can reproduce every step of your study to double-check your results or apply your methods to other problems.

There are specific sub-sections of the Methods section for each kind of information – these sub-sections are indicated in parentheses along with the information that they should include. You'll have to explain exactly *who* you will collect data from (Participants), *what* materials they will use as stimuli and for testing (Materials), and *which* specific tasks you'll have them do for how long and in what order (Procedure). Answers to these questions will specify your methods for data *collection*.

You'll also have to think through how you'll analyze the data once you have it in hand – these are your methods for data *analysis*, which include how you'll organize your data, classify and quantify your participants' responses, and how you'll analyze these responses with statistical techniques (Design and analyses).

> Planning is the key to successful research (and to other complex activities). It is particularly important to plan your analyses **before** you start to collect data.

This Task focuses on specifying your methods for data collection and analysis. As you compiled information for your Lit Review, you will have seen how other researchers approach your research problem and related questions. This is an excellent source of ideas for specifying your own methods.

> It is very important to note that specifying your methods will sometimes make you **reformulate or modify your initial research problem** if it turns out to be too hard to study. This means that you will also have to make changes to your Literature Review so that it matches the changes in your research problem.

Keep in mind that you are specifying your methods so that you know *exactly* what you will do at every step of your data collection and analysis. As with other plans, however, when they're put into practice, reality has a way of forcing you to change them.

1. Check for Internal Validity

Reality Check #1: Review your experimental design. Use the information below to answer these questions.

a. How confident are you that only your factors will cause the differences in your sub-process that you observe from the participants' reponses?

b. What other factors might possibly cause differences in your sub-process?

c. How will you control the effects of these other factors?

There are several goals that researchers keep in mind when they design an experiment and specify its methods. One of the most important of these goals is the following.

Maximize Internal Validity. Be sure that your factors are causing the differences that you hope to observe.

Is your contrast (or difference between the levels of the factor [~ independent variable]), rather than some other extraneous factor, causing the changes that you observe? (See Mitchell & Jolley, 2005, Ch. 8) The more evidence there is that the difference in your factors is what is actually causing any differences that show up, the greater is the *internal validity* of your experiment.

The world is very complex so a very wide range of factors can affect the outcomes that you observe in any experimental setting. Researchers have to have a very clear idea of as many potentially important factors as possible. That allows them to isolate or control the factors that they are not interested in and focus on the ones that they want to study in a given experiment. One of the most frequent questions that researchers get is "Why didn't you study factor *x*?", so thinking about the possibilities ahead of time allows you to give a clearer answer and avoid being caught by surprise.

Internal Validity (definition). The degree to which a particular factor *in fact* causes observed differences in measured outcomes.

We can think of factors in two groups: irrelevant factors and relevant factors.

Irrelevant factors. Irrelevant factors in fact do not affect the behaviors that you are studying. Some of these we know to be irrelevant from other studies. For example, Eye Color is irrelevant for reading performance. Other factors we don't pay attention to out of ignorance, and in some cases we're right without knowing it: i.e., there are some factors we don't know about that really *are* irrelevant. Either way, it's safe to ignore these factors. Even if they are irrelevant, experimenters have to be aware of them and sometimes need to provide evidence that they are in fact irrelevant.

Relevant factors. These are the ones researchers need to worry about, and you can think about four kinds of them: the factors that are indirectly relevant, the ones we don't even know about, the ones we know are relevant, and the ones we suspect are relevant.

Indirectly relevant factors are those things that affect the factors that we know are relevant. It's risky to ignore them, but most people do. Expert researchers do their best to measure them and keep them under control. These factors show up when you do an extra careful literature review and during data analysis. One corollary of Murphy's Law states that these indirectly relevant factors will make a mess of your results when you least expect it.

Unknown relevant factors are those things that in fact affect the processes that we are studying, but no one knows about them yet. When we design an experiment, we have no choice but to ignore them. But when we analyze our data, we're always on the look out for *any* relevant factors, especially those that no one knew about before.

Known-to-be-relevant factors are those that in fact affect the processes that we are studying, based on evidence from other studies. These factors are very, very important: we either focus on studying them or control their effects. We ignore them at the risk of invalidating the experiment.

Your factors are the factors that you suspect can affect the processes that you are studying, even if you don't have enough evidence to say with any certainty – which is why you are studying them.

Your factors will get built into your experiment as:

- Contrasting groups of participants (e.g., males vs. females)
- Contrasting materials (e.g., different instructions, different texts, etc.)
- Contrasting tasks (e.g., count the letter "e" vs. read for meaning)
- Contrasting settings (e.g., with or without distracting stimuli)
- Or combinations of them, with one contrast for each factor.

Maximizing internal validity means controlling the *other* relevant factors so that the effects of your studied factors can stand out.

> Experimental control is what makes experimental research different from (and more reliable than) other kinds of research.

Experimental control. Experimental control is the key to maximizing internal validity. The main idea is to control the effects of everything that is or might be relevant for your process so that *only* the factors that you are studying affect the process. Experimental control is also what makes experimental research different from (and more reliable than) other kinds of research.

> **Experimental control** (definition). The process of eliminating the effects of relevant but unwanted factors that influence the process under study.

There are basically two methods for controlling the effects of a relevant factor that you **don't** want to study:

- Make sure that there is *only one value* of that factor -- i.e., freeze the value;

For example, we know that the way instructions are phrased makes a big difference in how people respond. Because we need to control for the possible effects of instructions, we need to give all of the participants *the same single set of instructions*. This way, it's safe to say that the instructions did *not* cause any of the differences that we observe later. In other words, the factor Instructions only has one level or one value: the single set of instructions that was used.

- Make sure that the values of the factor appear at *random* – i.e., random selection;

We also know that people respond differently to the same situations, simply because people are different. We can't use only one value for the factor Participant – i.e., only one participant – because in that case we can't say anything about how other participants would act. The main option for dealing with the fact that people are so different is to use lots of participants. We can then use special methods to sample the participants at random. Some people will have more, others will have less of each characteristic, but the randomness will tend to cancel out the effects of these differences when you look at the whole group. *Random sampling* is one of the most powerful techniques in experimental research.

2. Measuring your sub-process

Your experimental design sketches out how your factors (or **in**dependent variables) determine your data collection procedure. You chose these factors because you suspect that they will affect the process or sub-process that you are studying.

The next step, then, is to decide how you will measure the changes that do (or do not) happen in your sub-process, i.e., decide on your measures or **de**pendent variables. **This is an extremely important decision!**

> ✋If your measures aren't detailed enough or relevant enough then the experiment fails because you're unable to detect differences that do in fact happen in your sub-process.

Unfortunately, we can't observe mental processes or sub-processes by looking at them directly. So, we researchers need to have participants provide some kind of observable response that we can link to the sub-process that we are studying.

For example, say we want to study how people comprehend the technical manual for a coffee maker or computer program. We can't observe their comprehension directly, so we measure it indirectly through multiple-choice questions, summaries, etc. So, there is plenty of methodological discussion about the different options. Some researchers argue that answering multiple-choice questions after reading a whole text is a measure of *(retrieval from) memory* but not of the process of getting the textual information *into* memory (i.e., comprehension). They say that there are too many other things happening between comprehension and the questions for this measure to say anything interesting about comprehension and, of course, propose other methods (based on reaction times or eye movements during reading). They raise the question: "does your 'comprehension test' really measure comprehension or something else?"

