

Experiment 36: Heart Rate, Blood Pressure, and Vagal Tone

What Determines Heart Rate?

Heart rate is the number of beats per minute of the heart (BPM) and it is determined by factors intrinsic to the heart, as well as regulatory pathways from the brain and hormonal signals from the adrenal gland. Once again, when the brain is involved, psychological states may show themselves in the peripheral response.

Factors intrinsic to the heart include pacemaker cells (SA node cells) which discharge electrical signals to the heart muscle in order to initiate the heart beat. Sometimes these signals become disordered and the heart may beat irregularly. You've probably all seen media examples of dramatic efforts to restore a normal heart beat in the emergency room with a defibrillator. The defibrillator can sometimes stabilize a chaotic or irregular heart rhythm or it can sometimes restore a heart beat when it has ceased.

The obvious purpose of the heart beat is to move blood around the body. The rate of the heart beat is one factor which influences cardiac output and the volume and speed of delivery of the blood to body cells. Clearly, there are times when the blood needs to reach those cells more or less quickly. Exercise, responding to stressors, and even just standing up may create greater cellular needs for oxygen and blood nutrients (mainly glucose). Relaxation, sleeping and other vegetative states generally create a reduced cellular need. Sensors in the brain stem and hypothalamus provide feedback regulation of the heart rate to meet the demands of body cells. Responding to stressors involves the activation of higher limbic system structures such as the amygdala and hypothalamus, which then send signals via the autonomic nervous system to increase (or decrease) the heart rate. Neurotransmitter signals from the sympathetic branch (norepinephrine) increase the heart rate (by binding to beta1-adrenergic receptors), while neurotransmitter signals from the parasympathetic branch (acetylcholine) decrease the heart rate (by binding to muscarinic cholinergic receptors).

There are individual differences in the resting heart rate which are related to genetics, gender (females generally have faster heart rates than males), and to physical condition (state of health as well as fitness). Also, there are individual differences in the size (and sometimes the direction) of the adaptive changes which take place to environmental events. Some of these differences are related to personality, psychological state, and perhaps fitness as well.

What Determines Blood Pressure?

When the heart beats it pumps blood through the circulatory system (arteries, arterioles, capillaries, venules, veins) to deliver blood to cells. The elements of the circulatory system are composed of smooth muscle cells and membranes to contain the blood. In its progress around the body, the nutritive elements are transported out of the blood to cells and the waste products of cells are transported into the blood for elimination from the body. The blood vessels exert a certain pressure on the blood, which depends in part on their elasticity and in part on neural and hormonal signals to the vessels. The elasticity of the blood vessels is limited by the build up of plaque (lipid/protein/immune cell deposits in the walls of the blood vessels) and elasticity generally decreases with the presence of certain lifestyle factors (diet, alcohol, smoking, lack of exercise) and with age.

Blood pressure is measured non-invasively with a sphygmomanometer. A pressure cuff is placed around the upper arm and inflated while the heart sounds (Korotkoff-sounds or K-sounds) are monitored. The cuff is inflated to occlude the flow of blood to the arm and then deflated slowly to determine two values. The first value is the amount of pressure in the cuff when the heart sounds (actually the turbulence of the blood as it rushes through the now open artery) are first heard in the arm after being occluded. This is termed the *systolic blood pressure* (SBP). The SBP is the pressure the arteries exert on the blood flow when the heart ventricles are contracting. The second value is the amount of pressure in the cuff when the heart sounds in the arm are gone and it is termed *diastolic blood pressure* (DBP). The DBP is the pressure the arteries exert on the flow of blood when the ventricles are relaxing and being filled by the atrial contractions. The blood pressure is reported in pressure units of mmHg and a typically normal blood pressure for a young person is about 120/80 (SBP/DBP).

Blood pressure is just another one of several factors which determine the delivery of blood to the cells. As in heart rate, the blood pressure is determined in part by factors intrinsic to the blood vessels themselves (elasticity) and by regulatory neural signals from the brain and hormones from the adrenal glands and kidneys. Obviously, if you want to move a substance quickly to the place where it is needed it is of value to be able to increase the rate of beating of the pump and the pressure on the contents of the delivery system. The neural and hormonal control of blood pressure is a complicated orchestration of constriction and dilation of vascular beds to achieve the adaptive delivery of blood to tissues in need.

