Experiment HP-5B: Personality and Vagal Tone

This lab is part 2 of a series of 4 labs. All labs can be done individually, but it is best to do them in this order:

1) Heart Rate, Blood Pressure, and Vagal Tone
2) Personality and Vagal Tone
3) Vigilance and Reaction Time
4) Hot Reactor

Equipment Required

PC or Mac Computer

IXTA, USB cable, IXTA power supply

BP-220 or BP-220A Non-invasive blood pressure transducer – also used in the Hot Reactor lab

Black tygon tubing

PT-320 Pulse plethysmograph – also used in the Personaly & Vagal Tone, Vigilance-Reaction Time and Hot Reactor labs

RM-204 Respiration monitor – used in the Personality-Vagal Tone and Hot Reactor labs

RM-220 Nasal Cannula – used in the Personality-Vagal Tone and Hot Reactor labs

EM-220 Event Marker – used in the Vigilance-Reaction Time lab

Warning: *As explained above, this procedure involves stopping blood flow to the arm, which is potentially dangerous. Please take the following precautions.*

Precautions

1. Know what you are doing ahead of time.
2. Do not leave the cuff inflated for any prolonged period of time (>20 seconds).
3. The subject should flex and extend their fingers between experiments to maintain blood flow.
4. This experiment should be performed by healthy individuals who do not have a personal or family history of cardiovascular or respiratory problems. It is preferable to use more than one subject during the course of the lab session.

Equipment Setup

1. Plug the PPG-320 into the PT port of the IXTA.
2. Connect the RM-220 Nasal cannula to the white port of channel A1.
3. Position the cannula so the prongs are just resting under the subject's nose, very close to the nostrils. Wrap the tubing behind the subject's ears, as shown above.

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Figure HP-5-S1: Nasal cannula connected to the IX-TA and showing the proper positioning on the face.

Figure HP-5-S1: Nasal cannula and pulse sensor connected to the IX-TA.

NOTE: If using the optional RM-204 respiration belt instead of the nasal cannula:

- Plug the RM-204 into channel A6 on the front of the IX-TA
- Click Edit → Preferences
  - Uncheck channel A1 – Respiration AND channel C2 – Breathing Rate
  - Place a check mark in channel A6 – name it Respiration by typing in the box
  - Click OK
- To create a new Breathing Rate channel, on the new Respiration channel
  - Click Fx → Periodic → Rate → OK
  - Click on the title of the new channel and rename it – Breathing Rate
  - Click on V2-V1 on the right hand side of the channel and change to Mean

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Exercise 1: Personality and Vagal Tone

Aim: To test a hypothesis that persons with high perceived shyness and behavioral inhibition have lower Vagal tone than persons with low perceived shyness. Vagal tone is measured as the difference between the maximum and minimum heart rates of the subject during normal breathing.

Procedure

1. Instruct the subject to sit quietly and breathe normally before and during the recordings to prevent the creation of motion artifacts. The subject should sit erect so that the muscles involved in pulmonary ventilation are able to move without restriction.

Warning: *Stop the experiment if the subject feels dizzy or nauseated.*

2. Type **Normal Breathing <Subject's Name>** in the Mark box.
3. Click Record. Click the mark button. Click AutoScale All. Record the subject's breathing and heart rates for at least one minute.
4. Click Stop to halt recording.
5. Select Save in the File menu.

Data Analysis

1. Adjust the display time by clicking the two mountains or one mountain icon to adjust the Display Time of the Main window to show a nice section of data containing five complete breath cycles.
2. Click on the Analysis window icon.
3. On the Respiration channel, click and drag one cursor to the beginning of the first breath cycle displayed in the Analysis window. Drag the other cursor to the beginning of the second breath cycle and measure the following:

- **Maximum Heart Rate**. The value for Max on the Heart Rate channel is the subject's maximum heart rate during the first breath cycle.
- **Minimum Heart Rate**. The value for Min on the Heart Rate channel is the subject's minimum heart rate during the first breath cycle.
- **Mean Heart Rate**. The value for Mean on the Heart Rate channel is the subject's mean heart rate.