There usually is no definitive answer for this kind of discussion, just a lot of argument back and forth about the strengths and weaknesses of different measures. This is one reason to mention other studies that have used the same dependent variables that you use. The implicit reasoning is that if other researchers have successfully used the same dependent variables, then at the very least your results will be comparable with theirs.

Dependent variables, then, have three parts:

- the participant's response,
- the test or "instrument" that they're responding to, and
- an explanation of how that kind of response relates to the specific process under study.

2.1 Participants' responses

Common participant responses that psychologists have used are: spontaneous behavior, pointing, pressing a button, choosing from a list of options, and verbal responses. Verbal responses can be as simple as *yes* or *no*, as common as short answers to questions, or as complex as long written texts.

To improve the reliability of your measurements, participant responses should be easy to record (in writing, on tape, on video, by computer, etc.) so that you can review and analyze them more than once. That will allow you and other people to review your analyses, which will make the results more reliable.

Your dependent measures are numbers, so you will need to count or measure something. Often, you will measure the same thing in different ways or measure more than one thing. So, it's common to have several dependent variables.

What will you count? Which responses? Which *kinds* of responses?

2.2 Test materials

Many experiments have test materials that are separate from the stimuli. In the example above, the participants read a text and someone tested their comprehension with a set of questions. The set of questions is one example of test materials.

In some simpler experiments, like a study of writing, participants may just respond to instructions about what to write about. Note that in this experiment there aren't any separate test materials. Participants just get instructions and write in response to the instructions. So, **the test materials may also be optional**. However, there has to be *some* response from the participants that will allow you to measure the process that you are studying.

To take another example, in reaction time experiments, participants react to stimuli and there is no separate set of test materials.

What will you use to test the participants? Describe your test materials. Provide the *exact* test materials that you will use.

2.3 Construct validity

Why did you choose *these* test materials? Why did you choose *these* specific kinds of responses?

You have to explain how your materials and responses relate to the specific process under study – this is called "construct validity". Convince the reader that they are a good way of measuring your process. This is another important goal that researchers try to reach.

> Maximize Construct Validity. Make sure that you're measuring your process or sub-process and not something else.

Construct validity is the technical term for how *relevant and reliable* your measures are for measuring some underlying or unobservable process or theoretical construct. For example, the Wechsler Intelligence Scale for Children (WISC) score (the measure) has high construct validity for measuring intelligence (the construct), but a low construct validity for measuring chess ability (a different construct). We know because there have been many studies to check how reliable and relevant it is – it's a *standardized* test. If you are using standardized testing materials or materials from some other experiment, be sure to cite the source; that will help convince the reader that your measures are reliable.

Reading comprehension tests, for example the standardized tests used for the SAT and GRE, are an interesting case. They provide relevant and reliable information about reading comprehension *as a whole*, but different questions on the tests provide information about different parts of the reading process. So, a standard reading comprehension test will not be useful for measuring only one sub-process of reading. To increase construct validity, you would have to choose the specific *kinds* of comprehension question that are related to the particular sub-process that you want to focus on.

Don’t take your measures for granted. Prepare your reasons for convincing the reader that you are really measuring your process.

How do your dependent variables measure the process or sub-process that you’re interested in?

3. Check for Risk of Type II error

The experimental design specifies more details about how you will investigate your factors and try to maximize internal validity. Your dependent variables are a way to measure what's happening (or not happening) with your process and specifying them carefully helps you maximize construct validity.

Reality Check #2: Review how you will measure what happens to your sub-process. Use the information below to determine how much you risk making a Type II statistical error. Make any changes to your methods that you can to reduce your risk.

Don't miss genuine effects

Another one of the most important goals that researchers keep in mind is this.

> Minimize Type II statistical error. Make sure that you don't miss any real differences in the sub-process that you're studying.

One goal of having systematic methods is to **avoid missing any genuine effects** that may result from your experimental manipulation of the "contrast" – this is called "avoiding Type II statistical error". This kind of error doesn't mean that there was a mis-application of statistical techniques; it means that the researchers didn't design and/or execute the experiment with enough safeguards like those described below.

The three most common ways of making a Type II statistical error are:

a) there were not enough participants;

b) the contrast was too subtle;

c) the dependent measures were not precise or reliable enough;

Working backwards from the statistical techniques that we will use for analysis, we know that the following steps help to avoid these problems with Type II error and help to optimize experimental results:

> **Type II statistical error** (definition). "False Negatives" or real effects that experimenters do not detect because of issues with the experimental method – often because there was too much individual variation or *error variance*.

Goal 1. Minimize the influence of variation between individual participants. The variability in the responses between participants is *error variance* and higher error variance makes it harder to detect the effects of your factors. There are several ways to minimize individual variation and error variance.

- Maximize the homogeneity of your participants (*within* each group of participants);
- Maximize the randomness of sampling (of stimuli and of participants);
- Maximize the number of participants;
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Goal 2. Maximize differences in the levels of each Factor, i.e., maximize the size of the *contrast*. Small or subtle differences between levels of a factor are very hard to detect reliably. People vary widely, so systematic differences between 18-year-olds and 19-year-olds will be hard to detect.

So, if 18-year-olds and 19-year-olds are two levels of the factor Age, then the researchers will probably not detect any systematic differences. A larger contrast, such as 15-year-olds vs. 20-year-olds will work better.

Goal 3. Maximize the sensitivity and reliability of your dependent measures.

If two or more people are analyzing parts of the same data, then they will analyze it slightly differently so the dependent measures will be less reliable, especially if there is some subjectivity in the analysis. This introduces more error variance into the measurement process and makes it harder to detect systematic effects of the factors.

Similarly, if your participants can answer only *yes* or *no* to some of your questions, then your measures won't be sensitive to the needs of participants who want to answer *maybe*. This will add some error variance because the *maybe*s may answer *yes* to some questions and *no* to others.

There are several ways to optimize your measurement process.

- Maximize the simplicity and the clarity of instructions to the participants;
- Maximize the standardization of your collection and analysis procedures;
- Maximize reliability of data coding procedures;

4. Specify the details of your methods

The experimental design specified a part of your method: the conditions in which you will observe the participants. When you analyze your data with the technique called Analysis of Variance (ANOVA), you have to know which factors are in the design, how many levels of each, and whether they are between- or within-subjects factors. So, the experimental design is also a plan for how you will do your statistical analyses after the data has been collected. This is no coincidence.

You've already thought about most of the components of your data collection method: the participants, the materials, the tasks. The next step in specifying your methods is to describe in more detail each of the following components of how you will collect data. This will help you put all of the information together in the same place to finish planning your experiment.

Here is an overview of the kinds of information that will have to provide. Later sections have more information about each component of your experiment.

1. Participants. Describe the participants. Who will participate? How many people will you need? What characteristics do they need to have? Why did you choose these?

2. Materials. Choose and describe all the materials. Why did you choose these? Where did you get them?

   a. Stimuli. What will they use for the task? Why these stimuli?

   b. Test materials. What will you test the participants with? Why these tests?

   c. Background questionnaire. What information will you get from each participant? Why?

