

Experiment HP-17: Levels of Processing and Memory

Do you have a hard time remembering someone's name, information for a test, or just where you left your keys this morning? How do we memorize information? How can we help keep our memory sharp?

Memory has been studied in depth. Craik and Lockhart (1972) and Craik and Tulving (1975), discovered and expanded upon the "levels of processing model" of memory. This focuses on the depth of processing involved in memory, and predicts that the deeper information is processed, the longer a memory will last.

We generally process information in 2 main ways: shallow processing and deep processing.

- Shallow processing involves structural processing, we encode only the physical quality of something, what it looks like; and phonemic processing, we encode the sound of the object. Shallow processing only involves maintenance rehearsal, the repetition to help us hold the idea in short-term memory, and leads to fairly short-term retention of information.
- Deep processing involves semantic processing, which happens when we encode the meaning of a word and relate it to similar words with similar meaning. Deep processing involves elaboration rehearsal. This involves a more meaningful analysis of information using images, thinking, and associations, which leads to better recall. Giving words a meaning or linking them with previous knowledge leads to deeper encoding.

Thus, the idea that the way information is encoded affects how well it is remembered. The deeper the level of processing, the easier the information is to recall. It is known that semantically processed information involves elaboration rehearsal and deep processing which results in more accurate recall. Phonemic and visually processed information involves shallow

This explanation of memory is useful in everyday life because it highlights the way in which elaboration, which requires deeper processing of information, can aid memory.

- **Rework** – Put information in your own words or talk about it with someone else.
- **Method of loci** – When trying to remember a list of items, link each item to a familiar place or route.
- **Imagery** – Create an image of something you want to remember, elaborate on it and encode it visually.

The levels of processing model changed the direction of memory research. It showed that encoding was not a simple, straightforward process. This widened the focus from seeing long-term memory as a simple storage unit to seeing it as a complex processing system. This explanation of memory is useful in everyday life because it highlights the way in which elaboration, which requires deeper processing of information, can aid memory.

There are a number of criticisms of the levels of processing theory:

- It does not explain **how** the deeper processing results in better memories.
- Deeper processing takes more effort, and that may make it more likely people will remember something.
- The concept of depth is vague and cannot be observed; it cannot be objectively measured.

Even with these criticisms, recent studies have shown that deeper coding does produce better retention because it is more elaborate. Elaborative encoding enriches the memorization of an item by activating many aspects of its meaning and linking it into preexisting networks of semantic associations.

People typically spend a longer time processing the deeper or more difficult tasks. So, it could be that the results are partly due to more time being spent on the material. The type of processing, the amount of effort & the length of time spent on processing tend to be confounded. Deeper processing goes with more effort and more time, so it is difficult to know which factor influences the results.

This lab aims to look at various levels of processing and see which leads to better memory.

Equipment Required

PC or Mac Computer

IXTA, USB cable, power supply

2 – EM -220 Event Markers OR

1 – RPD-400 4-Button Response Pad

Start the Software

1. Click on LabScribe
2. Click Settings → Human Psychophysiology → CraikMemoryTest
3. Once the settings file has been loaded, click the **Experiment** button on the toolbar to open any of the following documents:
 - Appendix
 - Background
 - Labs
 - Setup (opens automatically)

Sensor Setup

1. Locate the EM-220 Event Markers and plug them into the Channel EM1 and EM2 inputs on the back of the IXTA ([Figure HP-17-S1](#)).
2. Or locate the RPD-400 4-Button Response Pad ([Figure HP-17-S2](#)) in the iWorx kit. Plug the connector in the RPD and into the Digital Inpu on the back of the IX-TA.



Figure HP-17-S1: EM-220 Event Marker.



Figure HP-17-S2 RPD-400 4-Button Response Pad.



Figure HP-17-S3: The IXTA shown with the RPD-400. If using the EM-220 Event Markers, these will plug into the EM1 and 2 ports on the TA as shown.

General Directions:

All Tests will follow the same directions.

- Subjects will be shown a series of 30 questions and 30 words
- Each question will stay on the screen for 1 sec; each word will show for 200 msec (TEST"X")
 - After the word is shown:
 - the subject will press the event marker in their right hand, or the letter "D" on the response pad, for "YES" if the word answers the question.
 - The subject will press the event marker in their left hand, or the letter "A" on the response pad, for "NO" if the word does not answer the question.
- Once the questions have been answered, the subject will be shown a series of 120 words (RECALL):
 - the subject will press the event marker in their right hand, or the letter "D" on the response pad, for "YES" if the word was one of the 30 shown previously.
 - The subject will press the event marker in their left hand, or the letter "A" on the response pad, for "NO" if the word was not shown previously.

Exercise 1: Test 1

Procedure

Warning: *In this exercise, it is important to remember to press the event marker in the correct hand (D or A) for answering YES or NO.*

1. Click on the Record button.
2. Click the **Test1** sequence on the toolbar and run the sequence to begin the sequence of questions and words.
3. Follow the general directions as outlined above.
4. After the thirty questions and answers, the sequence will end with the directions for completing the RECALL portion of the experiment.
5. Click Stop to halt recording.
6. Click on the Save button to save the data file.
7. Let your subject rest for a minute or so.
8. Click the Record button.
9. Click the **Recall** sequence on the toolbar and run the sequence to begin the sequence of words.
10. After the 120 words are shown, the sequence will end.
11. Click Stop to halt recording.
12. Click on the Save button to save the data file.