Psychological States and Cardiovascular Responses

Cardiovascular responses have been studied most often in the context of arousal and emotional states. The stress response (“fight or flight”) is a physiologically adaptive set of bodily changes in the presence of a life threat or a threat to one’s self worth. In general, activity of the sympathetic nervous system is enhanced, bringing about elevations in heart rate and blood pressure necessary to deal with the perceived threat. These responses are adaptive in the short term and generally improve human performances which require speed, strength, and endurance. Human performance which requires fine motor skills or complex cognitive processes is generally affected in a curvilinear fashion; performance is enhanced with moderate or optimal levels of the stress response, but hindered with high levels of the stress response (as anyone who plays the piano knows).

Studies have shown that anxiety, frustration, anger, fear, anticipation of pain and other negative emotional states can bring about elevations in heart rate and/or blood pressure. Positive emotional states of excitement, joy, and interest can also bring about elevated cardiovascular responses. There are, however, individual differences in the nature and the extent of cardiovascular responses in emotional states. Some of these differences stem from the nature of the individual personality (for example cynicism and hostility which we will look at in Chapter 6) and some stem from the nature of the environmental demands. Complicating the picture is the fact that heart rate and blood pressure may dissociate in response to environmental events. Research has supported the idea that tasks which require environmental intake or monitoring, cause heart rate lowering (blood pressure may rise or remain unchanged), while tasks which require environmental rejection (events which are aversive or bring about escape motivations) result in heart rate and blood pressure elevations. Similarly, it has been shown that tasks which tend to produce anxiety and self-focus (for example giving a speech if you have presentation anxiety) tend to elevate heart rate and blood pressure, while tasks which tend to produce anxiety and environmental-focus (for example listening to a lecture that you will be tested on later) tend to reduce heart rate while blood pressure may elevate or remain unchanged.

There are many complexities in the cardiovascular research literature and also many controversies. One interesting controversy deals with the degree to which physical fitness can perhaps mute the stress response to a psychosocial stressor. Physical conditioning of an aerobic nature has been shown in some experiments to reduce the stress response (or enhance recovery to pre-stress values) to a cognitive stressor task such as

mental arithmetic. In other experiments, the baseline values are lower in persons who engage in aerobic activities, but the change over baseline is shown to be about the same as in persons who are not physically active. Sports psychologists have conducted many experiments on this aspect of psychophysiology.

What is Vagal Tone?

The parasympathetic nervous system influences the tonic or resting heart beat by means of signals from the tenth cranial nerve, the Vagus. Even at rest, a person’s heart rate will fluctuate with his or her breathing cycle. Inspiration triggers an increase in heart rate, but this increase occurs after maximum inhalation. The latency between maximum inhalation and maximum heart rate is the time required for receptor (stretch, baro-, pH, O₂, CO₂) signals in the organ systems to be integrated, motor signals to be generated in control centers, and impulses to be delivered to effector organs (cardiac, skeletal, and smooth muscles). Conversely, expiration triggers a decrease in heart rate. The recording, shown in Figure 8-173 on page 205, is an example of this phenomenon.

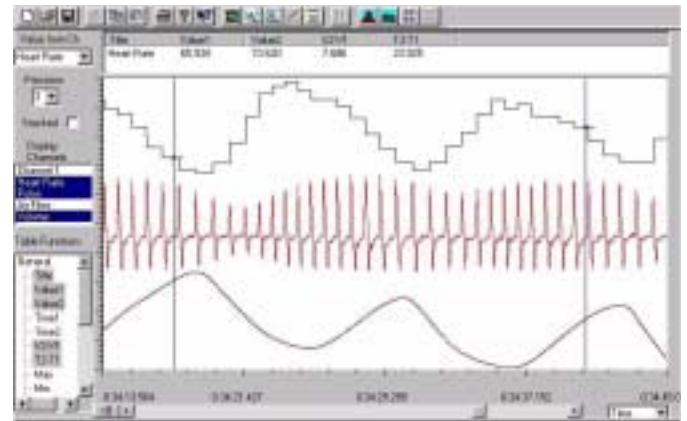


Figure 8-173: This is an example of respiratory sinus arrhythmia. Heart rate is the top trace, and respiration is the bottom trace. The maximum heart rate occurs after the completion of inhalation (peak of respiration cycle). The middle trace is the recording from the pulse plethysmograph, which also demonstrates changes in amplitude related to breathing and heart rate.

Notice that the change in the heart rate is in phase with the respiratory cycle. The change in the heart rate that results from breathing is known as respiratory sinus arrhythmia (RSA). The extent of the RSA is a rough measure of Vagal control over the resting heart beat, referred to as Vagal tone. The size of the RSA (degree of variability of the heart rate for each respiratory cycle) is what is determined by the Vagus nerve. When the heart rate varies considerably for each respiratory cycle, then we say there is good or high Vagal tone. When the heart rate is relatively steady with low variability for the

respiratory cycle, we say there is poor or low Vagal tone. In general Vagal control over the heart rate lessens during stressful experiences when sympathetic activity is heightened, thus allowing the heart rate to rise to meet the challenge.

