DATASTUDIO 101 (from PASCO)
A QUICKSTART TUTORIAL

1. ~~**Power on your computer station.**~~

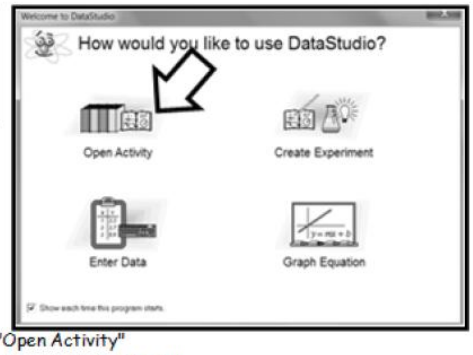
2. ~~**Create your folder L##N#C##**~~

3. ~~**Get the two files you will need for this lab: "template.ds" & "event marker.ds"**~~

4. **Open Datastudio.**

   - Click on the Datastudio icon on the Computer Desktop;

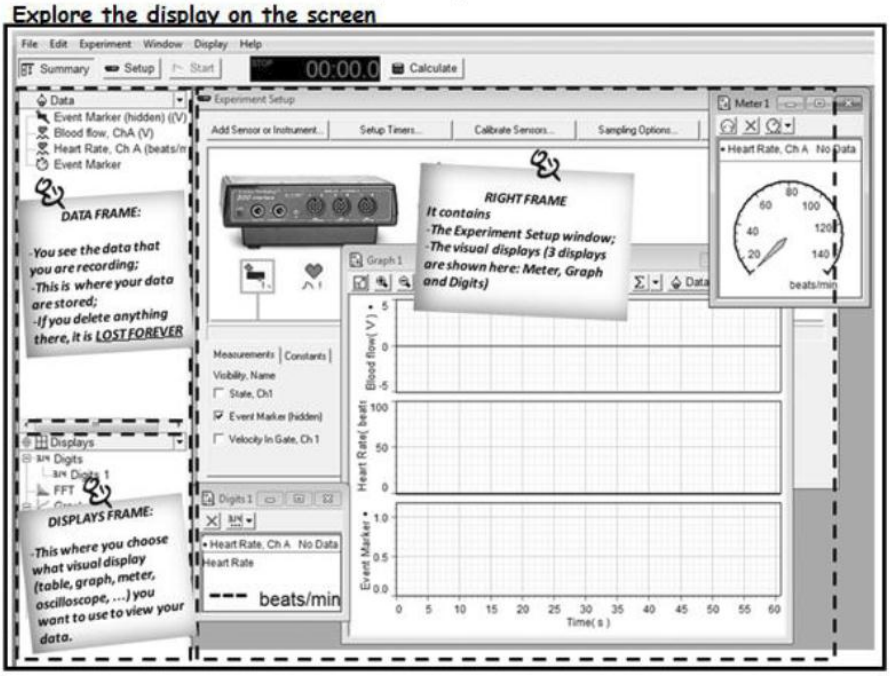
   - A Window opens ***"How would you like to use DataStudio?"***.



5. **Open "template.ds"**

   - Click "Open Activity"
   - Find and open "template.ds"

6. **Explore the display on the screen**



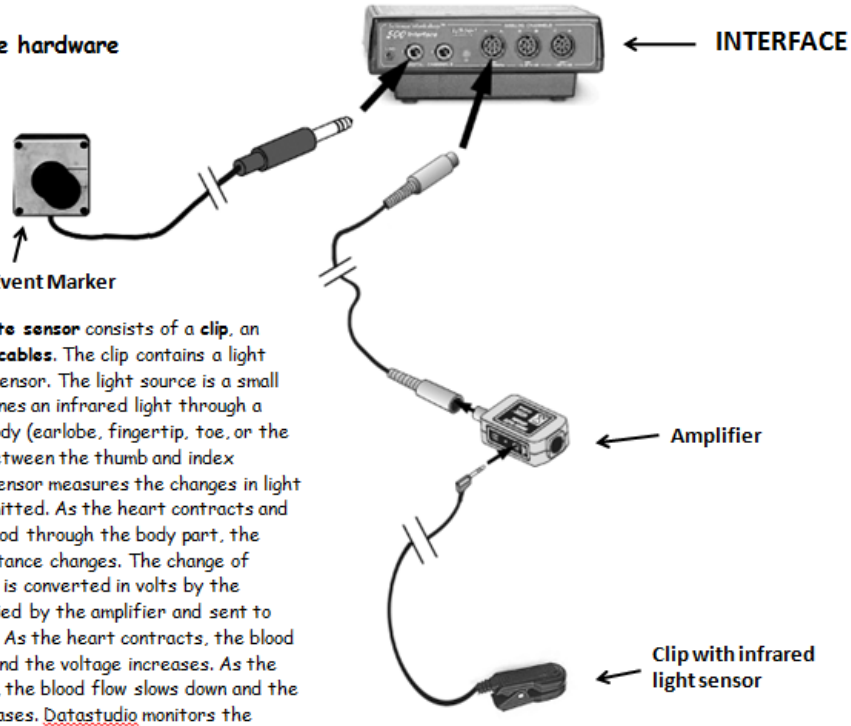
Experiment Setup: this is where the settings of the interface (WS500) and the settings and calibration of sensors and probes are found.

