

LABORATORY 8

Measurements of Memory (False and Real): Recall and Recognition

Purpose

- to introduce the use of **recall** and **recognition** as measures of memory;
- to give you experience with a **free recall** task and with using **ROC curves** to analyze recognition;
- to demonstrate the phenomenon of the bowed **serial position curve**, relating our memory for information from a sequence of events to the location in the sequence in which the information was presented; and
- to raise the question of how to apply knowledge about performance on a laboratory task to understanding phenomena encountered in other settings, such as clinical practice.

Introduction

Memory plays a central role in our lives. We define ourselves in terms of memories of things we have done and the ways people have responded to us; we make decisions, take courses of action, and interact with the people and situations in our world on the basis of our past experiences; and we connect ourselves with others on the basis of shared memories. In school, of course, we are trained to remember information to use on tests and to develop skills and expertise in different areas of study. In all these uses of memory, we generally presume that our memory is reliable and will safely provide a guide for decisions and actions.

Clearly, though, memory sometimes fails—we forget a date, or misremember someone’s name. Failures of memory, whether failures to recover information that is real or failures to reject information that is imaginary, have long fascinated psychologists, because of the insights such failures provide into the way memory works. The question of memory failure became an especially significant topic in clinical contexts in the 1990s, when some therapists believed that they had helped people recover unpleasant or traumatic memories that had been repressed, whereas other therapists believed such “recovered” memories were often fictitious and created by the process of therapy.

This lab explores the nature of memory and memory failures, drawing on materials and research by H.L. Roediger III and his colleagues.

Getting Started

For this lab, you need *Recall Test Sheets* on which to write down remembered words from each list that is presented, and you need a *Recognition Memory Test Sheet*, on which to indicate whether or not you recognize each item presented in a recognition test (these sheets are included at the end of the instructions). You will also need a master list of the words presented for study and a master list of the words presented for the recognition test; these master lists will be distributed after you have completed the recall and recognition tasks.

Collecting Data

The data collection will take place in a group format. The lab instructor will read 12 lists of 15 words each, one list at a time. While a list is being read, you should listen attentively, trying to remember the words. After the list has been read, the lab instructor will tell you to recall it, at which time you should write down as many words as you can remember. You may write them in any order you wish (this procedure is known as **free recall**). You will be allowed 2-3 minutes for your recall. The instructor will signal when the recall period is finished and when to prepare for the next list.

The sequence of list presentation followed by recall will be carried out for all the lists. After all the lists have been presented, the instructor will ask you to cover all your recall sheets, and will then present you with a recognition test. For the recognition test, the instructor will read a list of words, one at a time. For each word, your task is to indicate on your recognition sheet the following:

- 1) whether the word was among the words presented on **any** of the lists you heard, in which case you should indicate with an “O” that it is *Old*, or whether instead it was not on any of the lists, in which case you should indicate with an “N” that it is *New*;
- 2) if the word is *Old*, indicate with an “R” whether you *remember* the specific moment of its presentation or indicate with a “K” that you *know* it is familiar but remember only in general terms that it was presented; and
- 3) if the word is *Old*, indicate with a number where in the list it was presented (that is, whether it was first, second, third, etc.). In the case of *know* (“K”) items, this last response will necessarily be based on your estimate of the list position, because if you actually remember the item’s presentation, you should identify it as a *remember* (“R”) item.

Suppose that your responses for the first 6 test trials were as follows: You judged the first item to be “Old”, but did not remember a specific moment when the item was presented and just felt that it seemed familiar, leading to a *know* (K) response. You also estimated that the item might have been in the 3rd position of the list. You judged the second item also to be “Old”, but were able to *remember* (R) the exact moment of its presentation, and remembered that it was in the 15th (last) position. You judged the third, fourth, and fifth items to be “New”, and no further information was required for those tests. You judged the sixth item to be “Old”, and *remembered* (R) when it was presented, judging it to have occurred in the second position in the list. With this sequence of test results, your recognition sheet should look something like this:

1. O	K	3
2. O	R	15
3. N		
4. N		
5. N		
6. O	R	2

Data Analysis

The purpose of the data analysis is to characterize the nature of your memory for the materials you were presented and to assess the nature and degree of your “false” memory.

Step 1. Score the Recall Data

To begin, you need a copy of the List Master-Page, which shows all 12 lists, with the words in each list shown in their order of presentation. Score your recall for each list separately. Examine your recall to identify words that were on the list, and next to each word correctly recalled, put the number of its position in the list. For each list, there is also a word that was not presented but which is associated with all the words that were presented. This word is shown on the List Master-Page at the top of each list and it will be referred to as a *critical item*. Examine your recall to determine if you recalled the critical item; if you did, put a “1” next to it.