Personality and Vagal Tone

Vagal tone has been related to temperament (the innate “building blocks” of personality) and stress vulnerability in children. Children who show behavioral inhibition in novel situations (somewhat comparable to shyness) have low Vagal tone as evidenced by higher and less variable resting heart rates. Preschoolers who fail to show emotional expression also have low Vagal tone and are vulnerable to later depression and anxiety. There is also evidence that adults who are extremely shy or behaviorally inhibited have higher and less variable resting heart rates. Also adults with high Vagal tone may have lower blood pressure responses to stress, making them less vulnerable to hypertension and coronary heart disease. Interestingly, adults with high Vagal tone are more susceptible to hypnosis. The exact relationship between the autonomic nervous system’s regulation of physiological responses and personality is unknown, but many hypothesize that the innate sensitivity and reactivity of the nervous system may be the fundamental mechanism for biasing personality development and expression. You might want to read more about this interesting topic; a few references are provided at the end of this chapter.

In this experiment, you will collect and analyze heart rate and blood pressure data during:

- a baseline period;
- a mild cognitive stressor (spelling words backwards aloud);
- a vigilance reaction time task.

Equipment Required

- PC Computer
- iWorx unit, and USB or serial cable
- PT-104 Pulse plethysmograph
- BP-700 Blood pressure cuff
- EM-100 Event marker
- BP-600 Non-Invasive blood pressure sensor (optional)

Equipment Setup

- 1 Connect the iWorx unit to the computer (described in Chapter 1).
- 2 Plug the DIN connector on the end of the plethysmograph cable into Channel 3 (Figure 8-174 on page 206).

- 3 Place the plethysmograph on the volar surface (where the fingerprints are located) of the distal segment of the middle finger, and wrap the Velcro strap around the end of the finger to attach the unit firmly in place.

If using a simple blood pressure cuff

- 4 Plug the DIN connector of the event marker into Channel 4 (Figure 8-174 on page 206).
- 5 Place the blood pressure cuff around the upper portion of the left arm, between the elbow and the shoulder.

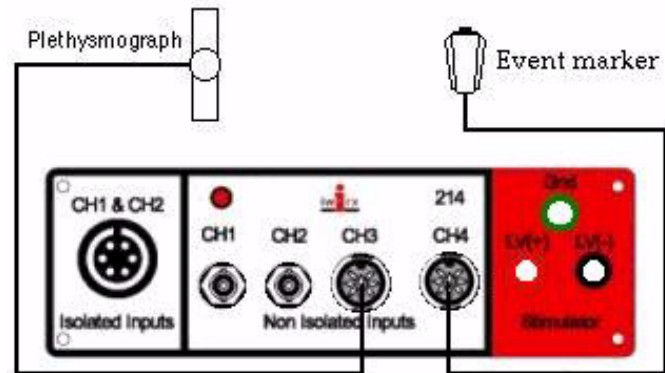


Figure 8-174: The equipment used for interpolating blood pressures from a simple sphygmomanometer.

If using a non-invasive blood pressure transducer

- 6 Plug the DIN connector of the non-invasive blood pressure transducer into the female end of the DIN-DIN extension cable. Plug the male end of the DIN-DIN extension cable into Channel 4 (Figure 8-175 on page 206).
- 7 Place the blood pressure cuff around the upper portion of the left arm, between the elbow and the shoulder.

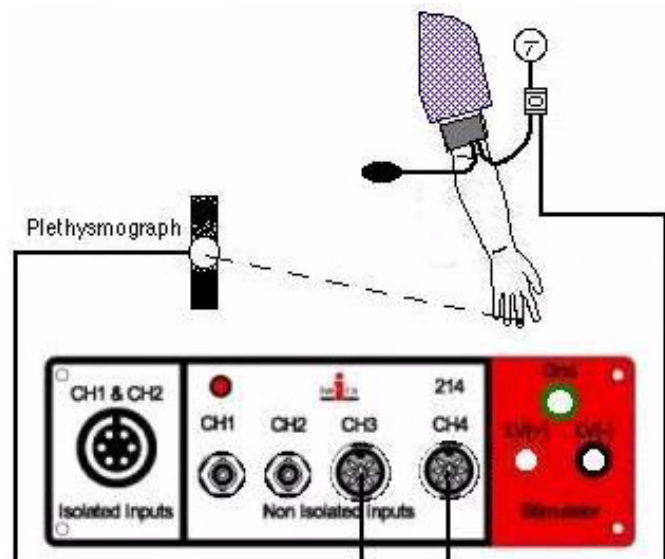


Figure 8-175: The equipment used for measuring blood pressure with a non-invasive blood pressure transducer.