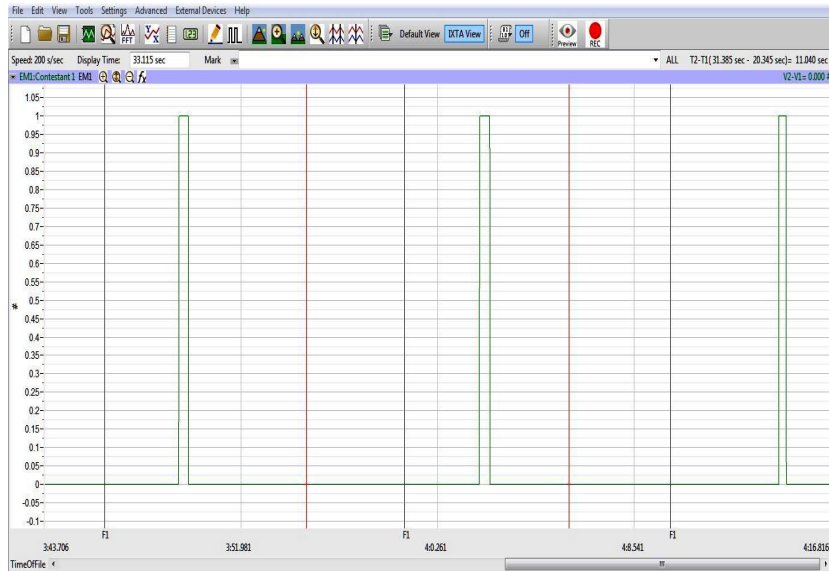


Figure HP-17-L1: Sample of what the data may look like. This sample only shows one graph of data. For this experiment, there will be two graphs of data, one representing the YES answer and one for the NO answers.

Data Analysis

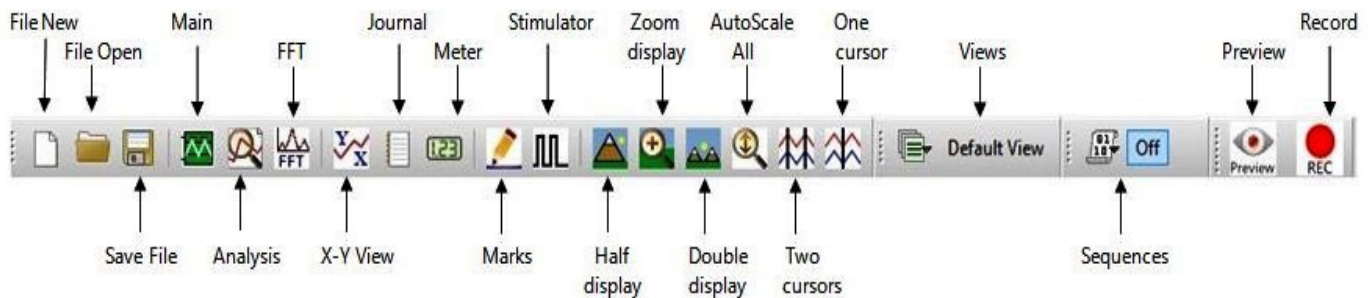


Figure HP-17-L2: LabScribe toolbar.

WORDS:

1. Click the Double Display time button until approximately 10 responses show on the screen.
2. Move one red cursor line to the mark made when the WORD was shown and the 2nd to the start of the click of the event marker or response pad. Make a notation if the word shown actually answered the question delivered.
3. Look at T2-T1 (upper right corner) and record that number.
4. Repeat for the next 9 words.
5. Repeat the procedure for the next 20 words (for a total of 30).

6. Enter the data into the table on the next page.

RECALL:

1. Move to the data where the RECALL sequence began.
2. Carefully scroll through the data looking for the YES and NO answers to whether the word was shown in the Test1 sequence.
3. Tally the YES and NO responses for the words the subject recognized as being shown from the sequence.

Questions:

1. What was the mean reaction time of the subject for answering the question?
2. What was the total percentage recall for all the words? Number of words recalled/Total shown
3. What was the percentage of words correctly identified?
4. What was the percentage of words incorrectly thought to be recalled (but were not actually shown)?

Exercises 2, 3, and 4:

Procedure

Repeat the same directions from Exercise 1.

Data Analysis

Repeat the same directions from Exercise 1.

Questions:

1. What was the mean reaction time of the subject for answering the question?
2. What was the total percentage recall for all the words? Number of words recalled/Total shown
3. What was the percentage of words correctly identified?
4. What was the percentage of words incorrectly thought to be recalled (but were not actually shown)?

It is important to keep track of the percentages between the different Exercises.

Table HP-17-L1 – Exercise 1 (Create your own data tables for Exercises 2, 3 and 4)

Image	Reaction Time (sec)	YES to question asked	NO to question asked	YES Recalled	NO Not recalled
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
17					
17					
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24					
25					
26					
27					
28					
29					
30					
Mean					