

Lab 8. Memory and Stimuli: How Does the Way Information Is Presented Affect Working Memory?

Introduction

The human body is made up of several systems that work together. These systems perform certain activities necessary for living. For example, the respiratory system (which includes the lungs) allows us to take in oxygen and get rid of carbon dioxide, and the digestive system (which includes the stomach) allows us to break down and use the food we eat. The *nervous system* is responsible for taking in information and directing the actions of other parts of the body. This system includes nerves and the brain. The nerves carry information around the body and the brain. The brain sends and receives information, controlling many different activities at the same time.

The brain gets information about the world around the body through *senses*. There are five senses: hearing, seeing, tasting, smelling, and touching. Each of these senses uses a special organ that is filled with lots of nerves. Those nerves send information to the brain that tells us what is going on in the world. The *eyes* are the organ for seeing. The eyes take in light waves to send information to the brain, and the brain uses that information to understand the world around us. But what does the brain do with that information?

Our senses respond to *stimuli*, which is the plural of *stimulus*. A stimulus is a thing or event that evokes a specific functional reaction in an organ or tissue. All things our eyes see, including the words on this page, are stimuli. Our senses take in information about the stimuli and send it to the brain by chemical and electrical signals. The brain reads that information and acts on it. The brain reads and uses the information in several ways:

- *Short-term memory* keeps information for only a few seconds. Your short-term memory handles the most basic information, like the light level in a room.
- *Working memory* keeps information for just a little longer, allowing us to organize it and make sense of it. You are using your working memory as you read this sentence.
- *Long-term memory* keeps lots of information for long periods of times, up to years and decades.

As information is processed, the brain makes connections across it and organizes it based on patterns. Using those patterns, the brain is able to take in more information faster and retain it longer. Information that is presented in a pattern makes it easier for our brains to make sense of the world.

Your Task

Design an investigation to see how much information people can store in their working memory. Your goal is to explore how the amount of information and the order in which it is presented affects what people can remember.

The guiding question of this investigation is, **How does the way information is presented affect working memory?**

Materials

You may use any of the following materials during your investigation:

- Set of cards numbered 1 through 9
- Set of memory letter cards
- Paper
- Timer

Safety Precautions

Follow all normal lab safety rules.

Investigation Proposal Required? Yes No

Getting Started

You will be given a set of cards to see how many numbers people can remember. For this test, you lay out one numbered card and give a person 20 seconds to memorize it. Cover the card with a piece of paper, and then have the person tell you the number. Lay out another card beside the first one. Give the person another 20 seconds to memorize the two numbers. Cover the card and then have the person tell you the numbers in the correct order. Keep adding more cards until the person cannot tell you the numbers in the correct order.

You will also be given a set of cards with the same group of letters on them but in different orders. For this test, lay out Card 1 in the set and give a person 30 seconds to memorize it. Take the card away and have the person tell you the letters that were on the card. Lay out Card 2 in the set and give the person 30 seconds to memorize it. Take the card away and have the person tell you the letters that were on the card. Do the same thing using Card 3.

To answer the guiding question, you will need to determine what type of data you need to collect, how you will collect the data, and how you will analyze the data. To determine *what type of data you need to collect*, think about the following questions:

- What kind of information can you get from the person telling you about what's on the card?
- What type of measurements or observations will you need to record during your investigation?

To determine *how you will collect the data*, think about the following questions:

- What types of conditions will you need to set up and how will you do it?
- During the experiment, when will you collect data and how often will you collect it?
- How will you make sure that your data are of high quality (i.e., how will you reduce error)?
- How will you keep track of the data you collect and how will you organize it?

To determine *how you will analyze the data*, think about the following questions:

- How will you connect information about people's memories to the types of cards you used?
- How will you compare subgroups?
- What type of calculations will you need to make?
- What type of graph could you create to help make sense of your data?

Connections to Crosscutting Concepts, the Nature of Science, and the Nature of Scientific Inquiry

As you work through your investigation, be sure to think about

- how scientists study systems by creating models of their structure and function,
- how the structure of living things affects the way they function,
- the way science is influenced by the society in which it takes place, and
- the specific role that experiments play in science.

Initial Argument

Once your group has finished collecting and analyzing your data, you will need to develop an initial argument. Your argument must include a claim, evidence to support your claim, and a justification of the evidence. The claim is your group's answer to the guiding question. The evidence is an analysis and interpretation of your data. Finally, the justification of the evidence is why your group thinks the evidence matters. The justification of the evidence is important because scientists can use different kinds of evidence to support their claims. Your group will create your initial argument on a whiteboard. Your whiteboard should include all the information shown in Figure L8.1.

FIGURE L8.1

Argument presentation on a whiteboard

The Guiding Question:	
Our Claim:	
Our Evidence:	Our Justification of the Evidence:

Argumentation Session

The argumentation session allows all of the groups to share their arguments. One member of each group will stay at the lab station to share that group's argument, while the other members of the group go to the other lab stations one at a time to listen to and critique the arguments developed by their classmates. This is similar to how scientists present their arguments to other scientists at conferences. If you are responsible for critiquing your classmates' arguments, your goal is to look for mistakes so these mistakes can be fixed and they can make their argument better. The argumentation session is also a good time to think about ways you can make your initial argument better. Scientists must share and critique arguments like this to develop new ideas.

To critique an argument, you might need more information than what is included on the whiteboard. You will therefore need to ask the presenter lots of questions. Here are some good questions to ask:

- What did your group do to collect the data? Why do you think that way is the best way to do it?
- What did your group do to analyze the data? Why did your group decide to analyze it that way?
- What other ways of analyzing and interpreting the data did your group talk about?
- What did your group do to make sure that these calculations are correct?
- Why did your group decide to present your evidence in that way?
- What other claims did your group discuss before you decided on that one? Why did your group abandon those other ideas?
- How sure are you that your group's claim is accurate? What could you do to be more certain?

Once the argumentation session is complete, you will have a chance to meet with your group and revise your original argument. Your group might need to gather more data or design a way to test one or more alternative claims as part of this process. Remember, your goal at this stage of the investigation is to develop the most valid or acceptable answer to the research question!

Report

Once you have completed your research, you will need to prepare an investigation report that consists of three sections that provide answers to the following questions:

1. What question were you trying to answer and why?
2. What did you do during your investigation and why did you conduct your investigation in this way?
3. What is your argument?

Your report should answer these questions in two pages or less. The report must be typed and any diagrams, figures, or tables should be embedded into the document. Be sure to write in a persuasive style; you are trying to convince others that your claim is acceptable or valid!