Start the Software

- 1 Click the **Windows Start** menu, move the cursor to **Programs** and then to the **iWorx** folder and select **LabScribe**; or click on the **LabScribe** icon on the Desktop.
- 2 When the program opens, select **Load Group** from the **Settings** menu.
- 3 When the dialog box appears, select **IPLMV3.iws**. Click **Load**.
- 4 Click on the **Settings** menu again and select the **HeartRate-BP-VagalTone** settings file.
- 5 After a short time, **LabScribe** will appear on the computer screen as configured by the **HeartRate-BP-VagalTone** settings.

Exercise 1: Baseline Heart Rate and Blood Pressure

Aim: To determine the resting heart rate and blood pressure of the subject.

Procedure

If using a simple blood pressure cuff

- 1 Select a person from your group to be the experimental subject.
- 2 Assign an observer to watch the gauge of the blood pressure cuff during the recording of the subject's pulse wave. This observer will press the event marker when the pressures displayed by the gauge are: 200, 180, 160, 140, 120, 100, 80, 60, and 40 mmHg.
- 3 Ask the subject to sit quietly and read from a text while you make a 1-minute record of the subject's baseline heart rate.
- 4 Click **Start** and record the finger pulse. Check Channel 3 (**Pulse**); if the pulse goes down, **Stop** the recording. Use the **Invert** function in the **right-click** menu for Channel 3 to orient the image in the correct direction, and **Start** recording again.
- 5 Click **AutoScale** for the Channel 3 (**Pulse**) to make the signal bigger.
- 6 During this initial recording, type the subject's first name and the words "Baseline Heart Rate" in the comment line to the right of the **Mark** button, and press the **Enter** key on the keyboard. Record for 1 minute.
- 7 Type the words "Baseline Blood Pressure" in the comment line. At the end of the 1-minute recording of the subject's baseline heart rate, press the **Enter** key on the keyboard.
- 8 Inflate the cuff until the pressure is just above 200 mmHg. Notice that the finger pulse disappears as the cuff is inflated (Figure 8-176 on page 207).
- 9 Slowly release the cuff pressure. When the observer sees the pressure in the cuff reach each of the values listed in Step 1 (200, 180,..... mmHg), he or she quickly presses and releases the event marker to produce a signal on the **Event** channel (CH 4).

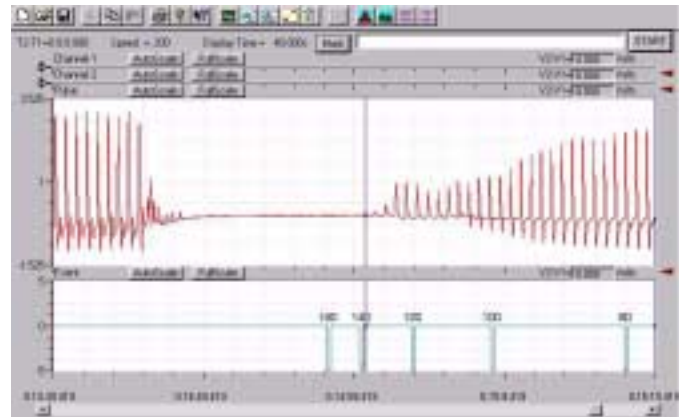


Figure 8-176: A recording of the pulse wave before, during, and after the occlusion of the brachial artery. Pulses disappeared as the pressure in the cuff exceeded that in the artery. As the pressure in the cuff is released, the pulse waves reappears with increasing amplitude.

- 10 When the cuff reaches 40mmHg, click the **Stop** button and remove the cuff. The subject should flex and extend their fingers to encourage blood circulation.
- 11 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(e.g. the **iWorx** or class folder). Click the **Save** button to save the file (as an *.iwd file).