In our example, data are displayed in a **Meter**, as well as in a **Graph** and in **Digits**.
Meter: the needle moves and shows value as value change over time;
Graph: the trace on the graph records how the value changes over time;
Digits: the number changes as value change over time.

7. **NOT RELEVANT TO Stat 450**

8. **First objective** Learning how to use Datastudio by **measuring the heart rate of a human subject**

9. **Explore the hardware**



The **Heart rate sensor** consists of a **clip**, an **amplifier** and **cables**. The clip contains a light source and a sensor. The light source is a small diode that shines an infrared light through a part of the body (earlobe, fingertip, toe, or the web of skin between the thumb and index finger). The sensor measures the changes in light that is transmitted. As the heart contracts and forces the blood through the body part, the light transmittance changes. The change of transmittance is converted in volts by the sensor, amplified by the amplifier and sent to the interface. As the heart contracts, the blood flows faster and the voltage increases. As the heart relaxes, the blood flow slows down and the voltage decreases. Datastudio monitors the frequency changes to calculate the heart rate

The event marker is used to indicate when an even occurs. Just press the button.

10. **LET'S PLAY!: collect your 1ST set of data:**

First, **hook your one of your team-mates to the Heart Rate Sensor.**
How? Use the **clip**. The clip can be attached to a part of the body such as an earlobe, a fingertip, toe, or the web of skin between the thumb and index finger **- LISTEN CAREFULLY YOUR TA** for info on how to get a great signal.

Then click on "Start" and look at your data being displayed live on the screen.

- The subject is still. **Record her heart rate for 20-25 sec** ;
- Then **click the event marker** and tell her **"Now"**. The subject **slowly fills her lungs to the maximum** and then **empties them slowly as much as she can**;
- When she has emptied her lungs to the max, the experimenter **clicks the event marker** and the subject will **resume breathing normally for a few sec;**
- Click on **stop.**

You can use our stopwatch or the Datastudio's clock at the top of the screen

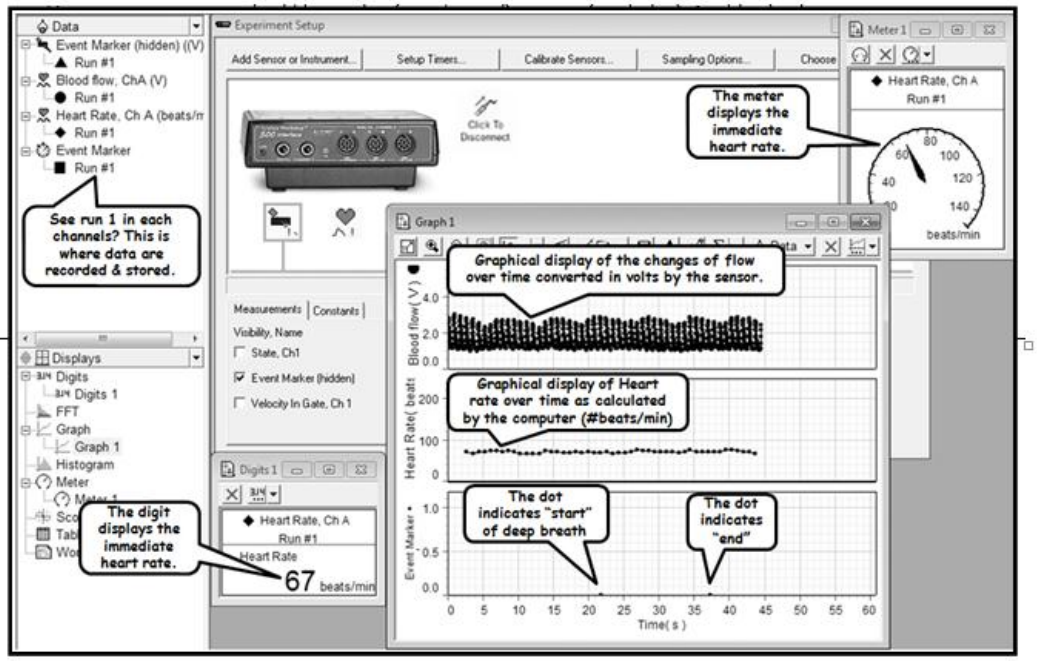
- This is what I recorded when I followed these steps (see figure below)

Look at the graph:

Do you see 1) the blood flow pulsing through your finger, 2) the heart rate being calculated and plotted automatically over time and 3) the 2 dots in the event marker channel.