Step 2. Create a Recall Spreadsheet in Excel

Open a blank spreadsheet. Starting in Cell B1, label column headings with numbers corresponding to serial positions in the list, beginning with “0” and increasing to “15”. Starting in Cell A2, label the rows with the List numbers (list #1, List #2, etc., up to List #12). For each list, go across the columns in the row for that list and enter a “1” if the word in that serial position **was** recalled and enter a “0” if the word in that serial position **was not** recalled. Remember that data for the *critical item* is entered in the column labeled “0”. Figure 1 illustrates how your spreadsheet should be organized.

Table 1. Hypothetical recall data as a function of serial position from immediate recall tests for each list in the memory laboratory exercise. Data for the critical items are shown in the column labeled 'C'.																	
Sample Spreadsheet for Scoring Recall																	
List #	Critical Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
1	0	1	1	0	0	0	1	0	0	1	0	0	0	1	1	1	7
2	1	1	0	1	0	0	0	1	0	0	1	1	0	0	1	1	7
3	1	1	1	0	1	1	0	1	1	0	0	0	1	0	0	1	8
4	1	0	1	1	0	1	0	0	0	1	1	0	1	1	0	1	8
5	0	0	1	1	0	0	1	1	0	0	1	1	0	1	1	1	9
6	1	1	0	0	1	1	0	0	0	1	0	0	1	0	1	0	6
7	1	1	0	0	0	0	1	1	0	0	1	1	1	0	1	1	8
8	0	1	1	0	1	0	0	1	0	0	1	0	0	1	1	1	8
9	1	0	1	1	0	1	1	0	1	0	0	1	0	1	1	1	9
10	0	1	0	1	0	0	1	1	0	0	1	1	0	1	1	0	8
11	1	1	0	0	0	1	1	0	0	0	1	1	0	0	0	1	6
12	0	1	0	1	0	1	0	0	0	1	0	1	1	0	1	1	8
mean	0.58	0.75	0.50	0.50	0.25	0.50	0.50	0.50	0.17	0.33	0.58	0.58	0.42	0.50	0.75	0.83	

Step 3. Calculate the proportion of recall for each position in the list

For each column of recall data, enter, in the row below the data for List #12, the formula for calculating the average of the data in that column. This formula will be

=average(List#1:List#12)

where you substitute the labels for the cells containing data from List #1 and from List #12 (in the example, these will be e8 to e19). This number will be the proportion of correctly recalled words.

Step 4. Make a Serial Position Curve

Make a graph that plots the proportion of correctly recalled words (from Step 3) as a function of serial position in the list, with positions going from 1 to 15. To make this graph in Excel, first copy the row of list serial positions (from Step 2), and paste it below the block of recall data (from Steps 1 to 3). Then copy the row with the proportion of correctly recalled words (from Step 3). Using the “Paste Special” option (in the Edit menu), with “values” selected, paste this proportion directly below the row of list serial positions.

Select both rows (the row of list serial positions and the row of proportion of correctly recalled words) and create a graph. In the Chart Wizard, select the “Scatter” option, and choose the option with symbols connected by straight lines. Make sure to create the graph on a new sheet, so you have a single page with just the graph on it. Print the graph, then draw (by hand) a horizontal dotted line to indicate the proportion of recall of “critical” items. What is the shape of the serial position curve? Does it show a primacy effect? Does it show a recency effect? How does recall of critical items compare to recall of list items? Do you show “false memory” in recall?

Step 5. Score the recognition test

To score the recognition test, you need a copy of the *Master Recognition-Page*, which lists all the items used in the recognition memory test and identifies each one as “Old”, “New”, or “Critical”. To score your recognition, you need to count how many times you responded with *Old* to each of these types of items.

How many times did you respond “Old” for all the items that were actually old? Divide this number by 24 (because the test included 24 *Old* items) to calculate your **Hit Rate**.

How many times did you respond “Old” for all the items that were actually new? Divide this number by 36 (because the test included 36 *New* items) to calculate your **False Alarm Rate for non-critical items**.

How many times did you respond “Old” for all the *critical items*? Remember, critical items were **not** presented, hence they were actually new items. Divide your number by 12

(because the test included 12 *critical items*) to calculate your **False Alarm Rate** for *critical items*. Do you show “false memory” in recognition?