3. Procedure. What will happen when during data collection and analysis?

   a. Tasks. What will the participants have to do? Why these tasks?

   b. Setting. Where will the participants be tested? Why these settings?

   c. Measurements. What will you be measuring? How will you be measuring it? Why?

   d. Analyses. How will you organize and analyze the data?

You will also need to put together a Script with your instructions and actions during data collection.

4.1 Participants

As a psychologist, you will usually be investigating people. Can you do anything you want with and to them, in the name of science? Obviously not. Your participants have rights that you need to respect. Another very important goal of experimental design, then, is this.

> Use maximally ethical procedures. Ensure that everything possible has been done to protect all of your participants from risk and to guarantee them both informed consent and full anonymity.

Ethical conduct on the part of the researcher is fundamental for successful research. There are at least three areas in which ethics plays a significant role in research:

- Honesty in using other people's findings (i.e., no plagiarism);
- Systematic respect for the participants' rights (i.e., minimize risk and maximize informed consent);
- Honesty in reporting the results of your research (i.e., no "fudging" data to report more "interesting" results);

The American Psychological Association has detailed norms on ethical behavior of both clinical and research psychologists. Review the Association's *Ethical Principles of Psychologists and Code of Conduct* (APA, 2002) so that your behavior is as professional as possible.

Two of your highest goals in doing and reporting research are to contribute to human knowledge and to build your own reputation for being able to contribute effectively. Insufficient attention to ethics is enough to make all of your research useless and your career a total disaster.

When talking about participants, there are two main components of ethical experimentation: minimizing risk and maximizing informed consent.

Risk management. Under no circumstances should you expose participants to *any* kind of risk. This includes risk of physical, cognitive or emotional harm, even risk of embarrassment.

> **NOTE:** For Research Methods, you can only choose a research problem that will NOT CREATE ANY POSSIBLE RISKS AT ALL for either you, the experimenter, or the participants who you recruit.

That means no experimental surgery in Research Methods; no drugs; no use of dangerous, vulnerable, or at-risk populations; no dangerous tasks or settings. Especially with your first experiment, you should not do anything risky!

Some kinds of research, such as medical research, involve unavoidable risks to the participants. In these cases, the researchers need to take especially meticulous care that the participants understand all of the risks and benefits very clearly and that they agree to participate in the experiment even so.

Risk management is why you need permission to carry out any research that involves human participants. There are two kinds of permission here: permission to do the study (from your Research Methods professor and from the University) and permission from the sources (institution and/or family) of the participants as well as the participants themselves.

Permission from the University

- University policy dictates that research for publication which uses human participants *must* first be reviewed and approved by an Institutional Review Board. Remember that if anything goes wrong in an experiment, then the University is in trouble, too.
- In the case of Research Methods courses, the professor plays the role of the Review Board for research that will not be published. That's why you have to do a Research Proposal, which is the next Task. The professor needs to know what to approve or not.

Permission from participants and sources of participants

- For this Research Methods course, you should be working with normal adults, usually university students. For normal adults, you should get them to sign a consent form. So, you won't be dealing with sources of participants like schools and clinics.

- If you ever do work with special populations *of any kind* (i.e., not normal adults), get permission *from everyone* possible: the participant's family, the teacher, the school / clinic / hospital, the participant, etc. Note that other institutions like schools, clinics, and hospitals also have Institutional Review Boards, so this process can take a long time. Policies on permission for research vary widely, so start your discussions early.
- Do NOT accept your favorite teacher's friendly invitation to test on her elementary or high-school class without getting permission from the school, too. All it takes is one talkative kid and one ill-informed parent for accusations to start flying and then *everyone* is in trouble. Even *with* permissions in place, all sorts of strange accusations happen sometimes.

Why all of this bureaucracy? Well, for one thing, some of our colleagues in the past have done some awfully questionable experiments that caused their participants distress and suffering. For another, parents and family members tend to get extremely upset if someone's doing experiments on their loved ones. The word "experiment" makes them imagine Frankenstein-like surgery on their cuddly little kids: exchanging body parts, removing brain tissue, inserting huge electrodes, etc.

> You should *never* use the word "experiment" when talking with any potential source of participants!

Say a "study".

Finally, the main reason for all of this is that those are the rules: ethical research demands risk management and informed consent.

<u>Anonymity</u>. When you take a look at the consent form in Appendix A, you'll see that participants are guaranteed anonymity.

> Never, ever, ever mention the name of a participant to anyone, much less in print or in public.

There are at least two reasons for this: one is that participants may feel embarrassed or upset by other people seeing their performance. The other is that if the data is anonymous, then the data analysis won't be influenced by other information about the participant. For example, "This is Stevie's data. He's smart; it must all be correct." This kind of thinking leads to analysis errors. It's harder to be influenced by "participant #20" . Finally, we know that someone's name doesn't systematically affect their behavior on most psychological tasks. It's irrelevant information that we simply don't need.

The easiest solution is simply: **Don't ask for the participants' names.**

<u>Informed consent</u>. For this Research Methods course, you must work with normal adults, usually university students. For normal adults, you should get them to sign a consent form. This is called "informed consent" to participate: participants have to be informed enough to give their consent with a clear idea of the risks and benefits of the experiment.

There is a sample consent form in Appendix A. Note that the material in brackets [like this] is what has to be changed for each experiment. You need one copy for each participant, plus a few extras just in case.

Informed consent means that the participants have to understand clearly:

- Potential benefits of the research

- Potential risks of the research for them individually
- How the researcher will protect their individual privacy
- That participation is voluntary and they can opt out of the experiment at any time
- Any compensation that they will receive (money, course credit, thanks) and that they will receive compensation even if they withdraw from the experiment

Notice that there is no mention of explaining the *specific goals* of the experiment. In fact, it's very important NOT to tell the participants exactly what you are looking for until after you have finished collecting data. You can give them *some* more information right after they participate but remember that they might communicate with your next batch of participants and that will often be enough to invalidate your results. General answers will usually do. You can offer to answer any detailed questions at all about the study "next week" (after you've finished collecting all of your data), for example.

Also, you cannot deceive your participants, i.e., lie to them. Deception is unethical. Vagueness about the specific research goals and questions is often necessary, though. If your participants feel the need for more details, you can tell them more about the tasks, but avoid giving them specific information about your goals until after you collect your data.

For schools and other institutions, rather than just answer the individual participants' questions, it's much better to return later and present your study and results (in non-technical terms!). That is the best way of showing your appreciation for their collaboration. It also establishes a better relationship with them in case you need to collect more data later on (because most researchers disappear and never come back!).

Finding participants

- How many participants do you need?
  - Calculate at least 15 participants per condition of your design.
  - Note that you *don't* need the same exact number of participants in each condition. The statistics program will correct for small differences automatically. On the other hand, the numbers shouldn't be very different either.
- Where will you find these participants?
  - You can ask professors to "borrow" their classes, recruit your friends (but not classmates), or draft strangers on campus.
  - Contact your sources of participants NOW. Plan as far ahead as possible. It's normal to have refusals, cancellations, bureaucracy, and no-shows. Be ready with additional sources of participants. You only have a window of two to three weeks for data collection, if you are not late with your Research Proposal, which is the next step after specifying your Methods.
  - If your methods allow it, try to collect data from a whole group of people, for example a whole class, at the same time. Sometimes a former professor will give you access to his or her class for this. *Always* offer to go back and explain what you did and why!