Look at the Meter and Digits:

Do you see the digits changing and the needle moving as the heart rate of the subject changes?



11. Now collect your 2nd set of data.

Same as before (see "10"):
"Click on "Start" and look at your data being displayed live on the screen.

- The subject is still. **Record her heart rate for 20-25 sec** ;
- Then **click the event marker** and tell her **"Now"**. The subject **<u>slowly</u> fills her lungs to the maximum** and then **empties them slowly as much as she can**;
- When she has emptied her lungs to the max, the experimenter **clicks the event marker** and the subject will **resume breathing normally for a few sec;**
- Click on **stop."**

Please note:

- **Experimenter: do not forget to click the <u>event marker</u> to signal the transition between episodes;**
- **Subject: keep your hand and arm connected to the probe very still.**

As you collect your data, look at the computer screen:

- **Look in the "Data" frame: you will see "run 2" – This is where your 2nd set of data is stored.**
- **Look on the graph:** do you see 1) the blood flow pulsing through your finger, 2) the heart rate being calculated and plotted automatically over time and 3) the 2 dots in the event marker channel.
- **Save** (*recording 1)* – **Always save after recording a new set of data (or run)** … just in case of computer crash.

12. Delete a run in a graph and bring it back!

- Delete "run 1" inside the graph: inside the graph, **highlight the symbol the run and then hit the delete key**
- Bring it back: **drag "run 1" from the data frame to the "graph#" caption found in the display frame**.

13. Keep a run in a graph but make it invisible!

- Look at the icons at the top of your graph.
- Click on the icon that says "data" select and unselect runs and see what is happening.

14. Delete a whole graph and bring it back!

- Delete the whole graph: click on the X of the graph window.
- Recreate the graph: drag the runs into the "graph" caption found in the display frame.

15. Delete a run in the data frame and bring it back!

- Delete "run 1" inside the data frame: inside the frame, highlight the run and then hit the delete key
- Can you undo it and bring it back inside your graph? No! (Thanks god you already saved the file…..otherwise "bye bye" data… Exit the file but do not save it.) –
- Open this file again, your 2 runs should be there

16. Change the name, symbol & colour of the runs

- Double click on one of the runs inside the data frame. A window will open –Change name symbol and colour of run.

17. Rename the measurement (in dataframe)

- Double click on one of the name of measurement in the data frame (i.e. voltage, Ch.A"). A window will open –
- Change name of measurement (rename it "Flow")

18. Rename the title of the Y axis of the channels in graph display, change unit

- Go in the data frame and double click on the measurement associated with the channel that you want to affect. A window will open (same window as in 2-9) –
- The "variable name" labels the title of the Y axis (rename it)
- The "Units" represent the unit of the variable of the Y channel (change it).
- Try to change the label "voltage (v)" into "Blood flow (ml/min)

19. **Scrolling along axises** (i.e. moving along the axises to look for data that are out of sight)

- Move your cursor on the axis.
- When the arrow changes into a "small hand" click and drag (as you drag hold your click)
- You can also move along the axises by clicking on the arrows on your keyboard

20. **Scaling axises** (i.e. Increasing or decreasing the scale of my axis)

- Move your cursor on the axis you want to affect.
- When the arrow changes into a "small spring" click and drag (as you drag hold your click)

21. How to change the appearance of graphs

There are 4 ways to access commands that will let you change the appearance of your graph and its channels.

1-> At the top of the "Graph 1" window, there are icons.
Click on the icon on the right that is shaped like a small graph
2-> Double click inside the graph itself (you will get the same menu as you got in "1")

3-> On the right of the icon previously describe you can see a downward arrow. Click on it

4-> Right click inside the graph itself

22. Change the units of the X axis – time

- Refer to "21" and explore: browse through the menus until you find the proper tool to accomplish the task.

23. Display or hide the data points from traces

- Refer to "21" and explore: browse through the menus until you find the proper tool to accomplish the task.

24. Connect and disconnect the data points in traces

- Refer to "21" and explore: browse through the menus until you find the proper tool to accomplish the task.

25. Change thickness of lines in traces

- Refer to "21" and explore: browse through the menus until you find the proper tool to accomplish the task.

26. Disconnect the channels so that the time scale of each channel can be changed independently.

- When the 3 channels are disconnected, they will each have their own time axis and you will be able to resize or scroll each x axis independently from each other.
- Refer to "21" and explore: browse through the menus until you find the proper tool to accomplish the task.

27. Label events in channels

1-> At the top of the "Graph 1" window, there are icons.
2-> Click on the icon "A"
3-> Label the start of each episode of your run 2.

