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V. DATA ANALYSIS

FAST TRACK Data Analysis

1. Enter the **Review Saved Data** mode and choose the correct file.
   - Note Channel Number (CH) designations:

Channel	*Displays*	*Units*
CH 1	Pressure	mmHg
CH 2	Stethoscope	mV
CH 3*	ECG Lead II	mV

*ECG may not have been recorded.

   - Note measurement box settings:

Channel	*Measurement*
CH 1	**Value**
CH 3	**BPM**
CH 1	**Delta T**

2. Setup your display window for optimal viewing of the first recording.

3. Use the **I-Beam** cursor to select the point at the first event marker and record the pressure (CH 1 ï Value).

A

Data analysis continues…

Detailed Explanation of Data Analysis Steps

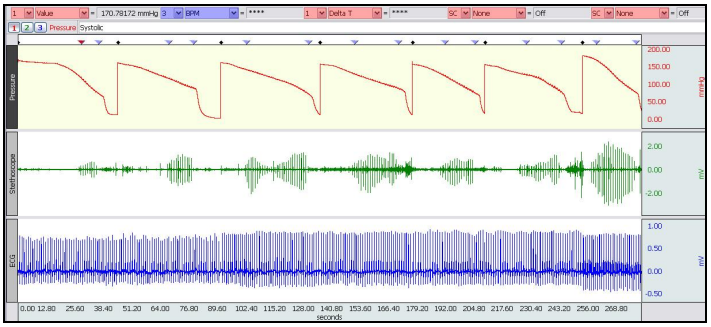

Fig. 16.22 Example Data

The measurement boxes are above the marker region in the data window. Each measurement has three sections: channel number, measurement type, and result. The first two sections are pull-down menus that are activated when you click them.

Brief definition of measurements:

Value: Displays the amplitude value for the channel at the point selected by the I-beam cursor. If a single point is selected, the value is for that point, if an area is selected, the value is the endpoint of the selected area.

BPM: **B**eats **P**er **M**inute first calculates the difference in time between the end and beginning of the area selected by the I-Beam tool (same as Delta T,) and then divides this value into 60 seconds/minute.

Delta T: Measures the difference in time between the end and beginning of the selected area.

The ñselected areaò is the area selected by the I-Beam tool (including endpoints).

Note: The append event markers ◆ mark the beginning of each recording. Click on (activate) the event marker to display its label.

Useful tools for changing view:

Display menu: Autoscale Horizontal, Autoscale Waveforms, Zoom Back, Zoom Forward

Scroll Bars: Time (Horizontal); Amplitude (Vertical)

Cursor Tools: Zoom Tool

Buttons: Overlap, Split, Show Grid, Hide Grid, -, +

Hide/Show Channel: ñAlt + clickò (Windows) or ñOption + clickò (Mac) the channel number box to toggle channel display.

This is the Systolic pressure that was audibly detected; event marker manually inserted.

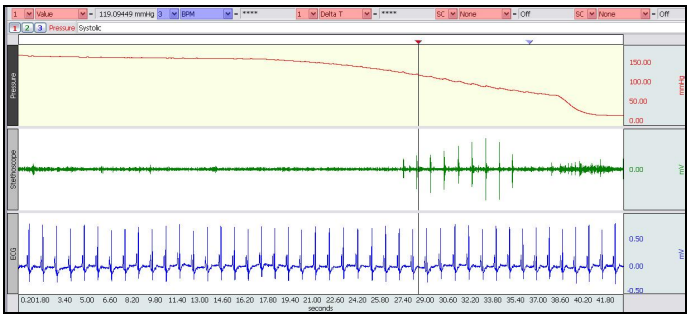

Fig. 16.23 Point of audibly detected Systolic pressure

Note: In the figure, the **Value** measurement represents cuff pressure at the selected point and the **BPM** measurement is not giving an accurate reading because only one point is selected with the I-beam cursor.

4. Select the point that corresponds to the first Korotkoff sound the stethoscope detected and record the pressure.

   A

This is the Systolic pressure that was detected by the stethoscope.

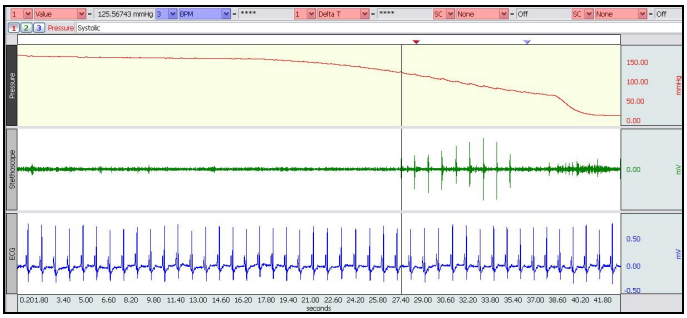

Fig. 16.24 Point of first Korotkoff sound

IF ECG is recorded: To help distinguish a Korotkoff sound from noise artifact, note that the sound normally appears near the time of the ECG T-wave. If needed, zoom in the data to see the details.