Sampling to ensure external validity

You can't study everyone. How will you choose your participants?

> Maximize External Validity. Design the experiment for more reliable generalizations.

When we do an experiment, because of practical limitations we work with a *sample* of the *population* of interest. For example, we study 40 college students (the sample) because we're interesting in how adults in general (the population) perform some task. Then, we would like to make a generalization and say that what happened with the college students would happen with *any* adult. More general (and true) statements are more valuable, so we want to maximize our generalizations.

To make the generalization plausible, we have to either show that the sample of students is *representative* of the population of adults or restrict our generalization to a smaller population. It's best to plan for the broader generalization.

Representativity here means that the sample has the same characteristics as the population, distributed in similar ways and amounts. For example, a similar distribution of males and females, high- and low-IQ individuals, republicans and democrats, etc. – whichever characteristics are considered relevant.

How representative are these participants of the population that you want to understand? If your sample of participants is representative, and you can show it, then you can *generalize* your results. This means that although you only studied 20 or 40 or 100 people, you can convince people to conclude that the same results would be found with *anyone* in the population.

It's generally accepted that the pool of participants taken from the students in Introduction to Psychology are a fairly random sample of the university population. Although it's questionable, most researchers also think that they're fairly representative of adults in general, for most research problems.

To establish representativity, you need to show that the participants have (almost) the same values as the population for the same characteristics. For example, similar mean IQ (and similar standard deviation), similar reading level, similar proportion of males and females, etc. according to what's relevant for the problem that you're studying.

Some people end the discussion here: with the sampling of the participants. However, *all* of the same principles hold for the representativity of the materials that are used, the tasks, the instructions, and the testing instruments. External validity increases as the researcher can show that the parts of the experiment are representative of the respective population (of materials, tasks, etc.).

How do we work toward maximizing external validity? By using systematic sampling techniques. There are several things that the experimenter has to sample: which participants, which materials, which tasks, etc.

Another very important step here is to randomize which participants are assigned to which experimental condition. Even if selection of participants is not random, you can make an effort to assign them randomly to the different experimental conditions. This will improve your ability to generalize your findings.

Random sampling. In random sampling, the researcher takes steps to avoid any systematic *bias* in deciding which individuals from the population of interest actually participate in the experiment: each member of the population has exactly the same chance of participating in the experiment. *Bias* here means that (usually inadvertently) more of one subtype of participant gets assigned to one experimental condition than to another condition. This kind of bias can lead the research to (falsely) conclude that the factor investigated caused differences in the observed outcomes, when in fact the different subtypes of participants were the cause. Truly random sampling from a population of participants is an ideal that is difficult to attain and is usually an issue only with large-scale studies that have hundreds or thousands of participants.

Random assignment. In practice, researchers emphasize *random assignment* (of participants to experimental conditions) instead of random selection because random assignment is more practical to carry out. Perhaps the most common technique for random assignment is to use a table of random numbers like the one on the next page.

Say that you need to assign 40 participants to 4 experimental conditions. You can follow these steps:

- Choose a two-digit number arbitrarily (from the serial number of a dollar bill, a license plate, the page of a book opened at random, etc.).
- Use the first digit and the column number and the second digit as the row number to find where to start in your table of random numbers.
- Go down the column one number at a time. If it is less than 41, then write that number on the list for experimental condition #1 until you have enough participants for condition 1. If the number is more than 40 (your total) or was already seen, then skip it. If you get to the bottom of a column, go to the next column.
- Repeat until you fill all of the experimental conditions.

Why is this random? For one thing, the assignment does not depend on any characteristics of the participants or the experimenter. If you did the sampling yourself, you might unconsciously assign the smart (or male, or white, or …) participants to one condition or other. For another, the random number table is designed to provide a sequence that's very close to pure randomness.

Stratified sampling. Stratified (or probability) sampling is the procedure in which approximately random sampling is applied to *parts* of the population.

For example, if the population of interest is all American adults, then the experimenter might choose a random sample by race (independent samples for each race) and ensure that the distribution of races in the sample follows the distribution of races in the population (e.g., 10% Black, 4% Asian-American, 1% Native American, etc. – this is called *proportional stratified sampling*).

Convenience sampling. The reality of student research is that you will be happy to accept for testing anyone who can be convinced to volunteer. This is simply the sample that is most convenient for the experimenter, with absolutely no guarantees (and little likelihood) that the sample will be at all representative. This means that it will be difficult to accept any generalization of the results to a broader population.

Often, even apparently small differences among the participants can lead to big differences in the experimental results. One group may be more intelligent or more experienced than another, for example. This is why being careful about selecting subjects randomly is very important, so that these differences tend to cancel each other out. The background questionnaire is a kind of "insurance" so that the experimenter can double-check this assumption after collecting the data.

Table of Random Numbers

39634 62349 74088 65564 16379 19713 39153 69459 17986 24537
14595 35050 40469 27478 44526 67331 93365 54526 22356 93208
30734 71571 83722 79712 25775 65178 07763 82928 31131 30196
64628 89126 91254 24090 25752 03091 39411 73146 06089 15630
42831 95113 43511 42082 15140 34733 68076 18292 69486 80468

80583 70361 41047 26792 78466 03395 17635 09697 82447 31405
00209 90404 99457 72570 42194 49043 24330 14939 09865 45906
05409 20830 01911 60767 55248 79253 12317 84120 77772 50103
95836 22530 91785 80210 34361 52228 33869 94332 83868 61672
65358 70469 87149 89509 72176 18103 55169 79954 72002 20582

72249 04037 36192 40221 14918 53437 60571 40995 55006 10694
41692 40581 93050 48734 34652 41577 04631 49184 39295 81776
61885 50796 96822 82002 07973 52925 75467 86013 98072 91942
48917 48129 48624 48248 91465 54898 61220 18721 67387 66575
88378 84299 12193 03785 49314 39761 99132 28775 45276 91816

77800 25734 09801 92087 02955 12872 89848 48579 06028 13827
24028 03405 01178 06316 81916 40170 53665 87202 88638 47121
86558 84750 43994 01760 96205 27937 45416 71964 52261 30781
78545 49201 05329 14182 10971 90472 44682 39304 19819 55799
14969 64623 82780 35686 30941 14622 04126 25498 95452 63937

58697 31973 06303 94202 62287 56164 79157 98375 24558 99241
38449 46438 91579 01907 72146 05764 22400 94490 49833 09258
62134 87244 73348 80114 78490 64735 31010 66975 28652 36166
72749 13347 65030 26128 49067 27904 49953 74674 94617 13317
81638 36566 42709 33717 59943 12027 46547 61303 46699 76243

46574 79670 10342 89543 75030 23428 29541 32501 89422 87474
11873 57196 32209 67663 07990 12288 59245 83638 23642 61715
13862 72778 09949 23096 01791 19472 14634 31690 36602 62943
08312 27886 82321 28666 72998 22514 51054 22940 31842 54245
11071 44430 94664 91294 35163 05494 32882 23904 41340 61185

