Cognitive Psychology
Fall Laboratory Manual

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Overview

The laboratory activities in this manual provide cognitive psychology students with the opportunity to act as participants and experimenters in several research activities. Each activity is a replication of a classic experiment in cognitive psychology and/or a demonstration of a specific research methodology used in the study of cognitive processes. We then aggregate the data from the class and compare the results to previously published research findings.

Goals of the lab exercises

The aim of the laboratory activities is to encourage you to think critically about theories and research in cognitive psychology. You are encouraged to raise questions and to suggest alternative viewpoints! By completing these activities, you will gain a better understanding of the methods used by cognitive psychologists, the types of research questions that cognitive psychologists study, and the results that are typically obtained. You will also obtain an understanding of some of the general factors involved in research design as well as specific methods and techniques of data interpretation.

Each lab activity is worth **ten points**:

2 points – Quiz
At the start of each lab there will be a short multiple-choice quiz covering the study topics that are posted on the website for that week. The aim of the quiz is to encourage you to study the material on a regular basis, rather than cram on the day before an exam. You must arrive on time to lab – if you arrive late, you will not be allowed to take the quiz.

2 points – Contributing to class discussion
After each lab activity is completed, there is a group discussion based on questions in the lab manual. The aim is to help you verbally clarify the material and think carefully about it. You are expected to contribute to the discussion by answering questions, responding to other students, asking new questions, offering new insights, and generally participating with enthusiasm. Points will be awarded based on your participation in this discussion.

6 points – Homework assignment
There is a homework assignment for each lab activity. The homework questions are on the web page, and you will submit your answers via the web page before you attend your next scheduled lab. Homework will only count for labs you attend.

- *Homework receipt*: When you submit your homework, you will be directed to a web page indicating the time and date you sent the assignment, along with a record of the work you sent. You must print/save this page and keep it as proof that you completed the assignment. If a discrepancy arises, this is the only acceptable proof that you've completed an assignment.
- *Late homework*: Late homework will be penalized by 1 point per day unless you have a valid documented excuse. Days that occur during weekends and holidays still count (e.g. if the work is due on Friday and you submit it on Monday, you will lose 3 points). You are advised to submit your homework early. Encountering last-minute computer problems will not be accepted as an excuse for late homework.
- *Spelling and grammar*: Your answers must be in complete, grammatically correct sentences. Points will be deducted for poor spelling and grammar, so please make sure you proofread everything you turn in. You are advised to use a word processor to type your answers, and then copy them into the web page. This way you can use a spell checker before submitting your assignment. It also allows you to save your work as you go, in case of a computer crash.
- *Makeup labs*: If you have an approved absence, you will be allowed to make up the missed lab during the dedicated makeup week at the end of the semester. Only students with prior authorization will be allowed to make up missed labs. Homework for authorized makeup labs is due by noon on the Wednesday of finals week. In addition to submitting the homework questions via the web page, you must email the answers to the discussion questions to Dr. Braje by noon on the Wednesday of finals week (brajewl@plattsburgh.edu).

Laboratory Activity #1: Reaction Time

Objectives

- Understand the different types of reaction time measures
- Understand how reaction time can be used to make inferences about processing
- Experience participating in a reaction time study

Introduction

Like most psychologists, cognitive psychologists are interested in studying behavior. What makes this particularly difficult in the case of cognitive psychology is that we are studying the "behavior" of the mind, rather than something that we can directly observe. For example, we can directly observe whether people obey orders given to them by an authority figure, but we cannot directly observe the decision processes that occur in their minds as they do this.

In order to study what is happening in the brain, cognitive psychologists measure outward behavior and use that to *infer* what the brain is doing. For example, if Jim takes much longer to obey orders than Jenny does, we might infer that Jim is thinking more about whether he wants to follow the orders; or Jim may have a harder time understanding the orders; or Jim may have not been paying attention to the orders; etc.

One direct measure that cognitive psychologists often rely upon is *reaction time* (abbreviated *RT*). This refers to the *amount of time it takes you to respond to a stimulus* (in most studies, these are simple auditory or visual stimuli). There are three main types of RT:

> **Simple RT**
> With Simple RT, there is one stimulus, and one response. For example, a shape (any shape) appears on the screen, and you have to press a button as quickly as you can once it appears. This type of RT tells you how long it takes from sensing the stimulus to making a motor response to the stimulus. It is typically the fastest type of RT – you simply have to react as quickly as you can.
>
> **Go/No-go RT**
> With Go/No-go RT, there are several stimuli, but only one requires a response. For example, there may be 8 shapes (circle, square, etc.). You have to press a key ("go") only when a square appears. If it is any other shape, you do nothing ("no-go"). This type of RT tells you how long it takes to sense the stimulus, identify which stimulus it is, and make your response. It typically takes a bit longer to respond in this case, because you now have the added step of *identifying* the stimulus.
>
> **Choice RT**
> With Choice RT, you have several stimuli and several responses. For example, there may be a square and a circle. If the square appears you have to press one key, and if the circle appears you have to press a different key. This type of RT tells you how long it takes to sense the stimulus, identify which stimulus it is, decide what type of response to make, and make your response. It usually takes the longest because you must identify stimulus *and* select the right response.

In today's lab, you will experience these three types of RT measurements. The aim of this first lab is simply to expose you to some methodology that will be referred to throughout the course. In the experiments, you will view a small window on the computer screen. The entire window will turn a particular color, and you will have to respond to that color in either a simple, go/no-go, or choice RT paradigm. The on-screen instructions will give you more details.