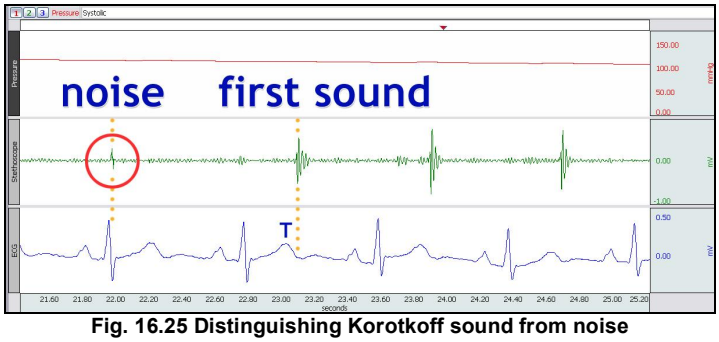

Fig. 16.25 Distinguishing Korotkoff sound from noise

5. Select the point that corresponds to the second event marker and record the pressure.

   B

This is the Diastolic pressure that was audibly detected.

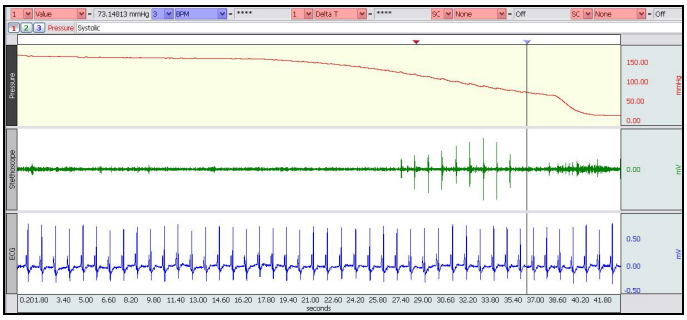

Fig. 16.26 Point of audibly detected Diastolic pressure

Data Analysis continues…

6. Select the point that corresponds to the last Korotkoff sound the stethoscope detected and record the pressure.

   B

This is the Diastolic pressure that was detected by the stethoscope.

As in Step 4, the ECG ï T wave can be used to distinguish a Korotkoff sound from noise artifact.

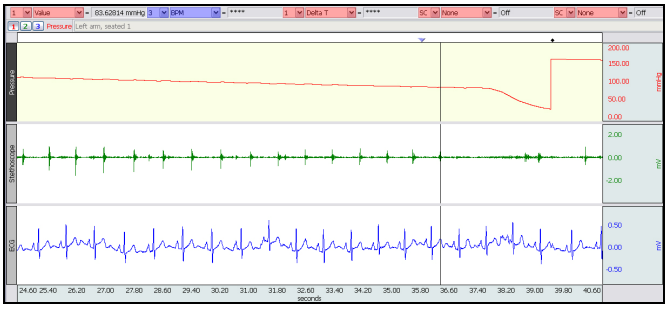

Fig. 16.27 Last sound detected by stethoscope

7. Measure BPM.
   - Using ECG signal:

     In the region between Systolic and Diastolic pressure, select one R-R interval and record the BPM measurement (Fig. 16.28).

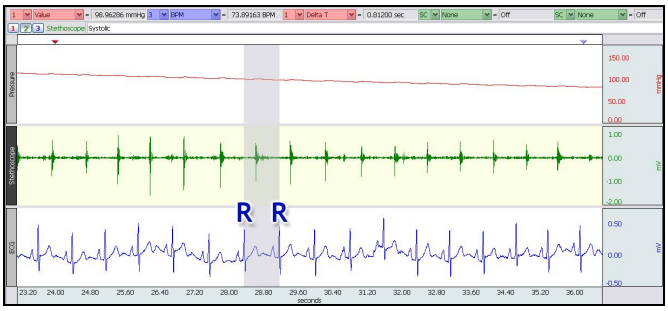

Fig. 16.28 One R-R interval selected

   - Using Korotkoff sounds:

     If ECG was not recorded, select the area between two successive Korotkoff sound peaks and record the BPM measurement (Fig. 16.29).

