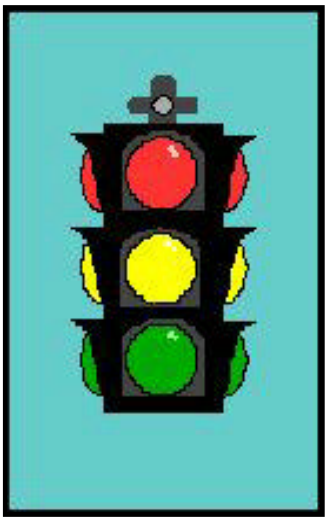
ACTIVITY CONTENTS:
Reaction Time

Reaction Time Introduction

Discovery Question: How does my reaction time change under varying conditions?



In this activity you investigate how your reaction time changes with varying environmental conditions and when perceived with different senses.

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Thinking About the Question

How does my reaction time change under varying conditions?

In sprinting, a starter uses 3 commands:

- On " Your Mark"
- "Set"
- the sound of a starting gun

A false start occurs if a racer starts before the gun is fired, and results in disqualification of the athlete. This discourages anticipation and forces athletes to react. The time between when the runner's body senses the gun and when they actually act is called "reaction time".

Different people have different reactions times. What would make one person have a different reaction time than another? Does a person respond better with one sense than with another? Do the conditions surrounding the reaction make a difference?

One way to test your reaction time and observe the affect of different stimuli is to see how quickly your can grasp a falling ruler. Go to "Investigating the Question" to see how.

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Reaction Time Materials

- metric ruler
- partner
- tape player and tapes (or other source of music)
- reaction time computer simulation (created by Noah Fields)

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Reaction Time Safety

No specifc safety features needed for this activity.

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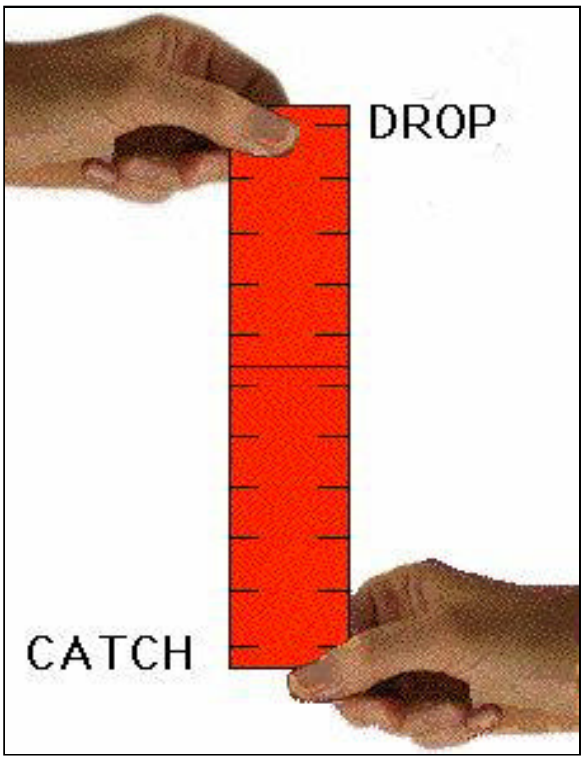
Reaction Time Investigation I

Measuring reaction time with a ruler

- **Cued by sight:**

1. Create a spreadsheet to record the results of your experiment. Refer to Technical Hints to see how to create a spreadsheet.



2. Hold a metric ruler just above a partner's open thumb and index finger, with the lowest number on the ruler at the bottom. Provide a 2 cm separation between the thumb and the index finger. Drop the ruler without warning.

3. Record the number on the ruler where your partner catches the ruler. Take all measurements from above your partner's thumb. Refer to Technical Hints to see how to fill in a spreadsheet.

4. Use the chart below to determine your partner's reaction time. Record their reaction time on the spreadsheet.

Centimeters	6	8	10	12	14	16
Seconds	0.11	0.13	0.14	0.16	0.17	0.18

Centimeters	18	20	22	24	26	28
Seconds	0.19	0.20	0.21	0.22	0.23	0.24

5. Use the spreadsheet to calculate the mean reaction time for each type of drop. In the row next to "Mean", in each column, under sight, sound, and touch enter the formula to calculate the mean reaction time for all ten trails.Refer to Technical Hints to perform an average.

6. Create a new spreadsheet for yourself. Refer to Technical Hints to open a second spreadsheet. Record your drop distance and reaction time for ten trials.