Program
Online Psychology Lab
http://opl.apa.org

Instructions

1) Open Chrome (NOT Explorer—the program will not run with Explorer).
2) Go to the Psy 321 page; click on *links to online labs*.
3) Select today's lab, *Reaction Time*.
4) Enter **6542** for the class ID.
5) Enter your gender and age.
6) Click "yes, I wish to participate."
7) Follow the onscreen instructions to complete all 3 tasks. Be sure to read through everything carefully!
8) When the experiment is finished, click on *Save Data*, unless you have reason to believe there is a problem with your data. If you are not sure, check with your TA before clicking on anything.
9) Once your data have been sent successfully, you can quit the program.
10) You will be able to obtain the data in class on Monday.

Discussion questions

Remember, the Discussion questions are for your own use—you will not need to hand these in. The aim of the discussion is for you to further explore and clarify the material with the help of your classmates and TA. The Discussion points you earn are based on your level of participation in the discussion. You should aim to answer at least one question as well as respond to what other students say. Even if another student has answered a question, you can always add your own thoughts and/or information—be sure to take the initiative and speak up!

1. What was the independent variable in this experiment? What was the dependent variable?

2. Describe each of the 3 tasks. Which task did you think was the easiest? Why? What data do you need to look at to find out if that task really was the easiest?

3. Before each colored screen was presented, there was a brief delay. The length of this delay varied slightly – sometimes it was longer than others. Why do you think this was done?

4. The order of the tasks was randomized. Why was this necessary?

5. With reaction times, higher values mean longer reaction times, i.e. slower responses. If a person's average reaction time for a Simple RT task was 0.89 seconds, and her average reaction time for a Choice RT task was 1.44 seconds, on which task did she perform "better?"

6. Many things can influence how quickly a person responds. Describe some factors that might influence a person's reaction time. Would these factors increase or decrease reaction time? Why should these factors have this effect?

Homework questions

Remember – the answers to these questions must be submitted through your web page before you attend the next lab (Lab 2).

1. What was the prediction for this experiment? Do the class data support the prediction? [2 pts]
2. In this experiment, some participants will naturally respond more quickly than others. Explain why these individual differences are NOT a problem for the interpretation of our data. [1 pt]
3. Describe one way an experimenter can influence the speed-accuracy trade-off. [1 pt]
4. Use the class data to calculate the time to identify the color. Show your calculations. [1 pt]
5. Use the class data to calculate the time to choose the response. Show your calculations. [1 pt]

Laboratory Activity #2: Mental Rotation

Objectives

- Experience participating in a mental rotation task
- Understand how theories can be tested by evaluating the results of experiments
- Understand how response times can be used to determine the mental representations of objects
- Test one of the prominent theories of mental representation

Introduction

You almost never get the same view of an object twice. So how do you recognize an object from a new viewpoint? One idea is that the visual system stores *canonical views* of an object in memory, and then "mentally" rotates a new view to check for a match with the stored view. If this is true, then the time to accurately identify an object should grow with the rotation angle between the stored view and the new view.

We can formulate a specific version of this hypothesis, and then design an experiment to test it. It has been known for several decades that human observers do in fact behave as if they are doing mental rotation when identifying whether a figure is the same as a standard figure or not. Shepard and Metzler (1971) measured the time required for observers to recognize that two drawings were of the same object, as a function of rotation angle. They did their experiment with perspective drawings of 3D objects that could be rotated in 3D. They found that the participants' reaction time increased as the angle of rotation between the two objects increased, implying that the participants were "mentally rotating" the two objects to see whether they were the same or not.

We are going to do a version of this mental rotation study. Our goal is to find out how the time to tell whether one figure is a rotated version of another figure depends on the amount of rotation. In the experiment, you will view 2 figures. They will either be identical figures, or one will be a mirror image of the other. One may also be rotated relative to the other. Your task will be to decide whether the two figures are the same or not. You should try to be as fast as you can, because your reaction time will be measured. But you also want to make as few mistakes as possible.

References

Cooper, L. A. (1975). Mental rotation of random two-dimensional shapes. *Cognitive Psychology, 7*, 20-43.

Shepard, R. N., & Cooper, L. A. (1982). Mental Images and Their Transformations. Cambridge, MA: MIT Press/Bradford Books.

Shepard, R. N., & Metzler, J. (1971). Mental Rotation of Three-Dimensional Objects. *Science*, *171*, 701-703.

Tarr, M. J., & Pinker, S. (1989). Mental rotation and orientation-dependence in shape recognition. *Cognitive* Psyc*h*ology, *21*, 233-282.

Program

Online Psychology Lab
http://opl.apa.org

Instructions

1) Open Chrome (NOT Explorer—the program will not run with Explorer).
2) Go to the Psy 321 page; click on *links to online labs*.
3) Select today's lab, *Mental Rotation*.
4) Enter **6542** for the class ID.
5) Enter your gender and age.
6) Click "yes, I wish to participate."
7) Follow the onscreen instructions. Be sure to read through everything carefully!
8) When the experiment is finished, click on *Save Data*, unless you have reason to believe there is a problem with your data. If you are not sure, check with your TA before clicking on anything.
9) Once your data have been saved successfully, you can quit the program.
10) You will be able to obtain the data in class on Monday.

