Experiment HN-1: Auditory and Visual Reflexes

Background

During our day-to-day lives we detect changes in the environment and react appropriately. An external stimulus is detected by one or more neurons, which sends the sensory information to the central nervous system, where it is processed. If a motor response is initiated, it usually involves a series of action potentials which produce a muscle contraction and a movement of one or more parts of the body. A simple reflex is perhaps the easiest of this type of stimulus-response reaction. A loud sound or something flying at your eye makes you blink, while a tap on the tendon under the knee cap produces the knee-jerk (or myotactic) reflex.

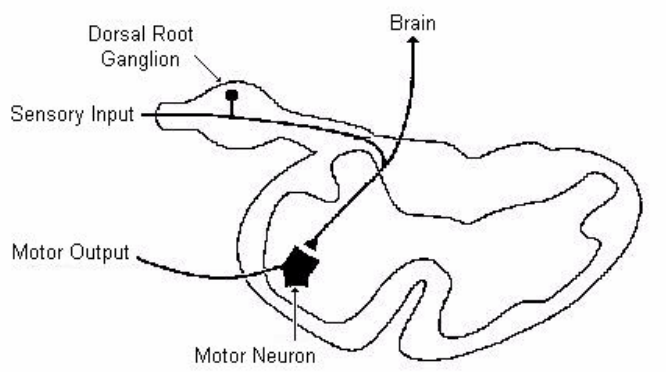

Figure HN-1-1: A cross section of the spinal cord showing the single synapse between the sensory and the motor neurons involved in the myotactic reflex.

A simple reflex like the myotactic reflex is produced via single synapses between sensory axons and motor neurons. The required circuitry for this reflex is confined to the spinal cord, as shown in Figure HN-1-1 on page HN-1-1. Sensory information also ascends to higher centers, but the brain is not necessary or required to perform the reflex. More complex reflexes usually involve additional (inter-) neurons and more than one population of motor neurons. Thus, more neurons and synapses are involved, which usually results in a longer delay between stimulus and response and often a more complex response. One example of such a complex response is the flexion withdrawal reflex, where a noxious stimulus to one leg causes withdrawal of the stimulated leg and extension of the other.

In this lab you will study the time taken between a stimulus and the response. These reaction time measurements will be made from an individual subjected to harmless visual and sound stimuli. In addition, the effect of priming and prediction will be examined.

Equipment Required

PC Computer

IWX/214 data acquisition unit

USB cable

IWX/214 power supply

EM-100 Event marker

IWX/214 Setup

1. Place the IWX/214 on the bench, close to the computer.
2. Check Figure T-1-1 in the Tutorial Chapter for the location of the USB port and the power socket on the IWX/214.
3. Check Figure T-1-2 in the Tutorial Chapter for a picture of the IWX/214 power supply.
4. Use the USB cable to connect the computer to the USB port on the rear panel of the IWX/214.
5. Plug the power supply for the IWX/214 into the electrical outlet. Insert the plug on the end of the power supply cable into the labeled socket on the rear of the IWX/214. Use the power switch to turn on the unit. Confirm that the red power light is on.

Start the Software

1. Click on the LabScribe shortcut on the computer's desktop to open the program. If a shortcut is not available, click on the Windows **Start menu**, move the cursor to **All Programs** and then to the listing for **iWorx**. Select **LabScribe** from the **iWorx submenu**. The LabScribe **Main window** will appear as the program opens.

1. On the **Main window**, pull down the **Settings menu** and select **Load Group.**
2. Locate the folder that contains the settings group, **IPLMv4.iwxgrp**. Select this group and click **Open**.
3. Pull down the **Settings menu** again. Select the **Auditory-VisualReflexes-LS2** settings file.
4. After a short time, LabScribe will appear on the computer screen as configured by the **Auditory-VisualReflexes-LS2** settings.
5. For your information, the settings used to configure the LabScribe software and the IWX/214 unit for this experiment are listed in Table HN-1-1 on page HN-1-2. These settings are programmed on the **Preferences Dialog window** which can be viewed by selecting **Preferences** from the **Edit menu** on the LabScribe **Main window.**

Table HN-1-1: Settings on the Channel Window of the Preferences Dialog Used to Configure the iWorx Recording System for Experiment HN-1.