   C

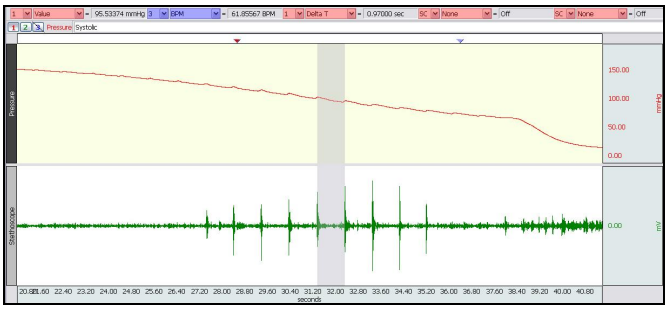

Fig. 16.29 Sound interval selection approximates R-to-R interval

Repeat this measurement on two successive R-waves (or sound peaks).

C

BPM changes on a beat-by-beat cycle, so for more accurate measurement you should take BPM (R-R) measurements on 3 successive R-waves and find the average BPM.

TIP: You may hide CH 1 (Pressure) to make it easier to see the other channels. (Alt + click on PC, option + click on Mac.)

8. *If ECG was not recorded skip to Step 9.* Zoom in on one of the ECG complexes in the time between systolic and diastolic pressure.

9. Using the I-beam cursor, select the area from the peak of the R-wave to the beginning of the sound detected by the stethoscope.

   Note the Delta T measurement.

   E

Fig. 16.30 Timing of Korotkoff Sounds

Data Analysis continues…

10. Repeat Steps 3 ï 8 for each recording to complete the Data Report.

This lesson acquired seven recordings (unless modified for your lab session). Recordings are identified by their append event markers. ◆

11. Perform measurements and calculations for Pulse Speed per Table 16.7.

12. Answer the questions at the end of the Data Report.
13. **Save** or **Print** the data file.

An electronically editable **Data Report** is located in the journal (following the lesson summary,) or immediately following this Data Analysis section. Your instructor will recommend the preferred format for your lab.

14. **Quit** the program.

END OF DATA ANALYSIS

END OF LESSON 16

Complete the Lesson 16 Data Report that follows.

BLOOD PRESSURE

- *Indirect measurement*
- *Ventricular Systole & Diastole*
- *Korotkoff sounds*
- *Mean Arterial pressure*

DATA REPORT

Studentôs Name: _____

Lab Section: _____

Date: _____

I. Data and Calculations

Subject Profile

Name:_____ Height:_____

Age:_____ Time: _____ Gender: Male / Female Weight:_____

A. Systolic Measurements

Complete Table 16.2 with the systolic measurements for all data recordings. Note the pressure measurement at the event marker insertion point (where Director audibly detected and marked systolic) and where the first Korotkoff sound was detected with the stethoscope microphone. Calculate the Delta difference (Δ) between the trials for each condition, the trial average pressure, and the Delta difference between the event marker and stethoscope microphone average pressure measurements.

Table 16.2 Systolic Data

Systolic Pressure mmHg 1 Value						
Condition	**Trial**	**Audibly Detected Pressure (Event marker)**	**Average Pressure (Calculate) A**	**Microphone Detected Pressure (In data, unmarked)**	**Average Pressure (Calculate) B**	**Δ Average Pressure B minus Average Pressure A**
Left arm, seated	1					
	2					
	Δ					
Right arm, seated	1					
	2					
	Δ					
Right arm, lying down	1					
	2					
	Δ					
Right arm, after exercise*	1					

*For ôRight arm, after exerciseôrecording, calculate the Delta difference between the ôAudibly Detected Pressureôand the ôMicrophone Detected Pressureôvalues, and record the result in the right column.

B. **Diastolic Measurements**

Complete Table 16.3 with the diastolic measurements for all data recordings. Note the pressure measurement at the event marker insertion point (where Director audibly detected and marked diastolic) and where the sound disappeared from the stethoscope microphone. Calculate the Delta difference (Δ) between the trials for each condition, the trial average pressure, and the Delta difference between the event marker and stethoscope microphone average pressure measurements.

Table 16.3 Diastolic Data

Diastolic Pressure mmHg 1 Value						
Condition	**Trial**	**Audibly Detected Pressure (Event marker)**	**Average Pressure (Calculate) A**	**Microphone Detected Pressure (In data, unmarked)**	**Average Pressure (Calculate) B**	**Δ Average Pressure B minus Average Pressure A**
Left arm, seated	1					
	2					
	Δ					
Right arm, seated	1					
	2					
	Δ					
Right arm, lying down	1					
	2					
	Δ					
Right arm, after exercise*	1					
*For ôRight arm, after exercise ô recording, calculate the Delta difference between the ôAudibly Detected Pressure ô and the ôMicrophone Detected Pressure ô values, and record the result in the right column.						