82509 11842 86963 50307 07510 32545 90717 46856 86079 13769
07426 67341 80314 58910 93948 85738 69444 09370 58194 28207
57696 25592 91221 95386 15857 84645 89659 80535 93233 82798
08074 89810 48521 90740 02687 83117 74920 25954 99629 78978
20128 53721 01518 40699 20849 04710 38989 91322 56057 58573

00190 27157 83208 79446 92987 61357 38752 55424 94518 45205
23798 55425 32454 34611 39605 39981 74691 40836 30812 38563
85306 57995 68222 39055 43890 36956 84861 63624 04961 55439
99719 36036 74274 53901 34643 06157 89500 57514 93977 42403
95970 81452 48873 00784 58347 40269 11880 43395 28249 38743

56651 91460 92462 98566 72062 18556 55052 47614 80044 60015
71499 80220 35750 67337 47556 55272 55249 79100 34014 17037
66660 78443 47545 70736 65419 77489 70831 73237 14970 23129
35483 84563 79956 88618 54619 24853 59783 47537 88822 47227
09262 25041 57862 19203 86103 02800 23198 70639 43757 52064

Background Questionnaires

The background questionnaire is one kind of "experimenter's insurance". You can use it to double check the representativity of your sample and check for any characteristics that coincidentally were present more frequently in one condition than in another.

You can often use the information from the background questionnaire to do follow-up analyses. Say, for example, that you got no significant differences from your factors. This is where the "insurance" kicks in: you can reanalyze the data with new factors derived from the information on the background questionnaire. Maybe there are age or sex differences that weren't your main focus. Reanalyzing the data might give you unintended results that you can report, even if your planned factors did not seem to affect the process you are studying. That's much more practical than going out to collect more data.

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Anonymity. When you take a look at the consent form in the next section, you'll see that participants are guaranteed anonymity.

What most experimenters do is assign each participant an arbitrary number or code as soon as they show up to participate. Avoid having participants put their names on whatever data they provide for you, including the background questionnaire.

> You have to be extra, super sure that *the same code* goes on the same participant's background questionnaire and all data.

If there's a mistake or a missing code, then all of that participant's data has to go to the garbage and you will probably have to collect replacement data.

Questions. What should you ask on the background questionnaire? Questions about things that you think might affect the process that you are studying. For example, age, major, and gender are often relevant. If you're studying reading or problem solving, you might want to add some questions to get an idea of how much the participants know about the topic that's involved.

Name, address, telephone number, student ID, and shoe size do not affect any known psychological processes, so don't ask about them.

How many questions? There are no fixed limits either way. If you ask only a few questions, then you'll have fewer opportunities for reanalyzing the data, i.e., less "insurance". But asking too many questions will take up too much time. As a rule of thumb, 20 questions is fine, but not much more than that, unless you have something special in mind.

What kinds of questions? Multiple choice, yes/no, fill in the blanks, and open-ended questions can all be valuable. Likert-scale questions are also widely used: the participant has to put a mark along a scale of 5 or 7 items, e.g., from "strongly disagree" to "strongly agree".

Wording. There's a fine art of writing questions for questionnaires. There are professionals who are experts at doing only that. This is because people have a strong tendency to misunderstand your questions and provide you with irrelevant responses. One solution is to word the questions very simply, very directly, and in a way that is clear to the readers (not only to you!). The other solution is to test the questions with some extra participants to make sure. This is called *pilot testing*.

4.2 Materials

There are several kinds of materials used in an experiment:

- stimuli and/or distractors
- testing materials
- background questionnaire
- instructions

This section focuses on stimuli and distractors. See Measures for more information on the testing materials, Participants for more information on background questionnaires, and Procedure for more information on instructions.

Your choice of materials is very important to focus the experiment on a particular process or sub-process and to provide the type of responses that you are looking for. Don't underestimate just how important the materials are.

Choosing materials

Maximize External Validity. Design the experiment for more reliable generalizations.

When we do an experiment, because of practical limitations we work with a *sample* of the all the materials of possible interest. For example, we study students reading *one text* (the sample) because we're interesting in how adults read *any text* (the population). Then, we would like to make a generalization and say that what happened with the one text would happen with *any* text. More general (and true) statements are more valuable, so we want to maximize our generalizations.

To make the generalization plausible, we have to either show that the sample of texts is *representative* of the population of all reading materials or restrict our generalization to a particular kind of reading materials. It's best to plan for the broader generalization.

Representativity here means that the sample has the same characteristics as the population, distributed in similar ways and amounts. For example, a similar distribution of words and sentences, high- and low-frequency words, long and short sentences, etc. – whichever characteristics are considered relevant.

External validity increases as the researcher can show that the sample materials are representative of the respective population of materials. Ideally, some sort of random sampling would be used. In practice, however, it is more common to give reasons to think that the sample materials are representative.

Stimuli. Will you provide the participants with stimuli to react to? A picture to view? A text to read? Sometimes there are no stimuli. For example, in many experiments about writing, there are only instructions to write about this or that topic, with no other stimuli. Sometimes there are multiple stimuli, for example when there are distractors, as in the example above.

If you are using stimuli, then describe them in detail, including the source where you got them. If you have more than one set of stimuli, then describe each set.

Why did you choose these particular stimuli? It's important to show that they're representative of some population of relevant stimuli and how they're related to the goals of the experiment. Convince the reader that they will help reach the goals of the experiment.

Distractors. Think through the same questions for any distractors that you may want to use. Why do you think that they will be distracting? Will they interfere with the specific sub-process that you want to study or with processing in general?

4.3 Procedure

The Procedure is the sequence of steps that you will follow to collect and analyze your data. The Procedure specifies the tasks that the participants will carry out, the materials that they will use, the setting in which the experiment will take place, and the steps that the experimenter will take to make measurements and analyze the data.

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It's very important to plan the procedure out and think it through in great detail so that all of the participants go through the same exact steps. This is one part of experimental control: ensuring that variations in the procedure (which are not being studied) do not lead to different outcomes. Systematic, meticulous procedures also help reduce Type II statistical error.

It's worth repeating that one of the main reasons for planning out your procedure very carefully is to be sure that you don't miss any real differences.

Minimize Type II statistical error. Make sure that you don't miss any real differences.

One goal of having systematic methods is to **avoid missing any genuine effects** that may result from your experimental manipulation of the "contrast" – this is called "avoiding Type II statistical error". We discussed different ways of minimizing Type II statistical error above. Careful planning of the procedure helps with this one:

When you maximize the standardization of your collection and analysis procedures, then you reduce error variance and make it easier to detect significant effects of your factors.

Pilot Testing

Once you have decided on your tasks, instructions, materials and testing procedure, you should find a few volunteers to try them out on. This is called *pilot testing*: You rehearse the experimental procedure to make sure that the participants can actually understand your instructions (a frequent problem) and have an appropriate amount of time for each part of the procedure (neither too little nor too much time). Then you can check the responses from the pilot test to see whether you're getting the data that you need.

Previous students in Research Methods often showed surprise at how important it is to rehearse the procedure before collecting data and to do pilot testing to double check instructions, materials and timing. Several of them had to discard data and start again, which was *very* stressful!

You can't just improvise your data collection procedure! Too many things can go wrong.

Sessions

You probably won't collect all of your data at once. It's more likely that you'll run through the procedure until you get all of the conditions done or accumulate enough participants.