Discussion questions

1. What kind of strategy did you use to perform the task? Did you "feel" like you were mentally rotating the figures?

2. What were the independent variables in this experiment?

3. What were the dependent variables? Which DV is the most relevant to the hypothesis we are testing?

4. Draw a graph of the *expected* relationship between rotation angle and response time.

5. What other kinds of stimuli might we use in this type of experiment? How would different stimuli affect the results?

6. What are some real-world tasks that might require you to use mental rotation?

Homework questions

1. What was the main prediction for this experiment? Do the class data support the prediction? [2 pts]
2. What would the propositional code predict for this experiment? [1 pt]
3. Use the procedures discussed in class to calculate the rate of rotation (in degrees/second) for males. Use the data from 0 and 180 degrees. Show how you arrived at your answer. [1 pt]
4. Use the procedures discussed in class to calculate the rate of rotation (in degrees/second) for females. Use the data from 0 and 180 degrees. Show how you arrived at your answer. [1 pt]
5. What was the prediction for male vs. female reaction time? Was the prediction supported? [1 pt]

Laboratory Activity #3: Rubber Hand Illusion

Objectives

- Experience the classic rubber hand illusion
- Consider the methodology involved in the illusion
- Think about factors that contribute to the effectiveness of the illusion
- Evaluate ideas about consciousness

Introduction

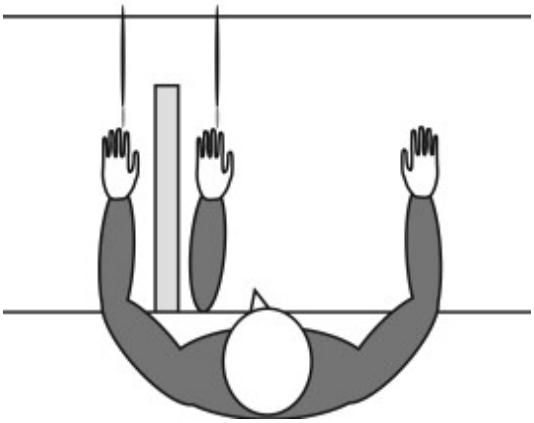
In 1998, Matthew Botvinick and Jonathan Cohen produced an illusion in which they were able to convince people that a rubber hand was their own hand. They did this by simultaneously stroking the person's real hand (which was hidden from view) and a rubber hand (which was visible). People began to feel that the fake hand was their own! One thing the illusion tells us about is how the brain integrates information from the senses – your sight, touch, and sense of body position all need to be combined for the brain to represent the body. It also makes us think about the notion of our own consciousness and self-awareness. In today's lab, you will attempt to replicate this classic illusion.

Reference

Botvinick and Cohen (1998). Rubber hands 'feel' touch that eyes see. *Nature*, 391, p. 756.

Instructions

1) For this lab, you need to get together with a partner.
2) Each pair should have one rubber hand, a towel, a barrier and 2 paintbrushes.
3) You will take turns being the experimenter and participant. You can choose who will be the participant first.
4) Participant: Position yourself as shown in the diagram. [Note: these instructions are for a rubber LEFT hand. Please reverse everything if you have a rubber RIGHT hand.] You should have both arms on the table, with your LEFT hand hidden behind the barrier, and your RIGHT hand visible to you. The rubber hand should be placed in view in front of you, as if it were your actual left hand.



5) Have the experimenter help you drape the towel over your left shoulder and over the wrist of the rubber hand. This helps to make it less obvious that the rubber hand is detached from your body – i.e. it helps to increase the strength of the illusion.
6) Please note – due to supply limitations, all rubber hands have the same skin tone. The rubber hand may not match your own skin tone particularly well. This is okay – the illusion typically works even when the hand looks different. We will talk about this issue more during the discussion.
7) Experimenter: Sit across the table from the participant. You will be using the paintbrushes to stroke the participant's LEFT (hidden) hand at the same time as the rubber hand. The strokes need to be as synchronized as possible – make sure you are doing the same thing at the same time to both the real and fake hand.
8) When everyone is ready, the TA will have everyone start together. You will continue with the synchronized stroking for 5 minutes. The TA will tell you when you stop. It may seem like a long time, but you need to stick with it to make the illusion work (in the original study, they did this for 10-30 minutes, so consider yourselves lucky!) Everyone must be quiet during this time – no talking is allowed.
9) When the TA has called time, the participant should immediately answer the questions on the next page.
10) Once the participants have completed the questions, switch roles so that the other person can be the participant.

Participant Questionnaire
For each item below, please indicate the response that best describes your experience, using the following scale:

-3	-2	-1	0	+1	+2	+3
strongly disagree			*neutral*			*strongly agree*

During the experiment, there were times when:

	ANSWER
1. It seemed as if I were feeling the touch of the paintbrush in the location where I saw the rubber hand touched.	
2. It seemed as though the touch I felt was caused by the paintbrush touching the rubber hand.	
3. I felt as if the rubber hand were my hand.	
4. I felt as if my real left hand were drifting towards the rubber hand.	
5. It seemed as if I might have more than one left hand or arm.	
6. It seemed as if the touch I was feeling came from somewhere between my own hand and the rubber hand.	
7. It felt as if my real hand were turning rubbery.	
8. It appeared visually as if the rubber hand were drifting towards my real left hand.	
9. The rubber hand began to resemble my own real hand in terms of shape, skin tone, freckles, or some other visual feature.	

Now, please rate how similar the skin tone of the rubber hand is to your own skin tone, using the scale below (circle your response):

1	2	3	4	5	6	7
Very different from my skin tone						*Very similar to my skin tone*

Discussion questions

1. Describe your experience of the rubber hand illusion. If you did not experience the illusion, why do you think this was the case?

2. All of the rubber hands used in this class had the same skin tone. Do you think the strength of the illusion might depend on how closely this skin tone resembled your own? What other factors (visual or otherwise) might increase or decrease the strength of the illusion?

3. Besides simply asking people how strongly they experience the illusion, what other measures could we use to test whether people really feel like the rubber hand is their own hand?