- **Cued by sound:**

1. How does reaction time change when the cue is sound rather than sight? Have your partner close his or her eyes and wait for a sound you make (like a tongue click) just as you let the ruler drop?

2. Record your partner's drop time and reaction time for ten drops on separate spreadsheets. Calculate the mean reaction time for the ten trails.

3. Record your drop distance and reaction time for ten trials. Calculate the mean reaction time for the ten trails.

- **Cued by touch:**

1. Have your partner close his or her eyes again. This time, touch his or her arm lightly with your finger just as you let go of the ruler.

2. Record your partner's drop time and reaction time for ten drops on separate spreadsheet. Calculate the mean reaction time for the ten trails.

3. Record your drop distance and reaction time for ten trials. Calculate the mean reaction time for the ten trails.

Answer Question 1 and 2 in the "Analysis".

Using mean reaction times, create a bar chart to compare the data for sight, sound, and touch cues. Refer to Technical Hints to see how to create a bar chart.

Answer Question 3 and 4 in the "Analysis".

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Reaction Time Investigation II

Measuring reaction time with a simulation

Some of you may have noticed that your results in the ruler investigation were affected by the accuracy of your timing method and device. You can use a computer simulation to get more accurate results. The reaction time simulation can measure in .001 second units!

1. Open Noah's reaction time simulation. Practice the simulation. Click on the green "GO" button to start the simulation. Click on the red "Stop" button following the beep. Your reaction time will be shown in milliseconds in the Elapsed Time box. Refer to Technical Hints to use the simulation.

2. How does a person's reaction time change when you are under different conditions or stress? Does the volume of the music affect your reaction time? Does the type of music affect the reaction time? Before you begin, decide on how to set up your investigation. After discussion in your group, write down the steps in your procedure and be prepared to explain them to your class.

3. Create a spreadsheet to record your results. Make a column for each type of music and a row for 10 trials. Create a row for mean reaction time. Refer to Technical Hints to create a spreadsheet.

4. Record you and your partner's reaction time with the simulation for ten trials while the room is perfectly quiet. Repeat the trials while listening to different types of music (e.g., classical versus rock). Record you and your partner's reaction time for ten trials the different background music.

5. Find the mean time for each type of music. Refer to Technical Hints to find an mean (average) on a spreadsheet. Using the data make a bar chart to compare the results for different kinds of music. Refer to Technical Hints to see how to create a bar chart.

6. Answer Questions 5 and 6 in the "Analysis".

Reaction Time Technical Hints

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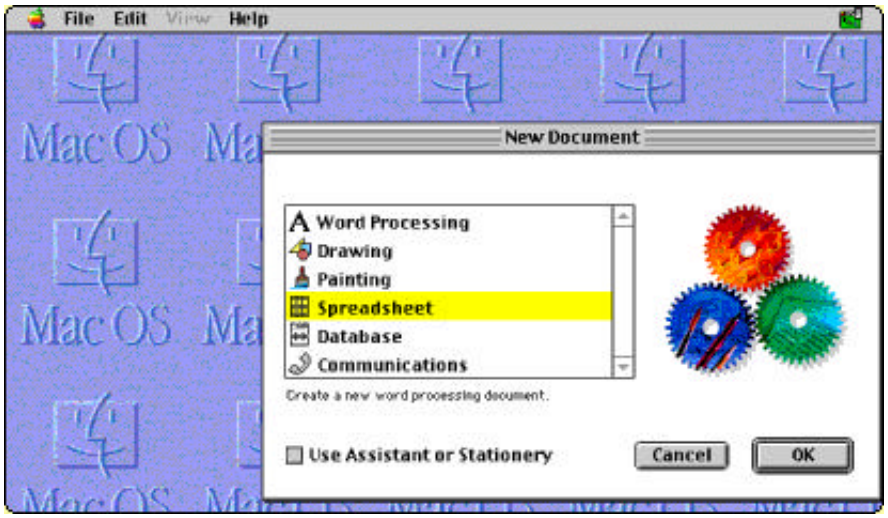
Reaction Time Technical Hints

To create a spreadsheet for ruler drop:

1. Double click on ClarisWorks. Select spreadsheet.
2. Place your name in A1 cell. In the same row, list senses (sight, sound, and touch) in neighboring cells.



3. List 1-10 for number of trials below your name. In cell A12 type Mean.

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Reaction Time Technical Hints

To fill in a spreadsheet for ruler drop:

For each trial, fill in the appropriate cell. Click in the cell, type in the number, and click on the check mark.