Step 6. Determine how good recognition was, using d'

Convert the three proportions you calculated in step 5 (“Hit Rate”, “False Alarm Rate for non-critical items” and “False Alarm Rate for critical items”) to z-scores, using the **p to z** conversion chart. Use the z-score equivalents for the Hit Rate and the False Alarm Rate for noncritical items to calculate a value of d' . Then use the z-score equivalents for the Hit Rate and the False Alarm Rate for critical items and calculate a second value of d' .

Note: To calculate d' , change the sign of the z-scores, then subtract the z-score for Hit Rate from the z-score for False Alarm Rate.

Step 7. Make an ROC graph of your recognition memory data

Make an ROC plot that ranges from -3 to +3 on both the x-axis and the y-axis. Plot two points, one that plots the Hit Rate against the False Alarm Rate for noncritical items and one that plots the Hit Rate against the False Alarm Rate for critical items. To make this plot, first enter the two False Alarm Rates in adjacent cells in an Excel spreadsheet, then, in the cell immediately below each False Alarm Rate, enter the Hit Rate (this will be a single number that is entered twice, because there is only one Hit Rate in these data). Select all four numbers, then start the Chart Wizard and select the “Scatter” option with unconnected points. Make sure you choose to put the chart on a new sheet at the end of the choices presented by the Chart Wizard.

After the chart is made, you will need to edit it so it looks like an ROC curve. Click on the y-axis, select “Format” from the menu bar, and choose “Selected Axis”. In the window that opens, click on the Tab marked “Scale”. Change the “Maximum” to +3, the Minimum to -3, and the value at which it crosses the x-axis to -3. Then click on the x-axis, and repeat the same steps, except to make the value at which it crosses the y-axis to -3.

Lab Report

Your report of this lab will consist of:

- 1) a title page;
- 2) a results section which includes the graph from Step 4 of the Data Analysis (the serial position curve) with the graph properly drawn and labeled, the graph from Step 7 of the Data Analysis (the ROC curve) and your answers to the various questions in the Data Analysis; and
- 3) a copy of your spreadsheet (from Step 2) of the Data Analysis section.

In your results, be sure to explain the reasoning behind your answers to the questions.

Recognition Test Page 1

Test Item	Old or New?	Know or Remember?	Position
1.	_____	_____	_____
2.	_____	_____	_____
3.	_____	_____	_____
4.	_____	_____	_____
5.	_____	_____	_____
6.	_____	_____	_____
7.	_____	_____	_____
8.	_____	_____	_____
9.	_____	_____	_____
10.	_____	_____	_____
11.	_____	_____	_____
12.	_____	_____	_____
13.	_____	_____	_____
14.	_____	_____	_____
15.	_____	_____	_____
16.	_____	_____	_____
17.	_____	_____	_____
18.	_____	_____	_____
19.	_____	_____	_____
20.	_____	_____	_____
21.	_____	_____	_____
22.	_____	_____	_____
23.	_____	_____	_____
24.	_____	_____	_____
25.	_____	_____	_____
26.	_____	_____	_____
27.	_____	_____	_____
28.	_____	_____	_____
29.	_____	_____	_____
30.	_____	_____	_____
31.	_____	_____	_____
32.	_____	_____	_____
33.	_____	_____	_____
34.	_____	_____	_____
35.	_____	_____	_____
36.	_____	_____	_____

Recognition Test Page 2

Test Item	Old or New?	Know or Remember?	Position
37.	_____	_____	_____
38.	_____	_____	_____
39.	_____	_____	_____
40.	_____	_____	_____
41.	_____	_____	_____
42.	_____	_____	_____
43.	_____	_____	_____
44.	_____	_____	_____
45.	_____	_____	_____
46.	_____	_____	_____
47.	_____	_____	_____
48.	_____	_____	_____
49.	_____	_____	_____
50.	_____	_____	_____
51.	_____	_____	_____
52.	_____	_____	_____
53.	_____	_____	_____
54.	_____	_____	_____
55.	_____	_____	_____
56.	_____	_____	_____
57.	_____	_____	_____
58.	_____	_____	_____
59.	_____	_____	_____
60.	_____	_____	_____
61.	_____	_____	_____
62.	_____	_____	_____
63.	_____	_____	_____
64.	_____	_____	_____
65.	_____	_____	_____
66.	_____	_____	_____
67.	_____	_____	_____
68.	_____	_____	_____
69.	_____	_____	_____
70.	_____	_____	_____
71.	_____	_____	_____
72.	_____	_____	_____