Parameter	Units/Title	Setting	Mode/ Function
Acquisition Mode		Chart	
Start		User	
Stop		User	
Display Time	Sec	5	
Speed	Samples/Sec	200	
Channel A3	Reaction Time	√	DIN8

Event Marker Setup

1 Locate the EM-100 event marker (Figure HN-1-2 on page HN-1-2), in the iWorx kit.

2 Plug the DIN8 connector to the EM-100 event marker into the Channel 3 input of the IWX/214 (Figure HN-1-3 on page HN-1-2).

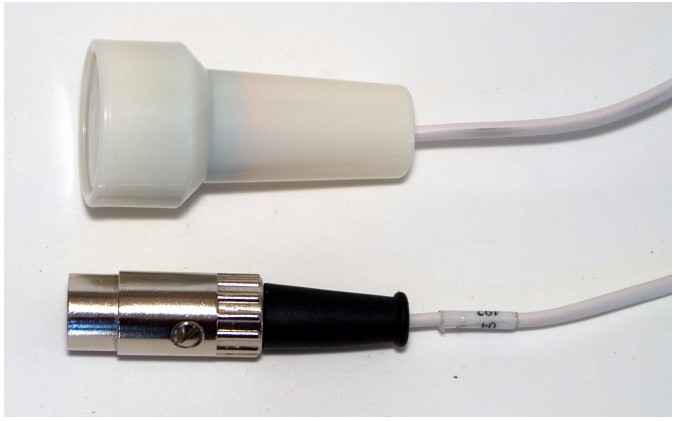

Figure HN-1-2: The EM-100 event marker.

Exercise 1: Reaction Time and Visual Cues

Aim: To measure the reaction time of a subject to a visual cue.

Procedure

1 Instruct the subject to:

- Sit in a chair and face the computer screen.
- Position a hand on the keyboard in a manner that enables the subject to push the **F1 key** as quickly as possible.
- Watch the right side of the computer screen and quickly press the **F1 key** on the keyboard when the signal generated by the event marker first appears.

2 Out of sight of the subject, another student should prepare to quietly press and release the button of the event marker. In this exercise, the subject will perform ten trials.

Figure HN-1-3: The EM-100 event marker connected to an IWX/214.

Warning: In this exercise, it is important to press and release the button of the event marker quietly because any sound could be used by the subject as a cue.

3 Type **<Subject's Name> Visual Cues** in the **Mark box** that is to the right of the **Mark** button. Press the **Enter key** to mark the recording.

4 Click on the **Record** button. Instruct the subject to press the **F1 key** on the keyboard to mark the recording as soon as he or she sees the visual cue on the right side of the computer screen (Figure HN-1-4 on page HN-1-2).

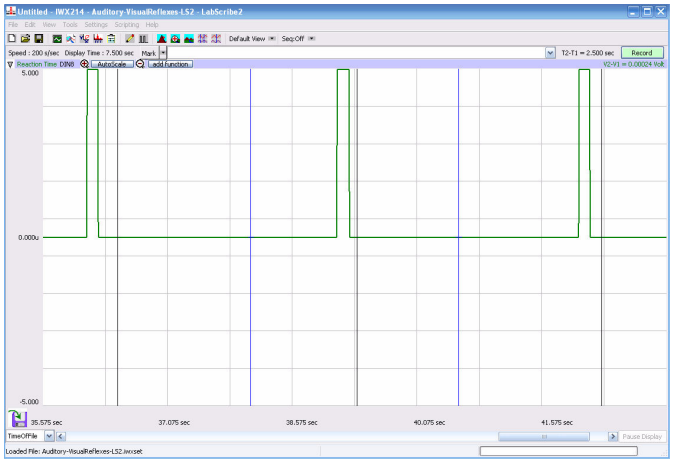

Figure HN-1-4: Three visual cues, each followed by the subject's response, are displayed on the Main window. Each visual cue is made by pushing the button of the EM-100 event marker momentarily; each response mark is made by the subject pushing the F1 key on the keyboard.