4. You didn't do anything with your right hand (the non-stroked hand). Do you think it matters whether that hand is on the table in view during this procedure? Why or why not?

5. What does this kind of illusion suggest regarding "out-of-body experiences" that people have reported?

Homework questions

1. What was the main prediction in this study? Did the data support the prediction? [2 pts]
2. What did we predict regarding the skin tone of the fake hand? Did the data support the prediction? [1 pt]
3. A control group is a group that is treated just like the experimental group, except that it does not get the treatment that is expected to produce the effect (illusion). If we were to conduct this study using a control group, what would we have the participants in that group do? [1 pt]
4. How could you make use of the principles underlying this illusion to deal with a real-world problem or situation? [2 pts]

Laboratory Activity #4: Short-term Memory

Objectives

- Experience the memory span task used to study human memory
- Learn about the limited capacity of short-term memory
- Learn about different factors that influence memory capacity

Introduction

One model of memory suggests that there are three stages of memory: a sensory store, a short-term store, and a long-term store. Sensory store holds a large amount of strictly-physical information for a very brief period. Short-term store holds a limited amount of sound-based information for a short period of time (a few seconds). For example, if someone tells you a phone number, you may try to remember it for just a few seconds by rehearsing it in your head, long enough to write it down on paper or to dial it. The phone number would be in your short-term memory. Memories that last longer (up to several years, or even forever) are in long-term store. These include things like you brother's name or some of the details of your first date.

In today's lab, you will participate in a *memory span task*. This is a classic measure of how much you can hold in your short-term memory. It involves viewing several stimuli, and then reporting them in the correct order. The more you can remember, the larger your memory span. Typically the memory span is around 7 (meaning you can correctly remember 7 items in order).

In the lab, we will examine how different types of stimuli influence your memory span. There will be five different types of stimuli: numbers, letters that sound different, short words, letters that sound the same, and long words. Research has shown that memory span is typically longer for the first 3 types of stimuli than for the last 2 types.

Program
Francis, G., Neath, I., MacKewn, A., & Goldthwaite, D. (2004). *CogLab*, Thompson/Wadworth.

Instructions
1) Start the *Coglab* program.
2) Under the *Short-term Memory* experiments, click on *Memory Span*.
3) Enter your name when prompted.
4) Read the instructions (from the Instructions menu). Make sure you fully understand the task before you begin!
5) Press the *Next Trial* button when you are ready to start the experiment. Note that you cannot correct mistakes, so be very careful in pressing buttons!
6) When you are finished, your data will be displayed in a window. Copy the data below.

Item type	**Final list length**
Numbers	_____
Letters sound different	_____
Letters sound similar	_____
Short words	_____
Long words	_____

Discussion questions

1. What do your data *in general* indicate about the capacity of your short-term memory? (Capacity means how much it can hold).

2. What was the independent variable in this study? What was the dependent variable?

3. In which condition was your memory span the largest? The smallest? Why do you think these conditions produced this type of memory span?

4. What special techniques did you use (or could you use) to try to remember the stimuli? Do these techniques change the capacity of your short-term memory?

5. During the experiment, you likely found yourself mentally rehearsing the stimuli (saying them to yourself over and over) in order to remember them. Why might a researcher want to prevent people from doing this? What could a researcher do to prevent people from doing this?

Homework questions

1. What was the prediction regarding the types of stimuli and memory span? Do the class data support the prediction? [2 pts]
2. Why do we expect your memory span to be shorter for long words? [1 pt]
3. Why do we expect your memory span to be shorter for letters that sound the same? [1 pt]
4. Give a specific example of how you could use *chunking* to increase your memory span <u>for letters</u>. Note that you must go beyond just describing what chunking is to answer this question. [1 pt]
5. Create a bar graph of the class results for the five conditions (draw NEATLY by hand on graph paper, or use a computer package). Make sure to label the axes. Everything must be plotted on a single graph. Hand your graph in during class on Wednesday or to your TA in lab. Please put your NAME and SECTION on your paper. You must do YOUR OWN graph. [1 pt]

Laboratory Activity #5: Levels of Processing

Objectives

- Experience participating in a timed judgment study
- Understand the levels of processing theory of memory
- Learn to test alternative theories by comparing research data with theoretical predictions
- Understand the need for studying some cognitive phenomena via an incidental task

Introduction

For today's laboratory, it is important that you remain naïve with respect to the predictions. Therefore, a full explanation of the theory and procedures will not be given here. You can obtain this information at the end of the lab, as well as in class on Monday. Please do not read ahead for this lab, as doing so may make your data invalid. Please do not tell other students in the class about this lab, so that they can remain naïve as well.

In this laboratory exercise, you will be asked to answer yes/no questions about simple English words. There will be 3 types of questions:

1) determine whether a word has a certain pattern of vowels and consonants; this deals with the *form* of the word.
2) determine whether a word rhymes with another word; this deals with the *sound* of the word.
3) determine whether a word belongs to a certain conceptual category; this deals with the *meaning* of the word.

Full instructions will be given on the computer screen at the beginning of the exercise. You should try to be as accurate as you possibly can. Your reaction time will be recorded, but you should stress accuracy over speed of response. Try to get all the questions correct. Be sure you fully understand the task before you begin!

References

Craik, F.I.M., & Lockhaart, R.S. (1972). Levels of processing: A framework for memory research. *Journal of Verbal Learning and Verbal Behavior, 11*, 771-684.

Craik, F.I.M., & Tulving, E. (1975). Depth of processing and the retention of words in episodic memory. *Journal of Experimental Psychology, 104*, 268-294.