Each time you run through your procedure, you'll have completed a data collection *session*. It's important to know how long a session takes and how many sessions you'll need so that you can double check how long you'll need to collect all of your data. Pilot testing will help you estimate this better.

Don't forget to include an estimate of how long it will take to distribute and collect all of the materials for each session. When you have 30 participants, this can take quite a while. You may consider bringing a research assistant to help with this.

Tasks

Describe the specific tasks that the participants will carry out during the experiment.

For example: "The participants will each read the experimental text and answered a 20-item reading comprehension test."

If differences in the tasks are the focus of the experiment, then the different tasks have to be described in detail. Why were *these* tasks chosen?

Setting

Describe the setting where the participants will carry out the experiment.

If differences in the setting (such as ambient noise or music) are *not* being studied, this description can be as simple as "a quiet room" or "their usual classroom".

If differences in the setting are the focus of the experiment, then the different conditions have to be described in detail. Why were *these* settings chosen?

Measurements

Describe as precisely as possible what you will be quantifying to try to measure your process. What will you count or measure and why? How many measurements will you have for each participant?

In many cases, you'll simply be able to count up the responses based on a list of correct or expected responses. In other cases, you'll need to describe how you'll code or classify the responses.

Coding the responses. You also need to describe how you will classify or "code" the participants' responses before you count them up.

For example, if you are giving the participants a comprehension test for which you have the "correct" answers, then that's what you will use to code the answers as correct or not.

Answering questions. If the participants are writing out free responses to questions, then things get more complicated. You have to explain what you will consider to be a "positive" response or a "negative" response, or a "correct" or "incorrect" response, or however you want to categorize them. You can try things like "A positive response will contain words from List A and no words from List B" or "A correct response will include the information that the brain has two hemispheres, even if the response uses synonyms or paraphrases of that information" (making a list of acceptable synonyms will be helpful).

Recall protocols. In reading research, another technique is to have participants write down everything that they can remember of what they've read (this is called a "recall protocol"). Then, for each sentence of the original text, see whether (or how much of) the same information (perhaps with synonyms or a paraphrase) for that sentence appears in the participant's recall protocol. The information might appear as the same as the original (one measure), or might be altered or re-organized (another measure). This can show which parts of the original text were more important to the participants and what kinds of processes they used for each (with or without changes).

The important thing in this section is to be explicit and clear enough so that someone else could actually do the coding for you. This degree of clarity helps you avoid situations where you're not sure how to code the data, even when you're doing it yourself.

Instructions

You always need to provide clear, direct instructions so that the participants know what to do. There are usually different instructions for each part of the experiment: instructions on how to start the experiment, on how to finish, on what to do next, etc. These instructions may be different in different experimental conditions of the same experiment, as well.

> Every participant in a given experimental condition must get *the same exact instructions*. There should be *minimal* differences in instructions from one condition to another.

There is a sizeable experimental literature showing that even small variations in phrasing instructions can lead to very different results. Use very short, simple sentences and avoid any technical terms.

Decide: What instructions will you provide at each step?

> Heads-up. A very common error is to give all of the instructions about every step of the experiment together at the beginning. In this scenario, participants promptly forget everything that the experimenter said and confusion takes over, turning data collection into a living hell and invalidating your results.

A better strategy is to provide only *the immediately relevant information* at each step of the experiment. Just answer "what do I do now?"

Ex: "Study the text carefully so that you can answer some questions about it. You will have 3 minutes to study it."

Later: "Please stop reading and pass the text to the front of the class. Now please answer the questions on the next sheet that you receive according to what you read. You will have 7 minutes."

Later: "Please put your pen down now. Pass the sheets to the front of the class."

Later: "Thank you very much for your participation. Do you have any questions about the study?"

To implement this strategy, as part of this task, you will develop a Script, just like for a movie or a play: a list of who says and does what at each step of the experiment. The script is not included in the final research report or in the published version. It's used here to help plan the experiment in more detail. Submit it as a separate document.

Sample Script

<Participants arrive>

"Hello everyone, please be seated"

<Participants sit down. Experimenters pass out consent form>

"I am going to pass out a consent form for this experiment. Please read the form and sign the bottom if you agree to further participate in this experiment."

<Participants read and sign consent form. Experimenters collect consent forms>

"I am now going to pass out a questionnaire, please answer the questions as accurately as possible. When you are finished turn it over and leave it on you desk."

<Pass out questionnaire and wait for participants to complete it>

"I am now going to pass out two papers to you, one containing a story and the other blank. Please keep the paper with writing face down until instructed to turn it over."

<Pass out both papers, blank and sheet containing text>

"You will have 1 min 45 s to read the text. After the time is up, turn the paper back over and I will come and collect them. When I collect you paper I will also give you a pen you will be required to write with. You will then write on the blank sheet what you remember from the story. You may now turn over your paper and begin reading."

<Time 1 min 45 s>

"Stop. Please turn you paper face down and I will come collect them."

<Collect the papers and pass out the pens>

"With the pen that was given to you please write what you remember from the story. When you are finished turn you paper face down and raise you hand. At this time I will come collect your answer and pen.

<Wait for participants to complete their responses>

<After all data is collect and study is over>

"Thank you for participating in this study. The goal of this study was to examine how personality types and musical distractions affect reading comprehension. Does anyone have any questions?"

<Answer any questions>

"Thanks for coming. You are free to leave at this time."

4.4 Design and Analyses

An extremely important part of planning an experiment is deciding which techniques will be used to analyze the data and exactly what kinds of data those techniques require. Many too many people happily go out and collect data and then panic when they don't know how to analyze it. Also, if you don't plan the analyses ahead of time, you run a serious risk of not collecting the right data. Then you have to go back and collect more, which is very time consuming and stressful. That's why we talked about the experimental design first.

Think ahead for a minute. You'll end up with (for example) 15 participants in each of 4 experimental conditions. For each participant you'll have both the background questionnaire and the measures that you generated from their responses to the experiment. This is your data set. How will you analyze it statistically?

One question that comes up is "Do I *have to* do statistics?" The short answer is "Yes." At the very least, to see how they're used and to learn to do them yourself.

<u>Experimental Design</u>. When you did your experimental design it was also a plan for doing statistical analyses. In our case, the plan is to use Analysis of Variance (ANOVA) – that's what we planned the data collection for. Most of you will be using a simple two- or three- factor design. Here you need to specify what factors correspond to your independent variables and how many levels (or groups) there are for each factor.

So, in our simple case, you'll have (for example) Gender and Music as between-subjects factors, where each has two levels. This is just re-stating your design as a plan for analysis.

<u>Statistical techniques</u>. Most of you will be doing Analysis of Variance (ANOVA). Why use ANOVA? For one thing, it's the most widely used technique in experimental psychology. For another, it's the technique of choice for comparing groups like "Male" and "Female" or "Narrative

text" and "Procedural text". Another (strong) reason is that we planned our data collection specifically for this technique.

If we had factors that were measured on a continuous scale, like Age and IQ, then we would have two choices. We could sacrifice some information by forcing the factors into groups (like "Older" and "Younger") so that we could use ANOVA. Or we could keep the continuous-scale factors and move to another statistical technique like regression.