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D8

	A	B	C	D	E	F	G	H
1	Arthur's Trial	Sight	Sound	Touch				
2	1	0.14	0.23	0.16				
3	2	0.2	0.21	0.17				
4	3	0.19	0.2	0.18				
5	4	0.22	0.25	0.14				
6	5	0.14	0.22	0.2				
7	6	0.23	0.24	0.22				
8	7	0.22	0.2					
9	8	0.2	0.21					
10	9	0.14	0.23					
11	10	0.18	0.22					
12	Mean							
13								
14								
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20								

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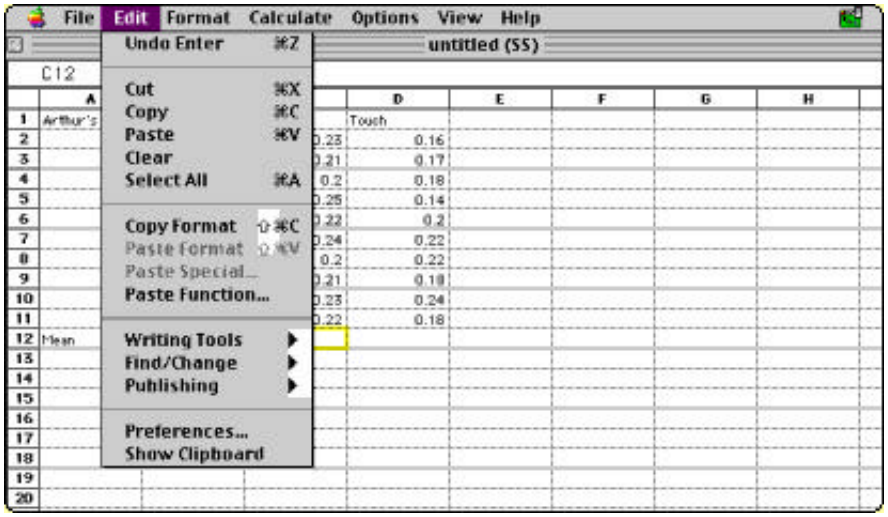
Reaction Time Technical Hints

To find an mean (average) on a spreadsheet:

1. Click in the cell that you would like to place the mean (average) value.
2. Select Paste Function from the Edit menu. Choose the Average function.
3. Highlight the numbers that you are averaging. The cells will automatically appear in the parenthesis. Delete all other numbers.
4. Click on the check mark.



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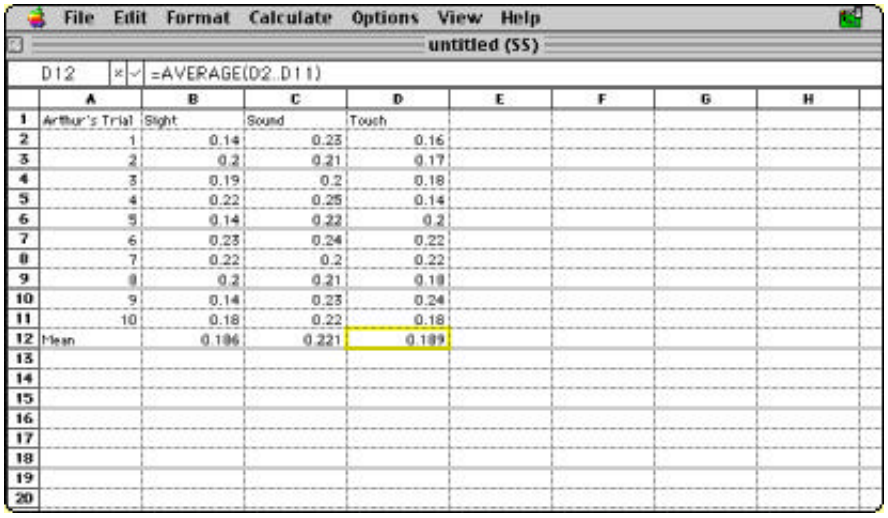
Reaction Time Technical Hints

To open a second spreadsheet:

Select New from the File menu.



	A	B	C	D	E	F	G	H
1	Arthur's Trial	Sight	Sound	Touch				
2	1	0.14	0.23	0.16				
3	2	0.2	0.21	0.17				
4	3	0.19	0.2	0.18				
5	4	0.22	0.25	0.14				
6	5	0.14	0.22	0.2				
7	6	0.23	0.24	0.22				
8	7	0.22	0.2	0.22				
9	8	0.2	0.21	0.18				
10	9	0.14	0.23	0.24				
11	10	0.18	0.22	0.18				
12	Mean	0.186	0.221	0.189				
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Reaction Time Technical Hints

To create a bar chart for ruler drop:

1. Highlight sight, sound, and touch columns.
2. Select Make Chart from the Options menu. Choose Bar Chart.
3. Click on the Axes button. Choose the X Axis button. Type Trials 1-10 and Mean in the box. Click OK.