Program

Computer Laboratory in Memory and Cognition , J. Keenan & R. Keller

Instructions

1) Run the *Memory & Cognition* program.
2) Choose *Levels of Processing 1*.
3) When you are prompted, tell it to begin the experiment.
4) Read the directions carefully. You can use the "/" key to indicate "yes," and the "z" key to indicate "no." Also note that "c" stands for "consonant" and "v" stands for vowel.
5) When you finish, hit "Continue" to get to the data screen. Record your data below, and also record them on the sheet to pass in.

Question Type	**Encoding stage**		**Recognition stage**
	# Correct	**Reaction Time**	**# Correct**
Form – true			
Form – false			
Rhyme – true			
Rhyme – false			
Category – true			
Category – false			

# of false recognitions: _____

6) When you have your data recorded, return to the previous menu. The program will ask you if it is OK to continue and that your data will be lost. Say "yes."
7) Return to the main menu, then exit the program.

Discussion questions (please do not read until after you've completed the experiment)

1. What were the independent variables in this experiment?

2. What were the dependent variables?

3. Which type of encoding decision seemed easiest for you to make? Do your data (response times) support this?

4. Which type of decision produced the best recognition memory? How would you account for this?

5. The instructions at the beginning of this experiment did not indicate that you would later be tested to see how well you recognized the original words. Did you suspect that you might have to remember them? Why do you think you were not informed? What would you have done differently had you known?

6. Why do you think we recorded the total number of false recognitions?

Homework questions

1. What was the prediction for this experiment? Do the class data support the prediction? [2 pts]
2. The multi-store (Atkinson-Shiffrin) model of memory predicts that if you spend more time studying an item, it will stay in STM longer, and will therefore be more likely to be transferred to LTM and be remembered. In our class data, which condition had the longest encoding times? Which condition was remembered the best? What does this imply for the multi-store (Atkinson-Shiffrin) model? [2 pts]
3. Previous research has shown that people tend to remember words to which they make a YES (TRUE) response better than words to which they make a NO (FALSE) response. Is this pattern evident in the class data? Why do you think YES items tend to be remembered better than NO items? [1 pt]
4. The participants in this experiment were all college students. How do you think the results would differ if this experiment were run on people in the same age range but who had not attended college? Explain why. [1 pt]

Laboratory Activity #6: Encoding Specificity

Objectives

- Experience the facilitating effect of retrieval cues in a recall task
- Learn about two factors that affect the extent to which various cues facilitate recall
- Understand the use of a between-groups design

Introduction

How good is your memory? That may depend on how we *test* your memory! There are many different ways in which your memory can be tested.

- *Free recall* test: you are simply asked to recall something from your memory. For example, "What is the name of your 5th-grade teacher?"
- *Cued recall* test: you are given a hint, or cue, to help you remember something. For example, "Her name is a type of bird."
- *Recognition* test: you are given several items, and you have to choose the one that you remember. For example, you are given "Jones, Smith, Robin" and you have to select the correct name of your teacher.

Recognition tests tend to be the easiest type of test, and *free recall* tests tend to be the hardest, with *cued recall* falling in between. In this lab we will focus on *cued recall* tests. When a cue is presented, it is likely to bring certain things to mind, which you can then recognize as correct or incorrect. This explains why it is generally easier than a *free recall* test. However, some cues are likely to be better than others. For example, saying "her name starts with a consonant" is probably not as helpful as saying "her name is a type of bird." In the laboratory exercise today, we will examine the effectiveness of different types of cues on memory.

References

Smith, S.M., Glenberg, A. & Bjork, R.A. (1978). Environmental context and human memory. *Memory and Cognition, 6*, 342-352.

Tulving, E. & Thomson, D.M. (1973). Encoding specificity and retrieval processes in episodic memory. *Psychological Review, 80*, 352-373.

Program

Francis, G., Neath, I., MacKewn, A., & Goldthwaite, D. (2004). *CogLab*, Thompson/Wadworth.

Instructions

There will be two phases in this experiment: a *Study phase*, during which you are to learn target words, and a *Test phase*, in which you will be asked to recall those words.

In the Study phase, you will be shown either single words, or pairs of words. The single word or second word in the pair will be in all capital letters—these are the *Target* words–you are to try to remember them. For pairs of words, the first word is the *Cue*, which you can use to help you remember the Target.

In the Test phase, you will see either single words (Targets) or pairs of words (Cues and Targets), and you will have to decide whether the Targets (in all capitals) had been presented in the Study phase. The cues, if presented, may or may not be the same ones you saw during the Study phase.

To run the experiment:

1) Run the *Coglab* program.
2) Select *Encoding Specificity* from the *Memory Processes* section.
3) Enter your name when prompted.
4) Read the instructions from the Instructions menu. If you are unsure about anything, be sure to ask your TA.
5) Press the space bar to run the experiment when you are ready.
6) When you finish, your data will be displayed along with a brief description of the predictions. Read through the explanation and record your data below.

Study phase	Test phase	Record your data:
Alone	Alone	
Alone	Weak	
Alone	Strong	
Weak	Alone	
Weak	Weak	
Weak	Strong	
Lure	Alone	
Lure	Weak	
Lure	Strong	

Discussion questions

1. What is meant by a "cue?"

2. What is the difference between *strong* cues and *weak* cues?

3. What were the independent variables in this experiment? What was the dependent variable?

4. Why do we expect you to perform best with the "strong" cues in the Test phase for words presented alone during the Study phase?

5. Why do we expect you to perform best with the "weak" cues in the Test phase for words presented with "weak" cues during the Study phase?