There are very many options for statistical analysis. The main point here is that you need to choose your statistical approach first and then build your data collection method to fit that approach.

<u>Interpretation</u>. If there is a significant difference due to your factor(s) – a main effect – what does that mean? The direction of the effect will be important – think through each scenario: group A performs significantly more than group B, group B performs significantly more than group A, or no difference. What will each kind of result mean? If there are two factors or independent variables, then you have to consider what a significant interaction or joint effect means – when they create significant differences jointly. (See Mitchell & Jolley, 2005, Ch. 9 for more discussion)

5. Writing up your Methods

PLEASE do not call this section your "Methodology"! "Methodology" is something totally different: it's the branch of the Philosophy of Science that studies scientific methods.

Scientists understand how difficult it is to do reliable experimental research. There are a range of decisions and tradeoffs that have to be made at each step of planning, collection, and analysis. It's important to show in your Methods section that you're aware of the potential problems and choices at each step of the process.

Previous sections talked about the different parts of the Methods section. This section focuses on putting them together.

Goals of the Method section

The Method section has several goals:

- To make sure that *you* know how you will proceed at every step of data collection and that you have documented all of the steps that you did take, for future reference.
- To make sure that the readers have a *very clear* idea of how you collected your data. In fact, your description should be clear enough for the interested reader to reproduce your experiment and find similar results. This is called *replicability*. If other people can reproduce (or *replicate*) your results, then they are more likely to believe your conclusions.
- To convince the readers that you were careful and systematic in thinking through your methods, so that they can believe your results and conclude that you are a clear-thinking, competent professional who does reliable work.

Working toward these goals builds your methodological credibility and makes the reader more likely to accept your results and conclusions.

Parts of the Method section

The outline below shows the standard parts of a Method section. (Imagine that each dash represents a paragraph. Talk about only one topic in each paragraph.) The section titles should be included in your Method section, according to the APA norms. The comments in <angle brackets> provide suggestions about what topics to cover in each paragraph. Chapter 1 of the APA Publication Manual (p. 17 ff) provides some more general information about this section.

The Method section usually makes reference to appendices that appear at the end of your paper, so you can consider them to be "parts" of the Method section, as well.

Finally, to help you collect your data more systematically, you need to develop a step-by-step ***script*** (like for a movie or play) of what you will say and do at each step in your data collection procedure. This is very important to have but it does NOT appear as a part of a research paper. You should submit the script as a separate document.

So, you'll be submitting two separate documents:

1) a Method section with appendices and

2) a Script.

Here's a standard outline for a Method section. There is more information about each section in the other parts of this Task.

Method

- <introduction>

Participants

-

Materials

- <stimuli>

- <testing materials>

- <background questionnaire>

Procedure

-

-

Design and analyses

- <experimental design and dependent measures>

- <statistical analyses>

[Note: Each appendix starts on a separate page]

Appendix A. Background questionnaire

Appendix B. Consent form

Appendix C. Stimuli

Appendix D. Testing materials

Verb tenses

For the planning phase and writing the Proposal (your next task), all of your Method section should be in the **future tense** because you're describing future work.

Ex: The participants *will* read a story and *write* a summary of it afterwards.

For the reporting and publication of your study, all of your Method section should be in the **past tense** because you'll be reporting on work that's already been done.

Ex: The participants *read* a story and *wrote* a summary of it afterwards.

Writing up your Participants section

To describe the participants in your study, you need to answer all of the following questions.

- What's the *population*? Who will you be studying? What kind of people do you want to make general statements about?
  - American adults? Young women? Race-car drivers? Crack users? Psych majors?

- What's the *sample*? Why *these* specific participants? How will you choose them? What characteristics should they have to be representative of the population?
    - Give each participant a **background questionnaire** to have evidence that they really do have these characteristics. Ask about characteristics that are relevant for your process.
    - *Representativity* is the most important factor here: do the few participants that you test have the same characteristics of the population, i.e., are they representative of the population? You need to provide evidence and arguments that they are. "Yes" is nowhere near good enough. A background questionnaire is a start.
    - *Random sampling* is a powerful technique to help assure representativity. Ideally, you'd be able to choose your participants in a totally random way from a master list of everyone in your population.
    - Generally, in class projects we use *convenience sampling*: we're happy to get anyone who will participate. This makes the research more practical, but leads to sacrifices in generalizability.
- Will the participants be grouped? How?

> Give the groups descriptive names like "Male" and "Female", not "Group A" and "Group B".
>
> Do NOT use "Group A" and "Group B" (or "Group 1" and "Group 2", etc.) to refer to groups of participants.

None of your readers will know what you're talking about! Use more descriptive terms, like *Males* and *Females*, the *Picture group* and the *No-picture group*, etc. If your readers can't understand which group is which, they'll never believe your results and they will conclude that *you* are too confused to know what you're doing.

You should *not* talk about groups in the Participants section unless they're groups of *different kinds of participants*.

☞Be careful *not* to mix information from the different sections of the Methods. The participants section should focus only on the characteristics of the participants, not what they do or what was done with them.

☞Don't use hyphens to talk about age ranges. Ex: "…between the ages of 18 - 30". Rephrase your sentence *without* the hyphen.

Writing up your Materials section

The materials section of the Methods must include a description of the stimuli, any distractors, and the testing materials. You should describe the materials and explain how you chose them to increase external validity.

A copy of the exact stimuli, distractors, and testing materials that you will use have to be included as appendices to your Method section (except if they are video or audio). They will also appear in an Appendix to the Proposal and to the final research report (again, except if they are video or audio).

The *stimuli* are the materials that participants are supposed to pay attention to and react to. The word "stimuli" is plural; the singular is "stimulus".

You may also be using *distractors*: materials that participants aren't supposed to pay attention to. Please note that it's spelled with *-or* even though MS Word wants you to put *-er*.

☞Be sure to explain exactly *why* you chose the stimuli and distractors that you chose.

You will also use some kind of *testing materials* to measure what's going on with your process. Your testing materials can be as simple as "Write everything that you can remember here." or as complex as 30 multiple-choice questions. Multiple-choice questions are very convenient but are *a really poor way* to measure comprehension. To focus on different sub-processes of comprehension, you need to use *different kinds of questions*: factual questions to get at semantic interpretation and questions that require the reader to combine information from different parts of the text or prior knowledge, to assess knowledge integration. Standardized reading-comprehension questions like those on the SAT actually work well only if you give each person dozens of them; even then, they don't tell you much at all about *why* or *how* readers had difficulty.

☞Be sure to explain exactly *why* you chose the testing materials that you chose.

☞Be careful *not* to mix information from the different sections of the Methods. The materials section should focus on the characteristics of the materials, not what was done with them. Be sure to cite a source for each of your materials if you don't make them yourself.

Consent forms are difficult to write. Almost all of you explained clearly in the consent form exactly what the participant will do and why. *That will invalidate all of your data immediately*. Also, there's a space for the title of your project, which also states why you're doing the experiment. The best strategy here is to avoid mentioning your factors: describe what the participants will do and mention your process.

☞On the consent form, don't explain that you're investigating the effects of x and y on your process. If you do, then the participants can often feed you the results that they think you want, rather than the results that you need.