Using a non-invasive blood pressure transducer

- 12 Inflate the cuff until the pressure is just above 200 mmHg. Notice that the finger pulse disappears as the cuff is inflated (Figure 8-176 on page 207).
- 13 Type "Systolic BP" on the comment line to the right of the **Mark** button. Slowly release the cuff pressure. When the smallest pulse wave first reappears on the computer screen, press the **Enter** key on the keyboard.
- 14 Type "Diastolic BP" on the comment line. Continue to release the cuff pressure. When amplitude of the pulse wave first reaches the maximum level, press the **Enter** key on the keyboard.
- 15 Continue to release pressure until 40mmHg, click the **Stop** button and remove the cuff. The subject should flex and extend their fingers to encourage blood circulation.
- 16 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(e.g. the **iWorx** or class folder). Click the **Save** button to save the file (as an *.iwd file).

Analysis of the Baseline Period

Finding the subject's baseline heart rate

- 1 Scroll through the recording and locate the section of data recorded during the subject's baseline period.
- 2 Use the **Display Time** icons on the **LabScribe** toolbar (Figure 8-177 on page 208) to adjust the time displayed on the **Main** window so that the data from the complete baseline period can be viewed on the screen.

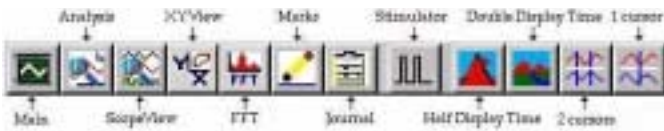


Figure 8-177: The LabScribe toolbar.

- 3 Click the **2-Cursor** icon (Figure 8-177 on page 208) so that two blue vertical lines appear on the **Main** window. Use the cursors to select the data from the complete baseline period.
- 4 Click the **Analysis** icon (Figure 8-177 on page 208) to open the **Analysis** window.
- 5 Display the **Heart Rate** channel (Channel 5) in the **Analysis** window by selecting it from the **Display Channels** menu on the left side of the **Analysis** window.
- 6 Use the mouse to click and drag a cursor to each edge of the **Analysis** window. Select **Max**, **Min**, and **Mean** from the **Table Functions** list and **Heart Rate** from the **Value from Channel** menu. The values displayed in the table across the top of the **Analysis** window will be the maximum, minimum, and mean heart rates from the period.
- 7 Enter data into the **Journal** by either typing the titles and values directly or by using the **right-click** menu. Place the cursors to take measurements; then, select **Add Title to Journal** or **Add Data to Journal** from the **right-click** menu to add the measurements to the **Journal**.
- 8 Enter the subject's data in Table 8-27 on page 211.

Finding the subject's baseline systolic and diastolic blood pressure when using the simple sphygmomanometer.

- 9 Find the section of recording where the subject's blood pressure was determined. Scroll through the **Pulse** channel (CH 3) and find the point where the pulse wave first reappears after the cuff pressure is released (around 120mmHg in Figure 8-176 on page 207).
- 10 Click the **2-Cursor** icon (Figure 8-177 on page 208) so that two blue vertical lines appear on the **Main** window.

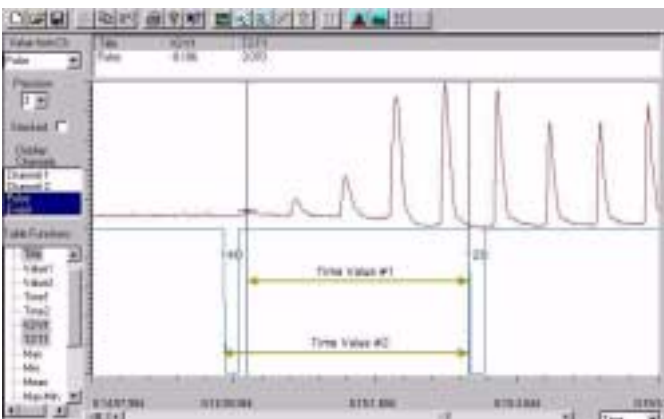


Figure 8-178: The finger pulse trace showing the recording taken as cuff pressure declined from 140 (left) to 120 (right) mmHg. The (blue) cursor is located at the first pulse signal and the time values to be measured are shown.

- 11 Use the cursors to select the section of the recording that includes this small pulse wave and the closest event mark on each side of the wave.
- 12 Click the **Analysis** icon (Figure 8-177 on page 208) to open the **Analysis** window (Figure 8-178 on page 208).
- 13 To find the systolic pressure, place one cursor on the peak of the smallest pulse wave (Figure 8-178 on page 208) and the second cursor on the event mark to the right of the peak. Measure the time interval between them and call it "Time Value #1" (Figure 8-178 on page 208).
- 14 Move the cursor from the pulse wave to the event mark on the left side of the pulse wave. Measure the time interval between the two event marks and call it "Time Value #2" (Figure 8-178 on page 208).
- 15 Calculate: $(\text{Time Value \#1} / \text{Time Value \#2}) \times 20\text{mmHg}$.
- 16 Add the number calculated in Step 7 to the lower blood pressure value associated with the event mark on the right side of "systolic" pulse wave. The sum of these two numbers is the systolic blood pressure.
- 17 As more pressure is released from the cuff, the amplitude of the pulse wave increases. The pressure at which the pulse wave reaches the maximum amplitude is the diastolic pressure (around 80mmHg in Figure 8-181 on page 215). Use the cursors to select the area around the pulse wave that first reaches the maximum amplitude. Include the event marks on either side of the wave, that are closest to the wave. Use the **Analysis** window to interpolate the data and make the same type of calculation used to determine the systolic pressure.