6. What memory techniques did you use to remember the paired words?

7. Why do you think you can remember better when you are given cues?

Homework questions

1. What does the *encoding specificity principle* predict for words learned with a "weak" cue in the Study phase? [1 pt]
2. What does the associative strength principle predict for words learned with a "weak" cue in the Study phase? [1 pt]
3. For words learned with "weak" cues in the Study phase, did the class remember more when tested with strong cues or weak cues? Which hypothesis does this support–associative strength or encoding specificity? [1 pt]
4. For words learned with no cues in the Study phase, did the class remember more when tested with strong cues or weak cues? Which hypothesis does this support–associative strength or encoding specificity? [1 pt]
5. How might the encoding specificity principle, rather than the associative strength principle, account for the effectiveness of "strong" cues in the Test phase for words learned with no cues in the Study phase? [1 pt]
6. The police are trying to get Mr. Smith to remember everything he said and did during the argument that eventually led to his wife's death. Some officers argue that Mr. Smith should first be returned to the scene of the crime, and then, while there, be asked to recall everything that happened. Others want to simply suggest possible actions to Mr. Smith to see if he recognizes any of them as what occurred. In light of the findings of our laboratory exercise, which of these two methods should be more effective in getting Mr. Smith to remember the information? Explain your answer. [1 pt]

Laboratory Activity #7: False Memory

Objectives

- Understand how fragile memory can be.
- Examine the reconstructive nature of memory.
- Participate in a demonstration of a classic memory experiment.

Introduction

Today's lab will be described after you have completed the experiment. In order for the demonstration to work, it is important that you remain naïve with respect to the exact manipulations.

References

Deese, J. (1959). Influence of inter-item associative strength upon immediate free recall. *Psychological Reports*, *5*, 305-312.
Deese, J. (1959). On the prediction of occurrence of particular verbal intrusions in immediate recall. *Journal of Experimental Psychology*, *58*, 17-22.
Roediger, H.L. III & McDermott, K.B. (1995). Creating false memories: Remembering words not presented in lists. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *21*, 803-814.

Program
Francis, G., Neath, I., MacKewn, A., & Goldthwaite, D. (2004). *CogLab*, Thompson/Wadworth.

Instructions
1) Run the *CogLab* program.
2) Under the *Memory Processes* experiments, click on *False Memory*.
3) Enter your name when prompted.
4) Read the instructions (from the *Instructions* menu). Make sure you fully understand the task before you begin!
5) When you are finished, your data will be displayed. Copy your data below:

	Percentage recalled
In original list	
Normal distractor (not in list)	
Special distractor (not in list)	

Overview of the experiment (do not read until you have completed the experiment)

Today's lab is based on studies involving implanting memories. Recent literature has focused on how easy it is to create a memory for something that never actually occurred. Such memories are sometimes called *false memories*. The memory feels completely real to the person –s/he will typically express high confidence in remembering the item.

In the experiment, you first studied several lists of words. Afterwards, you were given a recognition test to see which words you remembered. You may have noticed that the words in each list seemed to be related to each other. The words in each list were related to another word called the *critical associate* (the program labels this the "special distractor"). This is a word that all of the words on the list had in common. For example, the list might have contained the words *dress*, *pretty*, *niece*, *sister* – all words that are related to the critical associate *girl*. The critical associate, however, was never actually presented to you for studying. We are interested in seeing whether you recognized the critical associate as a word from the studied list – if you did, then you formed a false memory!

The prediction is that the percentage of times you remember the critical associate (special distractor) will be higher than the percentage for the other (not special) distractors. It is also probably equal to or a bit smaller than the percentage for the items that were actually presented.

Hand in your data when you are done.

Discussion questions

1. What was the independent variable in this experiment? What was the dependent variable?

2. Why do we need to know how many of the (not-special) distractor words you recognized?

3. How might semantic cues explain the formation of false memories in this experiment?

4. Some people are more suggestible than others. How do you think suggestibility would influence the likelihood of a person forming a false memory? Why?

5. What does the phenomenon of false memory tell us about memory in general?

6. Can you think of any examples where you had an incorrect memory for something, or where your memory for an event clearly contradicted somebody else's?

Homework questions

1. What was the prediction in this experiment? Was it supported by the class data? [2 pts]
2. How can the phenomenon of false memory explain people supposedly uncovering (false) repressed memories of past abuse? [1 pt]
3. Why do you think we are so susceptible to forming false memories? [1 pt]
4. What can you do to protect yourself from forming false memories? [1 pt]
5. What do these findings suggest regarding eyewitness testimony used in trials? [1 pt]

Laboratory Activity #8: Semantic Memory

Objectives

- Experience participating in a lexical decision task
- Understand how response times can be used to measure the structure of mental representations
- Examine one theory of knowledge representation

Introduction

One area of cognitive psychology explores how we represent and retrieve our knowledge about the world. For example, you "know" that grass is green. But how is that knowledge stored in the brain? And if you were asked what color the grass is, what processes occur that allow you to answer the question correctly? How humans accomplish this seemingly simple and automatic task is still in the process of being understood.

One common method for studying knowledge representations is the *lexical decision task*. In this task, the observer is presented with either a real word or a pseudo-word (something that is pronounceable but is not a word, e.g. *fong*). The observer has to determine as quickly as possible whether the stimulus is a word or not. In order to do this, the observer needs to search through his/her mental store of words (the *lexicon*) to see whether the stimulus is present.

One question we can ask is how the words are organized in the lexicon. Are they stored in alphabetical order, like a dictionary? By how long they are? By meaning? Many researchers believe that words are organized by meaning. That is, words that are related to each other (e.g. bread and butter) are stored near each other in the lexicon, and words that are unrelated (e.g. bread and nurse) are stored farther away from each other. Meyer and Schvaneveldt tested this notion using a lexical decision task. They predicted that if two words on successive trials were closely related to each other, then observers would be faster making a lexical decision about the second word. Their prediction was supported. In today's lab, you will run through a similar type of experiment.