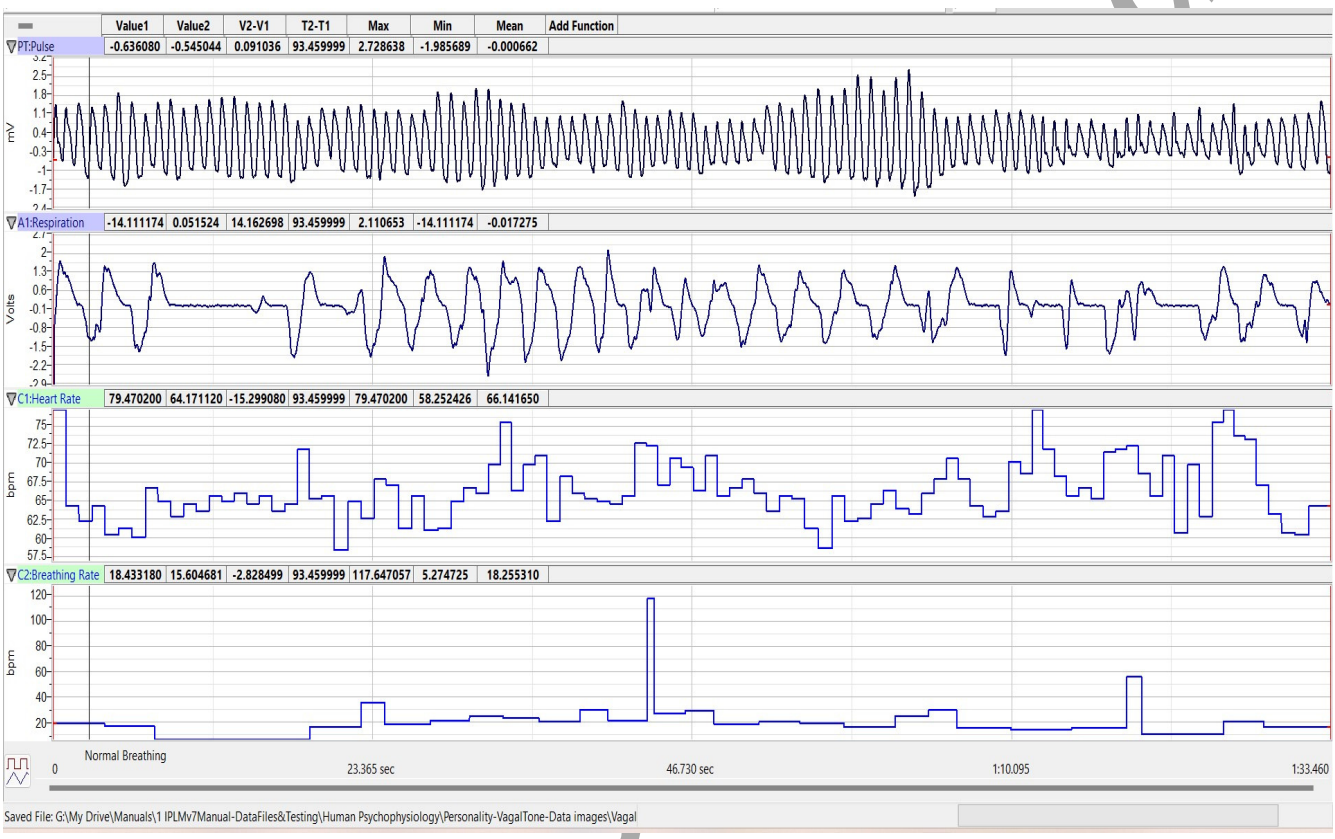

Figure HP-5-L1: The pulse wave, respiration, heart rate, and breathing rate recordings of a subject using abdominal breathing while at rest are displayed, from top to bottom, in the Analysis window. On the respiration channel, inhalation is displayed as an upsweep. Notice that the heart rate goes up during inhalation.