- 18 Enter the subject's data in Table 8-27 on page 211.

Finding the subject's baseline systolic and diastolic blood pressure when using a non-invasive blood pressure transducer.

- 19 The non-invasive blood pressure transducer was calibrated in a previous section of this experiment. By programming the units conversion for the **Event/BP** channel (CH 4), the LabScribe software converts the output of the transducer from voltage to pressure. The pressure values can be read directly on the **Main** window.
- 20 Click the **1-Cursor** icon (Figure 8-177 on page 208) so that a single blue vertical line appears on the **Main** window.
- 21 To find the subject's systolic pressure, place the cursor over the small pulse wave on the **Pulse** channel (CH 3) that represents the reoccurrence of pulsatile blood flow. The pressure in the cuff at this point, displayed in the upper right corner of the **Event/BP** channel (CH 4), is the subject's systolic blood pressure.
- 22 To find the subject's diastolic pressure, place the cursor over the first maximum-sized pulse wave on the **Pulse** channel (CH 3) that represents the full return of pulsatile blood flow. The pressure in the cuff at this point, displayed in the upper right corner of the **Event/BP** channel (CH 4), is the subject's diastolic pressure.
- 23 Enter the subject's data in Table 8-27 on page 211.

Exercise 2: Mild Cognitive Stressor

Aim: To determine if a mild cognitive stressor (spelling backwards) has any effect on heart rate and blood pressure.

Procedure

- 1 Ask the subject to sit quietly as the rest of your group prepares for this exercise.
- 2 The mild cognitive stressor that will be used in this exercise is spelling backwards. Alphabetized lists of five-letter words to be used in this exercise are located in Table 8-26 on page 209.
- 3 Select twelve words at random from the Task A list before the exercise begins. Words from the Task A list are paired with similar words from the Task B list. For example, if you select “above” from Task A list, then you must select its mate “abide” from Task B list. Note the twelve words from each list.
- 4 Designate a member of the lab group to speak the words to the subject during the tasks, and another member of the group to record the words misspelled by the subject in each task.

- 5 Before beginning the exercise, inform the subject of the experimental conditions:

- Task A will be performed first. In Task A, the subject will spell the twelve words selected from the “A” list in a forward manner, as printed.
 - In Task B, the subject will spell the twelve words from the “B” list in a backward manner. The words from the “B” list are paired with the words selected from the “A” list. The words from the “B” list should be spoken in the same order as the mated words from the “A” list.
 - The words in each task will be spoken by a member of the lab group at five-second intervals, whether the subject has finished the spelling of the previous word or not. Since each task contains twelve words, each task will last one minute.
 - Another member of the lab group will keep track of the number of words spelled in error in each task, whether forward or backward. Spelling of a word that is not completed before the next word is spoken is considered to be misspelled.
- 6 The assumption in this exercise is that Task A will be less distressing than the Task B.
 - 7 Click **Start** to begin recording the finger pulse of the subject. Click **AutoScale** for the **Pulse** channel (CH 3) to make the signal bigger.

Table 8-26: Five Letter Word Lists for Tasks A and B

Task A Spell Forward	Task B Spell Backward	Task A Spell Forward	Task B Spell Backward
above	abide	maple	mouse
adopt	adult	niche	nickel
ahead	alarm	nectar	novel
barge	batch	prowl	pearl
bread	brain	pride	prune
cable	candy	rusty	rowdy
champ	chief	realm	rafter
clean	clear	rapid	ruler
derby	deuce	sound	sober
dough	dozen	smock	smart
dream	drive	start	stomp
earth	empty	shawl	shock
event	exert	tramp	tackle
frame	frost	treat	truck
flour	flack	table	truth
growl	grant	wrath	whack
house	heart	water	worth
joust	juror	weary	woman
leach	lucky	young	yours
learn	laugh	zeros	zebra