Reference

Meyer, D. E. & Schvaneveldt, R. W. (1971). Facilitation in recognizing pairs of words: Evidence of a dependence between retrieval operations. *Journal of Experimental Psychology, 90,* 227-234.

Program

Francis, G., Neath, I., MacKewn, A., & Goldthwaite, D. (2004). *CogLab*, Thompson/Wadworth.

Instructions

1) Run the *CogLab* program.
2) Run the *Lexical Decision* program.
3) Enter your name when prompted.
4) Read the instructions carefully. Make sure you fully understand the task before you begin!
5) When you are finished, read through the explanation.
6) Click on the *Data tables* tab to see your data. Copy your data below:

Condition	Reaction time (ms)
Associated words	
Unassociated words	
Word then nonword	
Nonword then word	
Two nonwords	

Discussion questions

1. What was the independent variable?

2. What was the dependent variable?

3. Were your results consistent with the expectation?

4. Explain what a *lexicon* is.

5. Why do the non-words need to be included in this experiment?

6. What results should you expect for conditions involving nonwords? Why?

Homework questions

1. What was the prediction in this experiment? Was it supported by the class data? [2 pts]
2. Explain in your own words what a lexical decision task is. [1 pt]
3. Explain in your own words how the spreading activation model can account for the expected difference between related and unrelated words in this experiment. [1 pt]
4. This lab demonstrated that words can prime each other when they are related in terms of meaning. Describe two other ways that words might prime each other. [2 pts]

Laboratory Activity #9: Comprehension

Objectives

- Learn about the role of context in comprehension
- Compare a constructivist and nonconstructivist view of language
- Experience one procedure used to study language comprehension

Introduction

Today's lab will involve reading three passages of text, and then answering several questions about each one. For the lab, it is important that you remain naïve regarding the purpose. The lab will therefore be explained to you after you have completed it.

Program
Computer Laboratory in Memory and Cognition , J. Keenan & R. Keller

Reference
Schallert, D.L. (1976). Improving memory for prose: The relationship between depth of processing and context. *Journal of Verbal Learning and Verbal Behavior, 15,* 621-632.

Instructions

1) Start the *Memory and Cognition program*.
2) Select *Constructive Process I* and click *Start*.
3) Select *Begin the Experiment* and click *Continue*.
4) Read the introduction.
5) Follow the instructions to run through the practice trials. Be sure to read the practice conclusion and instructions for the lab. Click *Continue* to start the lab.
6) When you are finished, read through the interpretation on the screen and copy your data in the table below and on the sheet to hand in.

	Strong meaning	Weak meaning	No title
Strong responses			
Weak responses			

Overview (do not read until after you have finished the lab)

This experiment is a modified replication of an experiment reported by Schallert (1976).

Students who are just beginning to study language processing often assume that meaning is inherent in words, and that comprehension simply involves extracting meaning from the words. This is a *nonconstructivist* view of language comprehension. According to the this view, the meaning of a linguistic input (like a word, sentence, or paragraph) is the body of knowledge associated with each of its elements. Comprehension is viewed as a passive process. The *constructivist view*, on the other hand, assumes that meaning is constructed from the linguistic knowledge associated with the input plus the *context* in which the input occurs. Context can include knowledge of the other words in the sentence/paragraph, as well as knowledge about the situation in which the input is occurring (such as who is making the statement, or when and where it is being said). According to the constructivist view, the meaning of any particular word, sentence, or even paragraph can be influenced by the context in which it occurs.

The purpose of today's experiment was to demonstrate the constructivist view. In the lab, you read three paragraphs. Each was written so that it could be interpreted in two ways. The titles of the paragraphs were constructed so as to bias you towards one of the two interpretations. There were also six ambiguous words in each paragraph, whose interpretations ought to be biased by the context (title). By examining your performance on the multiple-choice questions, we can assess the extent to which the titles biased your interpretations.

Below are the paragraphs and their two possible interpretations; the ambiguous words are underlined.

Story 1: Worries of a Baseball Team Manager or Worries of a Glassware Factory Manager

> In the last days of August, we were all suffering from the unbearable heat. In a few short weeks, our daily job had turned from a game into hard labor. "All we need now," said the manager in one of his discouraged moods, "is a strike." I listened to him silently but I could not help him. I hit a fly. "I suppose things could get even worse," he continued. "Our most valuable pitchers may crack in this heat. If only we had more fans, we would all feel better, I'm sure. I wish our best man could come home. That certainly would improve everyone's morale. Especially mine. Oh, well, I know a walk would cheer me up a little."

Story 2: An Evening with Four Poker Players or Practice Night for a Musical Quartet

> Every Saturday night, four good friends get together. When Jerry, Mike, and Pat arrived, Karen had just finished writing some notes. She quickly arranged the cards and stood up to greet her friends at the door. They followed her into the living room and sat down facing each other. 'They began to play. Karen's recorder filled the room with soft and pleasant music. Her hand flashed in front of everyone's eyes and they all noticed her diamonds. They continued for many hours until everyone was exhausted and quite silly. Jerry made his friends laugh as he theatrically took a bow, entertaining them all with the wildness of his playing. Finally, Karen's friends went home.