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B1 Sight

	A	B	C	D	E	F	G	H
1	Arthur's Trial	Sight	Sound	Touch				
2	1	0.14	0.23	0.16				
3	2	0.2	0.21	0.17				
4	3	0.19	0.2	0.18				
5	4	0.22	0.25	0.14				
6	5	0.14	0.22	0.2				
7	6	0.23	0.24	0.22				
8	7	0.22	0.2	0.22				
9	8	0.2	0.21	0.18				
10	9	0.14	0.23	0.24				
11	10	0.18	0.22	0.18				
12	Mean	0.186	0.221	0.189				
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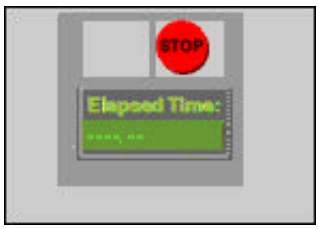
Reaction Time Technical Hints

To use the reaction time simulation:

1. Download Noah's simulation in "Materials".
2. Click on the "GO" button. It will turn bright green. Wait for the buzzer to sound and the "STOP" button to turn red before clicking on the "STOP" button.
3. Your reaction time in milliseconds will appear in the Elapsed Time box below the buttons.



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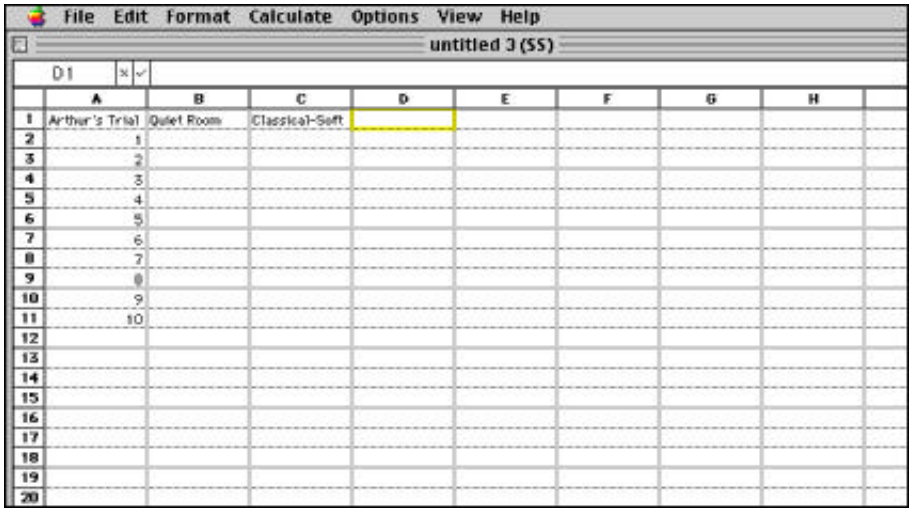
Reaction Time Technical Hints

To create a spreadsheet for simulation:

1. Open a new spreadsheet. Place your name in Cell A1.
2. After selecting the type and volume of music that you would like to use, type their description in Row 1.
3. Type in trial numbers 1-10 in Column A.
4. Type Mean in Cell A12.



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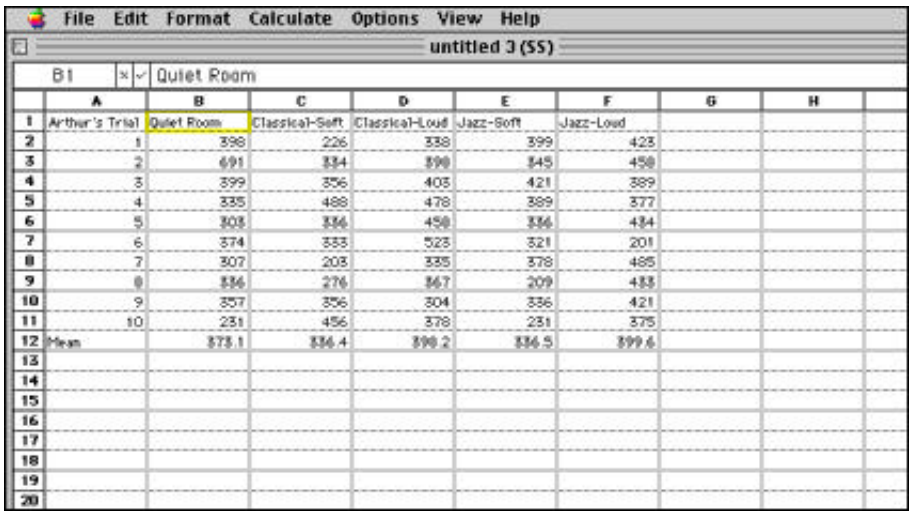
Reaction Time Technical Hints