- 8 Type the subject’s first name and the words “Begin Task A” in the comment line to the right of the **Mark** button. Press the **Enter** key on the keyboard as the first word in Task A is spoken. Continue to deliver a new word at 5-second intervals.
- 9 Type the words “End Task A” on the comment line. At the end of Task A, press the **Enter** key to enter a comment on the record.
- 10 Continue to record as you begin to take the subject’s blood pressure. It is important to measure the subject’s blood pressure as soon as possible.
- 11 Inflate the cuff until the finger pulse is occluded. Then, follow the procedures used in Exercise 1 to record the subject’s post-task blood pressure.
- 12 When the cuff is fully deflated, click **Stop** to halt the recording process.
- 13 Ask the subject to sit quietly as the rest of your group prepares for the next task. Begin Task B as soon as possible.

- 14 Click **Start** to begin recording the finger pulse of the subject. Click **AutoScale** for the **Pulse** channel (CH 3) to make the signal bigger.
- 15 Type the subject's first name and the words "Begin Task B" in the comment line to the right of the **Mark** button. Press the **Enter** key on the keyboard as the first word in Task B is spoken. Continue to deliver a new word at 5-second intervals.
- 16 Type the words "End Task B" on the comment line. At the end of Task B, press the **Enter** key to enter a comment on the record.
- 17 Continue to record as you begin to take the subject's blood pressure. It is important to measure the subject's blood pressure as soon as possible.
- 18 Inflate the cuff until the finger pulse is occluded. Then, follow the procedures used in Exercise 1 to record the subject's post-task blood pressure.
- 19 When the cuff is fully deflated, click **Stop** to halt the recording process.
- 20 Open the **Journal** and note the number of words misspelled in each task
- 21 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 (e.g. the **iWorx** or class folder). Click the **Save** button to save the file (as an *.iwd file).

Analysis of Heart Rates in Tasks A and B

- 1 Scroll through the recording and locate the section of data recorded during Task A.
- 2 Use the **Display Time** icons on the **LabScribe** toolbar (Figure 8-177 on page 208) to adjust the time displayed on the **Main** window so that the data from the complete period of Task A can be viewed on the screen.
- 3 Click the **2-Cursor** icon (Figure 8-177 on page 208) so that two blue vertical lines appear on the **Main** window. Use the cursors to select the data from the complete Task A.
- 4 Click the **Analysis** icon (Figure 8-177 on page 208) to open the **Analysis** window.
- 5 Display the **Heart Rate** channel (Channel 5) in the **Analysis** window by selecting it from the **Display Channels** menu on the left side of the **Analysis** window.
- 6 Use the mouse to click and drag a cursor to each edge of the **Analysis** window. Select **Max**, **Min**, and **Mean** from the **Table Functions** list and **Heart Rate** from the **Value from Channel** menu. The value displayed in the table across the top of the **Analysis** window will be the maximum, minimum, and mean heart rates from the period.
- 7 Enter data into the **Journal** by either typing the titles and values directly or by using the **right-click** menu. Place the cursors to take measurements; then, select **Add Title to Journal** or **Add Data to Journal** from the **right-click** menu to add the measurements to the **Journal**.
- 8 Scroll through the recording and locate the section of data

recorded during Task B.

- 9 Repeat Steps 2 through 7 for the data from Task B.
- 10 Enter the subject's data in Table 8-27 on page 211.

Analysis of Blood Pressures at the end of Tasks A and B

- 1 Find the section of recording where the subject's post-Task A blood pressure was determined.
- 2 Use the same procedures employed in *Data Analysis* section of Exercise 1 to measure the subject's blood pressure at the end of Task A. Use the directions that correspond to the type of blood pressure cuff you are using.
- 3 Report the subject's post-Task A blood pressure in the **Journal**.
- 4 Find the section of recording where the subject's post-Task B blood pressure was determined.
- 5 Repeat Steps 2 and 3 for the subject's post-Task B blood pressure.
- 6 Enter the subject's data in Table 8-27 on page 211.

Questions

- 1 Is the subject's mean heart rate and blood pressure higher in the first verbal task (spelling forward) than in the baseline period?
- 2 Is the subject's mean heart rate and blood pressure higher in the second verbal task (spelling backward) than in the baseline period?
- 3 Is the subject's mean heart rate and blood pressure higher in the second verbal task (spelling backward) than in the first verbal task (spelling forward)?
- 4 Is Task B more distressing than Task A?

Exercise 3: Vigilance Reaction Time Task

Aim: To determine if vigilance or careful monitoring of the environment has any effect on heart rate and blood pressure.