Story 3: Planning a Prison Escape or Strategy in a Wrestling Match

> Rocky slowly got up from the mat, planning his escape. He hesitated a moment and thought. Things were not going well. What bothered him most was being held, especially since the charge against him had been weak. He considered his present situation. The lock that held him was strong but he thought he could break it. He knew, however, that his timing would have to be perfect. Rocky was aware that it was because of his early roughness that he had been penalized so severely - much too severely from his point of view. The situation was becoming frustrating; the pressure had been grinding on him for too long. He was being ridden unmercifully. Rocky was getting angry now. He felt he was ready to make his move. He knew that his success or failure would depend on what he did in the next few seconds.

Although there were two interpretations for each story, Schallert (1976) found that the first one listed above for each story was always the more dominant interpretation when no title was presented. This more dominant interpretation is referred to as the *strong meaning*, while the other is referred to as the *weak meaning*.

You also answered 8 multiple-choice questions for each story. Two were just filler questions, and the other six tested your interpretation of the six ambiguous words. For these questions, one of the alternatives corresponded to the strong meaning, one to the weak meaning, and the other two were unrelated wrong responses. We were interested in seeing whether the context (title) would bias your choice of strong vs. weak responses.

Discussion questions

1. What was the independent variable? Describe each of the conditions.

2. What was the dependent variable?

3. This study used a within-groups design. What is a within-groups design? Why was it used here?

4. What do you think was randomized in this experiment?

5. How often were you *incorrect* in the Strong, Weak, and No Title conditions? Is your error rate the same in all three conditions? Do you think it should be?

6. What effect do you think a reader's background would have on his/her interpretation of the stories? For example, suppose the subjects for this experiment consisted of music majors and students from the wrestling team. How would this affect their interpretations of the Cards/Music story and the Prison/Wrestling story?

Homework questions

1. What was the prediction for the *strong* vs. *weak* titles? Did the class data support the prediction?. [2 pts]
2. What did we expect to find for the *no title* condition? Did the class data support this? [2 pts]
3. What other factor(s) can you think of, besides paragraph title and the reader's background, that might affect the interpretation of these stories? What effect would this factor have on the results? [2 pts]

Laboratory Activity #10: Creativity

Objectives

- Experience different ways of measuring creativity
- Understand how creativity can be studied experimentally
- Consider potential difficulties encountered when studying creativity

Introduction

This lab will examine various ways of looking at creativity. You will work through two exercises that demonstrate some of the ways of measuring creativity and compare this with your self-perception of your creativity. Then, you will participate in an experiment on creativity. After each exercise, you should record your data in the appropriate place.

References

Guilford, J.P. (1967). *The nature of human intelligence*. New York: Scribner.
Mednick, S.A. (1967). *The remote associates test*. Boston: Houghton Mifflin.
Smith, S.M., Ward, T.B., & Schumacher, J.S. (1993). Constraining effects of examples in a creative generation task. *Memory and Cognition*, *21*, 837-845.

Instructions for Lab Exercises

You will work through the following exercises as a class.

1. Self-perception

Using a scale of 1-10, rate how creative you perceive yourself to be.
(1=least creativity, 5=average creativity, 10=most creativity) Self-perception rating: _____

2. Divergent Production Test

For this test, you will be shown an object. You will be given 2 minutes to write down as many possible uses as you can think of for it. It doesn't matter how outrageous your idea is – write it down! You will need a piece of paper (to write down the uses) for this exercise.

	total # of uses	# of *unique* uses
Object :_____	1) _____	2) _____

3. Remote Associations Test

In this test, you are given 3 words, and you need to figure out what word they all have in common, the word that "goes with" each word. For example, if you see *charming*, *frog*, and *valiant*, the answer is *prince* (prince charming, frog prince, prince valiant). Note that the answer word must make sense when put next to each of the 3 words; it is more than simply something they have vaguely in common (e.g. *fairy tale* is vaguely related to the three words above, but doesn't make sense right next to them). You will be given 4 minutes to see how many you can solve. Record your results below.

Number of RAT problems you were able to solve: _____

4. Creativity Experiment

For this experiment, you will each be provided with a sheet of instructions. Follow the instructions carefully. Be careful not to look at anyone else's paper, as others may have been given different instructions from you. In order for the experiment to work, you must remain naïve with respect to the experimental manipulation and hypothesis. Therefore this experiment will not be explained to you until after you complete it. Record your data on this sheet (for your own records) and on the sheet your TA will pass out.

Once you have completed all 4 exercises, copy down your data in the data sheet and turn in to your TA.

Discussion questions

1. Did your perception of your own creativity correspond to your performance on the various tests of creativity? If not, what aspects of creativity are not captured by these tests? How would you test/measure these other aspects?

2. In the Divergent Production Test, which is a better indicator of creativity: the total number of uses you identify, or the total number of *unique* uses you identify? Why?

3. What was the independent variable in the Creativity Experiment? What was the dependent variable?

4. Why do you think examples might constrain people's creativity? What, if anything, can you do to avoid being constrained by examples?

Homework questions

1. Report the correlation (i.e. the actual number) between the Divergent Production score and self-perception. Explain what this correlation means regarding the relationship between these numbers. [1 pt]
2. What was the prediction for the creativity experiment (i.e. where you drew the little creatures)? Do the class data support the prediction? [2 pts]
3. During the various creativity exercises, did you go through all four of Wallas's proposed stages of creativity? Did you go through them in the order he proposed? If not, how did your experience differ from Wallas's model? [1 pt]
4. *Incubation* is one of the stages Wallas proposed. In this lab, there was not really sufficient time for incubation to occur. In what specific ways do you think your performance would have been different had you been given more time for incubation? [1 pt]
5. One alternative to the stage view of creativity is that creativity simply involves ordinary problem-solving mechanisms. Provide an example of a process or strategy you used in this lab that would be considered an ordinary problem-solving process. [1 pt]