5 Instruct the subject that the exercise has begun and that a visual cue could appear on the screen at any time

6 Use the event marker to deliver ten visual cues to the subject. The cues should not be less than five seconds nor more than ten seconds apart.

7 After the tenth cue, click **Stop** to halt recording.

8 Select **Save As** in the **File menu**, type a name for the file. Choose a destination on the computer in which to save the file, like your lab group folder). Designate the file type as ***.iwxdata**. Click on the **Save** button to save the data file.

Data Analysis

1 Scroll to the beginning of the data recorded for Exercise 1 to display the first trial on the **Main window**.

2 Use the **Display Time** icons to adjust the **Display Time** of the **Main window** to show both the visual cue made with the event marker and the mark made by the subject's response on the **Main window**. This trial can also be selected by:

• Placing one cursor before the beginning of the visual cue and the second cursor after the mark made by the subject; and

• Clicking the **Zoom between Cursors** button on the LabScribe toolbar to expand the complete reaction trial to the width of the **Main window**.

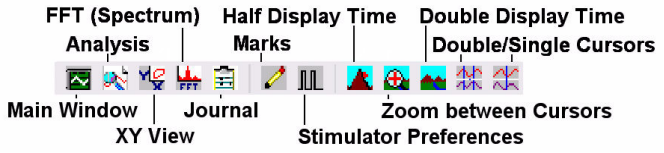

Figure HN-1-5: The LabScribe toolbar.

3 Click on the **Analysis window** icon in the toolbar (Figure HN-1-5 on page HN-1-3) or select **Analysis** from the **Windows menu** to transfer the data displayed in the **Main window** to the **Analysis window** (Figure HN-1-6 on page HN-1-3).

4 Look at the **Function Table** that is above the display of the **Reaction Time channel** displayed in the **Analysis** window. The mathematical function, **T2-T1**, should appear in this table. The value for **T2-T1** is seen in the table across the top margin of the **Reaction Time channel**.

5 Use the mouse to click on and drag a cursor to the onset of the signal used as the visual cue. Drag the other cursor over the mark made by the subject responding to the visual cue.

6 Once the cursors are placed in the correct positions for determining the reaction time, record the value for T2-T1 in the **Journal**. The value can be recorded in the on-line notebook of LabScribe by typing its name and value directly into the **Journal**. You may also record any data on separate data tables.

7 The functions in the **channel pull-down menus** of the **Analysis window** can also be used to enter the name and value for **T2-T1** into the **Journal**. To use these functions:

• Place the cursors at the locations used to measure the reaction time.

• Transfer the name of the **T2-T1** function to the **Journal** using the **Add Title to Journal** function in the **Reaction Time Channel pull-down menu**.

• Transfer the value for **T2-T1** to the **Journal** using the **Add Ch. Data to Journal** function in the **Reaction Time Channel pull-down menu**.

8 Once the reaction time in the first trial is measured and recorded, use the scroll bar at the bottom of the **Analysis window** to move the data from the second trial onto the window. If needed, use the **Display Time** icons to adjust the width of the **Analysis window** to show both the visual cue and the subject's response on the same window.

9 Repeat Steps 5 through 7 on the data from the second trial.

10 Use the same techniques used in Steps 5 through 8 to measure the reaction times from the other eight trials.

11 Once the reaction times in all ten trials have been measured and recorded, open the **Journal** and use the values to determine the mean reaction time of the subject. Discard the longest and shortest times from the data set, and determine the average of the eight remaining reaction times. Record the mean reaction time for this exercise in Table HN-1-2 on page HN-1-4.