- 1 Ask the subject to sit quietly as the rest of your group prepares for this exercise.
- 2 Before beginning the exercise, inform the subject of the experimental conditions:
 - When the event marker is pressed and released quickly, a signal pulse will appear on the **Event/BP** channel (CH 4) on the computer screen.
 - The subject should watch the computer screen for the signal pulse. As soon as the subject sees the signal pulse, the subject should respond by pressing the **Enter** key on the keyboard. This will place a mark on the data record.
 - The person on the event marker should monitor time and press the event marker at random intervals of 4 to 8 seconds. In one minute, it should be possible to make about 10 signal pulses appear on the screen.

- 3 If the non-invasive blood pressure transducer is connected to Channel 4 of the iWorx unit, disconnect it. Plug the DIN connector of the event marker into Channel 4 (Figure 8-174 on page 206).
- 4 Designate a member of the lab group to press the event marker during the exercise.
- 5 Record a second baseline heart rate for the subject, since his or her resting heart rate may have changed over the course of the experiment.
- 6 Click **Start** and record the finger pulse. Click **AutoScale** for the Channel 3 (**Pulse**) to make the signal bigger.
- 7 Type the subject's first name and the words "2nd Baseline HR" on the comment line to the right of the **Mark** button, and press the **Enter** key on the keyboard. Record for one minute.
- 8 After recording the subject's baseline heart rate for a minute, click **Stop** to halt the recording.
- 9 Instruct the subject to place his or her index finger on the **Enter** key of the keyboard, and to watch the trace of the **Event/BP** channel (CH 4) on the computer screen. At random intervals, a signal pulse will occur on the **Event/BP** channel (CH 4); she or he should press the **Enter** key as quickly as possible when the event takes place. The goal is to place the mark as close to the beginning of the signal pulse as possible.
- 10 Click **Start** and record the finger pulse. Click **AutoScale** for the Channel 3 (**Pulse**) to make the signal bigger.
- 11 Type the subject's first name and the words "Reaction Time" on the comment line to the right of the **Mark** button, and press the **Enter** key on the keyboard. Record one minute of heart rate data as signal pulses are delivered by the event marker to the computer screen at random intervals, and the subject presses the **Enter** key in response.
- 12 After recording the subject's reaction heart rate for a minute, click **Stop** to halt the recording.
- 13 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 (e.g. the **iWorx** or class folder). Click the **Save** button to save the file (as an *.iwd file).

Analysis

- 1 Scroll through the recording and locate the section of data recorded during the subject's second baseline period.
- 2 Use the **Display Time** icons on the **LabScribe** toolbar (Figure 8-177 on page 208) to adjust the time displayed on the **Main** window so that the data from the complete second baseline period can be viewed on the screen.
- 3 Click the **2-Cursor** icon (Figure 8-177 on page 208) so that two blue vertical lines appear on the **Main** window. Use the cursors to select the data from the complete second baseline period.
- 4 Click the **Analysis** icon (Figure 8-177 on page 208) to open the **Analysis** window.
- 5 Display the **Heart Rate** channel (Channel 5) in the **Analysis** window by selecting it from the **Display Channels** menu on the left side of the **Analysis** window.
- 6 Use the mouse to click and drag a cursor to each edge of the **Analysis** window. Select **Max**, **Min**, and **Mean** from the **Table Functions** list and **Heart Rate** from the **Value from Channel** menu. The value displayed in the table across the top of the **Analysis** window will be the maximum, minimum, and mean heart rates from the period.
- 7 Enter data into the **Journal** by either typing the titles and values directly or by using the **right-click** menu. Place the cursors to take measurements; then, select **Add Title to Journal** or **Add Data to Journal** from the **right-click** menu to add the measurements to the **Journal**.
- 8 Scroll through the recording and locate the section of data recorded during the subject's reaction time period.
- 9 Repeat Steps 2 through 7 for the data from Task B.
- 10 Enter the subject's data in Table 8-27 on page 211.

Questions

- 1 Is the subject's mean heart rate lower in the vigilance/ reaction time period than in the baseline period?
- 2 Does your data support the hypothesis that heart rate decreases when tasks that require the careful monitoring of the environment are performed?

Table 8-27: Heart Rate & Blood Pressure Results - Mild Stressor & Reactions

Subject_____					
Experimental Condition	Max HR (BPM)	Min HR (BPM)	Mean HR (BPM)	Systolic Pressure (mmHg)	Diastolic Pressure (mmHg)
Baseline 1					
Spelling Forward					
Spelling Backward					
Baseline 2				N/A	N/A
Reaction Time				N/A	N/A

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