C. **BPM Measurements**

Complete Table 16.4 with the BPM measurements from three cycles of each data recording and calculate the mean BPM for each.

* **Cycle** measurements: If ECG was recorded, use 3 BPM; if ECG was not recorded, use 1 BPM.

Table 16.4 BPM

Condition	**Trial**	**Cycle***			**Calculate the Mean**	
		1	**2**	**3**	of Cycles 1 ï 3	of Trial 1 ï 2 means
Left arm, seated	1					
	2					
Right arm, seated	1					
	2					
Right arm, lying down	1					
	2					
Right arm, after exercise	1					

D. **Summary of Mean Blood Pressure Data**

Complete Table 16.5 with the average from sound data from tables 16.2 and 16.3 and then calculate the pulse pressure and the mean Arterial Pressure (MAP). Note the pressure measurements at the event marker insertion points (where Director audibly detected and marked systolic and diastolic).

Pulse pressure = Systolic pressure – Diastolic pressure

$$\text{MAP} = \frac{\text{pulse pressure}}{3} + \text{diastolic pressure} \quad OR \quad \text{MAP} = \frac{(\text{systolic pressure} + 2\,\text{diastolic pressure})}{3}$$

Table 16.5 Average Systolic Pressure/Average Diastolic Pressure

CONDITION	SYSTOLE Table 16.2 Sound Average	DIASTOLE Table 16.3 Sound Average	BPM Table 16.4	Calculations: Pulse pressure	MAP
Left arm, seated					
Right arm, seated					
Right arm, lying down					
Right arm, after exercise					

E. **Timing of Korotkoff Sounds** NOTE: This table requires ECG data, which is not recorded on MP45 systems.
Complete Table 16.6 with the Delta T for each condition, and calculate the means.

Table 16.6

Condition	Trial	Timing of Sounds 1 Delta T	Mean (calc)
Left arm, seated	1		
	2		
Right arm, seated	1		
	2		
Right arm, lying down	1		
	2		
Right arm, after exercise	1		

F. **Calculation of Pulse Speed**
Complete the calculation in Table 16.7 using ñRight arm, seatedò data.

Table 16.7

Distance	Distance between Subjectôs sternum and right shoulder	cm
	Distance between Subjectôs right shoulder and antecubital fossa	cm
	Total distance	cm
Time	Time between R-wave and first Korotkoff sound	secs
Speed	Speed = distance/time = _____cm / _____sec	cm/sec

II. Questions:

1. Note the difference in systolic pressure value between when (a) the sound actually began, (b) was detected by the stethoscope transducer, and (c) was recorded, and the time when the observer first heard the sound and pressed the event marker keystroke. (Example: 141 mmHg ï 135 mmHg = 6 mmHg.) What factors could account for this difference? Would the observed difference be the same if measured by another observer? Explain your answer.

_____

_____

_____

2. a) Does your systolic and/or diastolic arterial pressure change as your heart rate increases?

_____

_____

_____

b) How does this change affect your pulse pressure?

c) How would you expect the systolic, diastolic and pulse pressures to change in a normal healthy individual as the heart rate increases?

3. Give three sources of error in the indirect method of determining systemic arterial blood pressure.

4. Use an equation that relates flow, pressure, and resistance to define mean arterial pressure:

5. Blood flow (liters per min). through the pulmonary circuit equals blood flow through the systemic circuit, but pulmonary resistance to flow is 5 times less than the systemic resistance to flow. Using the equation in Question 4, show that mean pulmonary pressure is 5 times less than mean systemic pressure.

6. Define the first and second sounds of **Korotkoff**. Which sound is used to approximate systolic pressure and which sound is used to approximate diastolic pressure?

7. Why is mean arterial pressure not equal to (systolic pressure ï diastolic pressure)/2?

8. Define **pulse pressure**. Explain, in terms of changes in systolic and diastolic pressures, why pulse pressure increases during exercise.

9. Give one reason why blood pressure in the left arm may be different than blood pressure in the right arm of a Subject at rest.

_____

_____

_____

10. Name an artery other than the brachial that could be used for an indirect measurement of blood pressure and explain your choice.

_____

_____

_____

III. OPTIONAL Active Learning Portion

A. ***Hypothesis***

B. ***Materials***

C. ***Method***

D. ***Set Up***

E. ***Experimental Results***

End of Lesson 16 Data Report