To create a bar chart for simulation:

1. Highlight quiet,the type of music, and Mean columns.
2. Select Make Chart from the Options menu. Choose Bar Chart.
3. Click on the Axes button.Choose Y Axis button. Type Time in Milliseconds. Choose the X Axis button. Type Trials 1-10 and Mean in the box. Click OK.



	A	B	C	D	E	F	G	H
1	Arthur's Trial	Quiet Room	Classical-Soft	Classical-Loud	Jazz-Soft	Jazz-Loud		
2	1	398	226	338	399	423		
3	2	691	334	390	345	450		
4	3	399	356	403	421	389		
5	4	335	488	478	389	377		
6	5	303	336	450	336	434		
7	6	374	333	523	321	201		
8	7	307	203	335	378	485		
9	8	336	276	367	209	433		
10	9	357	356	304	336	421		
11	10	231	456	378	231	375		
12	Mean	373.1	336.4	390.2	336.5	399.6		
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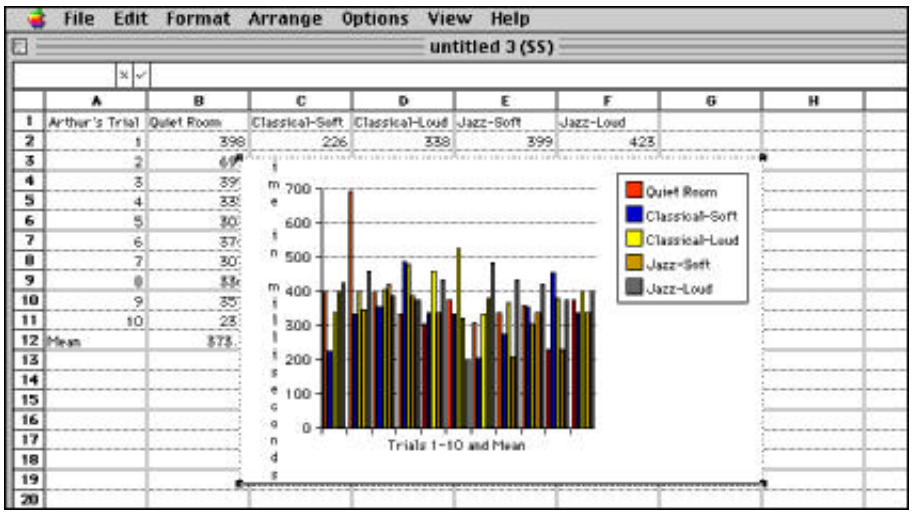
4. Enlarge graph, if necessary, by dragging the corner of the graph to size desired.



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Reaction Time Analysis

Answer the following questions on paper:

1. Look at your own data. For each cue answer the following questions:
   - What is the range (difference between the largest and smallest values) of the data for your ten trials?
   - Do you have confidence that the mean (average value) represents your typical reaction time? Explain.
2. Compare your data with your partner's. What similarities and differences to you see?
3. Look at the bar charts for you and your partner. Write a paragraph to explain your ideas about how the type of cue affects reaction time. Make sure to use your data to support your ideas.
4. Are there any other variables that affected your experimental results? Explain.
5. Look at you own data for each type of music. What variables might explain any differences? What variables might explain any differences.
6. Compare your data with your partners. Write a paragraph explaining any similarities and differences you see.
7. Compare the data for each type of music. Write a paragraph and explain your ideas about how the type of music affects reaction time.
8. Was there a difference in reaction times based on surrounding conditions? Think of occupations that demand alertness on the job (e.g., pilots, truck drivers, astronauts, etc.). What other types of stresses may affect reaction times?

Reaction Time Further Investigation

Design a test to determine the difference in reaction times between boys and girls. Does one gender respond better to one type of sense? How large a sampling group would be needed for a fair test?

Test your classmates and family members, neighbors, teachers, etc. to determine the difference in reaction times between ages. How large a sampling group would be needed for a fair test?

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