Packets of materials. Several of you had the practical idea of putting everything the participants will use into a neat little packet so you can hand it out at the beginning: instructions, stimuli, response sheets, questionnaires, everything. This is very convenient for the experimenter. BUT, it's usually a bad idea because you lose control of what the participants can use when. They *will* look ahead before you tell them to. They *will* take notes even though you said not to. Your job is to outwit your participants and get them to do things *your* way. The most effective strategy is to give them *only what they need* (and nothing else) at each step of your procedure.

Background questionnaires. *Never* ask for people's names because it violates their right to total anonymity. You have to have several very good reasons for me to allow you to ask their names.

Don't waste time by asking irrelevant questions. Ask questions about factors that you think will affect how well the participants can do your tasks or your process. Names don't affect your process.

Make sure that the questions are very simple and very easy to understand. Otherwise you get strange answers and have to throw out that part of the data.

Writing up your Procedure section

The following sections describe the parts of your data collection and analysis procedures that you have to specify now.

The Procedure specifies the tasks that the participants will carry out, the setting in which the experiment will take place, and the steps that the experimenter will take to make measurements and analyze the data. When you write up the procedure you need to answer the following questions.

Procedure. What will happen when during data collection and analysis?

a. Tasks. What will the participants have to do? Why these tasks?

b. Setting. Where will the participants be tested? Why these tasks?

c. Measurements. What will you be measuring? How will you be measuring it? Why?

d. Design and Analyses. How will you organize and analyze the data?

Remember that you need to write up the procedure in two different ways:

a) a summary of the procedure goes in the Procedure subsection of the Method section. It includes information about tasks, instructions, setting, measurements, and design and analyses. Information about each section follows.

b) a precise, step-by-step script including the exact words that the experimenter says, and the actions carried out by the participants, at each point in the experiment. This is NOT included in your research paper, but is essential in planning your experiment.

The script is *not* part of your Methods section or research report. It is *a separate document* that we use just for planning and data collection. Don't even mention it in your research report.

☞You should describe your procedure only once and then describe the differences in the other conditions. One group did a wonderful job of describing the procedure in a very meticulous, very detailed way. More detail is much better than less. BUT, you only have to include the details that might possibly affect your process. "The experimeter will press the play button" is too much detail. "The music will start before the participants begin to read." is fine.

☞This is not school any more. There are no tests, instructors, or examiners. Your participants have different *tasks* to do.

Instructions. Clear instructions are difficult to write. You have to use very short, very simple sentences to be sure that the participants will understand easily. Don't use passive voice or any technical terms at all. If you're wordy or vague, then the participants will do the wrong thing and you'll have to throw out your data. It happened to several people last semester alone.

Give your participants a few minutes to ***study*** the texts that they're supposed to understand or memorize. Don't tell them just to "read" them. Also, tell them *before they start* that they will have to show that they understand and remember all the information in the text. That gives them a specific goal to try for.

Design and experimental conditions

Some students are *very* creative and come up with some very "unusual" ideas for experimental designs, all of which will give you *enormous* headaches. There's a reason that there are some example designs in the Task Package: you're supposed to use them, usually with different factors. In fact, you have to give me additional, very good reasons for doing something different.

By the way, you don't need (and shouldn't have) a specific *control group (or control text, etc.)*. **If you do have one, eliminate it from your design.** We're doing more refined, sophisticated experimental designs than a simplistic treatment/control experiment. Remember to ask in class *why* you don't need a control group.

Note that when *any*thing (except participants) is different from one experimental condition to another, you're adding a new factor and making your experiment more complex. You should ONLY STUDY TWO factors for this experiment. You may study three if you can explain why you need the extra one. **Review everything that changes from one experimental condition to the next. Now fix your proposal to make sure that *at most two things change* from one condition to the next.**

Further Resources on Specifying your Methods

Bunge, M. 1967. *Scientific Research* (2 vols.) New York: Springer Verlag.

Christensen, L. 2004. *Experimental Methodology*. Boston, MA: Pearson Education.

Jackson, S. 2006. *Research Methods and Statistics: A critical thinking approach*. Belmont, CA: Thomson Wadsworth.

Krathwohl, D. 1988. *How to prepare a research proposal*. Syracuse, NY: Syracuse University Press. [especially Chapter 4]

Kumar, R. 1996. *Research Methodology*. Newbury Park, CA: Sage.

Lammers, W. & Badia, P. 2005. *Fundamentals of Behavioral Research*. Belmont, CA: Thompson Wadsworth.

Leedy, P. & Ormrod, J. 2005. *Practical Research: planning and design [8th Edition]*. Upper Saddle River, NJ: Prentice-Hall.

Mitchell, M. & Jolley, J. 2005/2007. *Research Design Explained*. Belmont, CA: Thompson Wadsworth.

Rudestam, K. & Newton, R. 1992. *Surviving your dissertation*. Newbury Park, CA: Sage.

Salkind, N. 2006. *Exploring Research*. Upper Saddle River, NJ: Prentice-Hall.

Appendix A: Sample Consent Form [no IRB permission]

Agreement to Participate in Research

Responsible Investigator(s): ______________________________

Topic of the Study: ___________________________________

For a class on Research Methods, you have been asked to participate in a research study investigating [explanation of the purpose of the research].

You will be asked to [describe what will be required of subjects, where and when the study will occur, and what materials and/or devices will be employed].

[Include a short description of any reasonably foreseeable risk or discomforts to the subjects, or a statement that no risks are anticipated. Please be aware that emotional discomfort is considered to be a "risk" of which subjects must be informed.]

[Include a short description of any direct benefits to the subjects or to others which may reasonably be expected from the research, or a statement that no discernable benefits are expected. General feelings of reward from being of help to research are not direct benefits. However, you may add that these are possible, indirect benefits, if applicable.]

No information that could identify you will be included in any reports of this study.

[Compensation for participation in the study (amount, nature, and reason), if any. Otherwise, please state that there is no compensation for participation.]

Questions about this research may be addressed to [name of the responsible investigator, email, area code, and phone]. Complaints about the research, about research subjects' rights, or about research-related injury may be presented to Prof. M. L. Dillinger, Department of Psychology, San José State University [mike.dillinger@sjsu.edu].

Your consent is being given voluntarily. You may refuse to participate in the entire study or in any part of the study. No service of any kind, to which you are otherwise entitled, will be lost or jeopardized if you choose to "not participate" in the study. If you decide to participate in the study, you are free to withdraw at any time without any negative effect on your relations with any participating institutions or agencies. At the time that you sign this consent form, you will receive a copy of it for your records, signed and dated by the investigator.

Your signature on this document indicates agreement to participate in the study.

The signature of a researcher on this document indicates agreement to include the above named subject in the research and attestation that the subject has been fully informed of his or her rights.

______________________________ ____________________

Participant's Signature Date

______________________________ ____________________

Researcher's Signature Date

______________________________ ____________________

Researcher's Signature Date

Notes on the Consent Form

• Be careful *not* to provide the participant(s) with details about the *goals* of the experiment. Instead, if they ask questions, provide details about the *tasks* that they will be carrying out.

• If the consent form is more than one page, each non-signature page must be initialed by the participant. Supply a line at the lower right labeled "Initial" for this purpose, as shown below:

Example 1: ______

Initial

or, Example 2: Initial ______