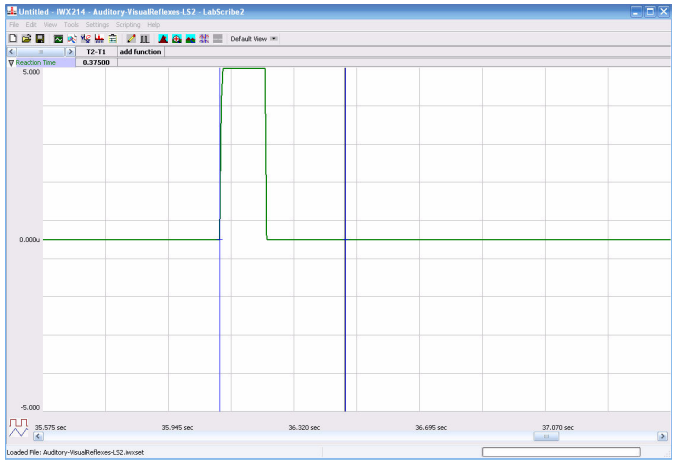

Figure HN-1-6: A visual cue, followed by the subject's response, are displayed on the Analysis window. The two cursors are positioned at the beginning of the visual cue and on the mark for measurement of the subject's reaction time (T2-T1) in this trial.

Exercise 2: Reaction Time and Auditory Cues

Aim: To measure the reaction time of a subject to an auditory cue.

Procedure

1 Cover the computer screen with an opaque piece of construction paper to prevent the subject from seeing any signal on the screen as a visual cue.

2 Instruct the subject to:

• Sit in a chair in front of the computer keyboard.

• Position a hand on the keyboard in a manner that enables the subject to push the **F1 key** as quickly as possible.

• Listen for the click (sound) of the event marker as the other student presses the button and then press the **F1 key** as quickly as possible.

3 Out of sight of the subject, another student should prepare to sharply tap the button of the event marker to create a auditory cue that is also recorded as a signal on the **Reaction Time channel**. In this exercise, the subject will perform ten trials.

4 Type **Auditory Cues** in the **Mark box** that is to the right of the **Mark** button.

5 Click on the **Record** button. Instruct the subject to press the **Enter key** on the keyboard to mark the recording.

6 Instruct the subject that the exercise has begun and that a auditory cue could be heard at any time

7 Use the event marker to deliver ten auditory cues to the subject. The cues should not be less than five seconds nor more than ten seconds apart.

8 After the tenth cue, click **Stop** to halt recording.

9 Select **Save** in the **File menu**.

Data Analysis

1 Use the same technique explained in Exercise 1 to measure and record the reaction times of the subject presented with auditory cues.

2 Enter the mean reaction time for this exercise in Table HN-1-2 on page HN-1-4.

Question

1 How does the subject's mean reaction time to visual cues compare to his or her mean reaction time to auditory cues?

2 What would cause a longer reaction time to one type of cue as compared to another?

3 How do your subject's mean reaction times compare to those of other subjects?

4 Do all subjects respond more quickly to the same cue?

Exercise 3: Reaction Time and Prompted Auditory Cues

Aim: To measure the reaction time of a subject to an auditory cue delivered immediately after a verbal prompt.

Procedure

Repeat Exercise 2 with an additional step. Before each auditory cue is delivered, tell the subject to get ready to respond to the cue. It is best to use a one word cue before immediately clicking the event marker button.

Data Analysis

1 Use the same technique explained in Exercise 1 to measure and record the reaction times of the subject presented with prompted auditory cues.

2 Enter the mean reaction time for this exercise in Table HN-1-2 on page HN-1-4.

Exercise 4: Reaction Time and Predictable Auditory Cues

Aim: To measure the reaction time of a subject to auditory cues delivered at a predictable interval.

Procedure

Repeat Exercise 2 with a predictable interval of five seconds between each auditory cue.

Data Analysis

1 Use the same technique explained in Exercise 1 to measure and record the reaction times of the subject presented with predictable auditory cues.

2 Enter the mean reaction time for this exercise in Table HN-1-2 on page HN-1-4.

Questions

1 To which auditory cue did your subject respond most quickly?

2 To which auditory cue did your subject respond to most slowly? For what reasons?

3 Did your subject respond more quickly or more slowly to same auditory cue as the other members of the class?

Table HN-1-2: Mean Reaction Times for Different Cues.

Cue	Mean Reaction Time of Your Subject (ms)	Mean Reaction Time of All Subjects (ms)	Shortest Mean Reaction Time in Class (ms)	Longest Mean Reaction Time in Class (ms)
Visual				
Auditory				
Prompted Auditory				
Predictable Auditory				