5. Once the cursors are placed in the correct positions for determining the maximum, minimum, and mean heart rates, these rates can be recorded in the on-line notebook of LabScribe by typing the names and values directly into the Journal.
6. The functions in the channel menus of the Analysis window can also be used to enter the names and values of the parameters from the recording to the Journal. To use these functions:
   - Place the cursors at the locations used to measure the cuff pressures from the Heart Rate channel.
   - Transfer the names of the mathematical functions used to determine the heart rates to the Journal using the Add Title to Journal function in the Heart Rate channel menu.

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- Transfer the value for the blood pressure to the Journal using the Add Ch. Data to Journal function in the Heart Rate channel menu.

7. On the Respiration channel, leave one cursor at the beginning of the second breath cycle. Click and drag the other cursor to the beginning of the third breath cycle displayed in the Analysis window.
8. Repeat Steps 4 and 5 for the second breath cycle.
9. Move the cursors to the beginning and end of each of the three remaining breath cycles and repeat Steps 4 and 5 for each breath cycle
10. Determine the means of the maximum and the minimum heart rates for the five breaths. Enter these values in Table 1.
11. Determine the difference (Δ) between the mean maximum and mean minimum heart rates and enter this value in Table 1. This difference, which will be used to measure **Vagal tone**, is also known as the **respiratory sinus arrhythmia (RSA) prominence**.

Table HP-5-L1: Heart Rate Variation during Normal Breathing

	Heart Rate (BPM)			Breath Rate (BrPM)
Subject	Max	Min	Δ	
Breath 1				
Breath 2				
Breath 3				
Breath 4				
Breath 5				
Mean				

12. On the Respiration channel, click and drag one cursor to the beginning of the first breath cycle. Click and drag the other cursor to the end of the fifth breath cycle displayed in the Analysis window and measure the Mean Breath Rate from the Breathing Rate channel. The value for Mean on the Breath Rate channel is the subject's mean breath rate over the five consecutive breath cycles.
13. Record the value for this rate in the Journal using one of the techniques described in Exercise 1, and in the data table.

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14. Have the subject answer the questions in the shyness/behavioral inhibition questionnaire in Table 2. From the way the subject answered the questions, how does all this related to Vagal tone?

Questions

1. What is the value for the Vagal tone of the subject? What percentage of the mean minimum heart rate is the value for the Vagal tone?
2. How does the Vagal tone of this subject compare to the subject's score on the shyness/behavioral inhibition questionnaire?
3. How does the Vagal tone of this subject compare to those of other subjects? When the Vagal tones and shyness scores of all the subjects are compared, is there a correlation between shyness/behavioral inhibition and Vagal tone?
4. Does any other factor besides shyness or inhibition affect Vagal tone?

Table HP-5-L2: Shyness/Behavioral Inhibition Questionnaire*

Question	
* Ratings: 0=never, 1=rarely, 2=occasionally, 3=often, 4=almost always. The total score is the sum of the ratings for all 20 questions	
How often do you experience awkwardness or discomfort in the following situations?	Score (0-4)
1. At a party	
2. On a dinner date	
3. In a class discussion when expected to contribute.	
4. In an uncrowded elevator.	
5. When introduced to someone.	
6. In a study group.	
7. When asked to introduce yourself in class.	
8. When asking someone out for coffee (tea, soda, etc.)	
9. When asking for notes from a classmate after an absence.	
10. When speaking to a professor.	

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How often do you have difficulty actually doing (taking action on) the following?	Score (0-4)
11. Making and sustaining eye contact in a conversation.	
12. Initiating a conversation with persons you do not know well.	
13. Disagreeing with someone.	
14. Asking a question in class.	
15. Making small talk.	
16. Asking directions or help.	
17. Calling people on the phone to invite them over.	
18. Giving aide or attention to someone in distress.	
19. Seeking information from others about class assignments.	
20. Telling someone they are bothering you.	
TOTAL	

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