This allows you to keep track of the events that happened during the experiment (in this example: it will indicate that at this precise moment shown by the event marker, your subject started one deep breath)

Warning:
If you delete the graph, all the labels will disappear for ever.
As a backup, keep good notes in your lab-book.

28. Quantification

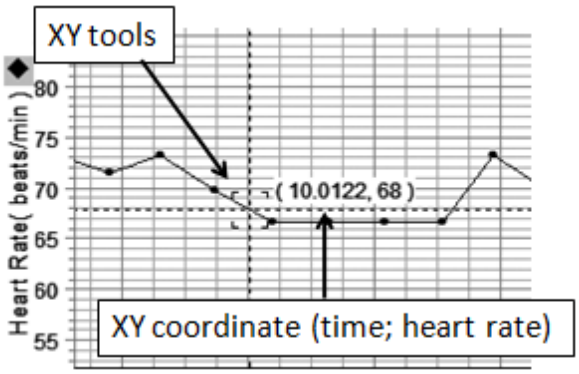
You can do either:

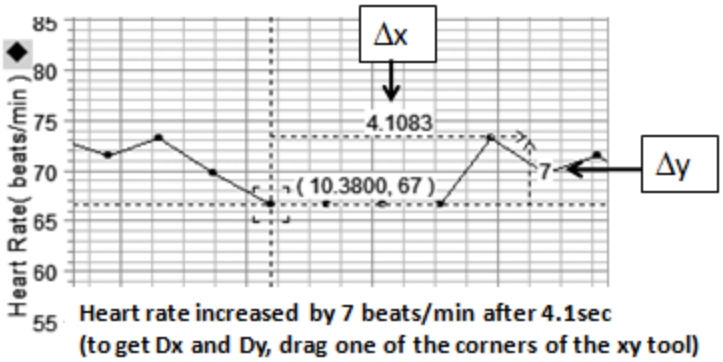
1-> **transfer data to excel** (transfer Flow, transfer Heart rate)
2-> use the XY icon to get the quantified information you want, then type it into your excel spreadsheet
3-> use the Σ icon to get the quantified information you want, then type it into your excel spreadsheet

There are many ways of quantifying your data. The challenge is to choose which one is appropriate for the study you are conducting

Explore "2":

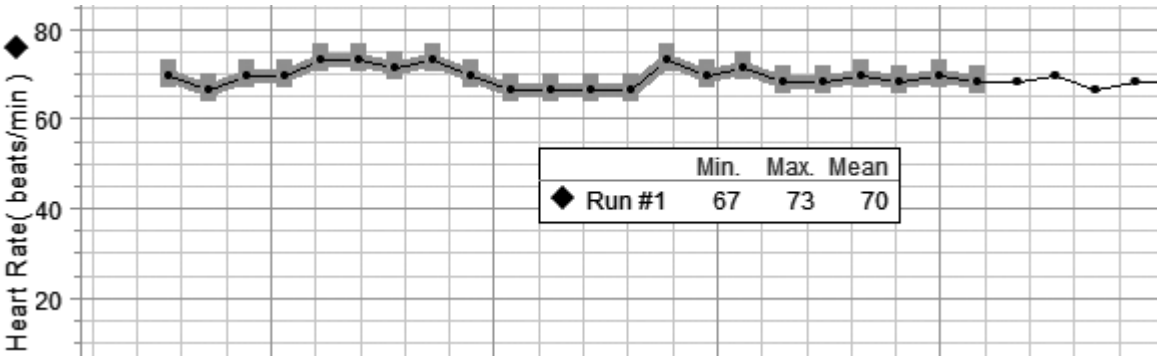
- Use "2" to find the heart rate of your subject exactly 10 sec after the start of the run
- Use "2" to find the biggest change of heart rate before your subject started her deep breath





Explore "3":

- Use "3" to find the average, the maximum and the minimum values of heart rate during the first period of your first run (before she starts her deep breath)



- **First click on** the S icon and select Minimum, Maximum and Mean
- **Then highlight the segment of recording that you wish to quantify and you see them...**
- **Select now the segment of recording between start and stop: what is the** minimum, maximum and mean heart rate then?

29. I cannot find my data on my graph! I know they are on the graph but I cannot find them.

- **Click on the channel your data are supposed to be on;**
- **Click on the "scale to fit" icon** on the utmost left of your graph window.

30. Remove data points (i.e. delete them from the trace -> this is different from "hiding them")

This feature should not be use to remove data points you do not like because they go against your preconceived idea of what should have happened. This is bias and .... you would be ***CHEATING*** – Bad – Shameful - Mortal sin for scientist!!!!

You will use this feature only to remove **artefact ONLY!**

What is an artefact? An **artifact** is any error in the perception, representation or measurement of any information or data caused by the involved equipment or technique.

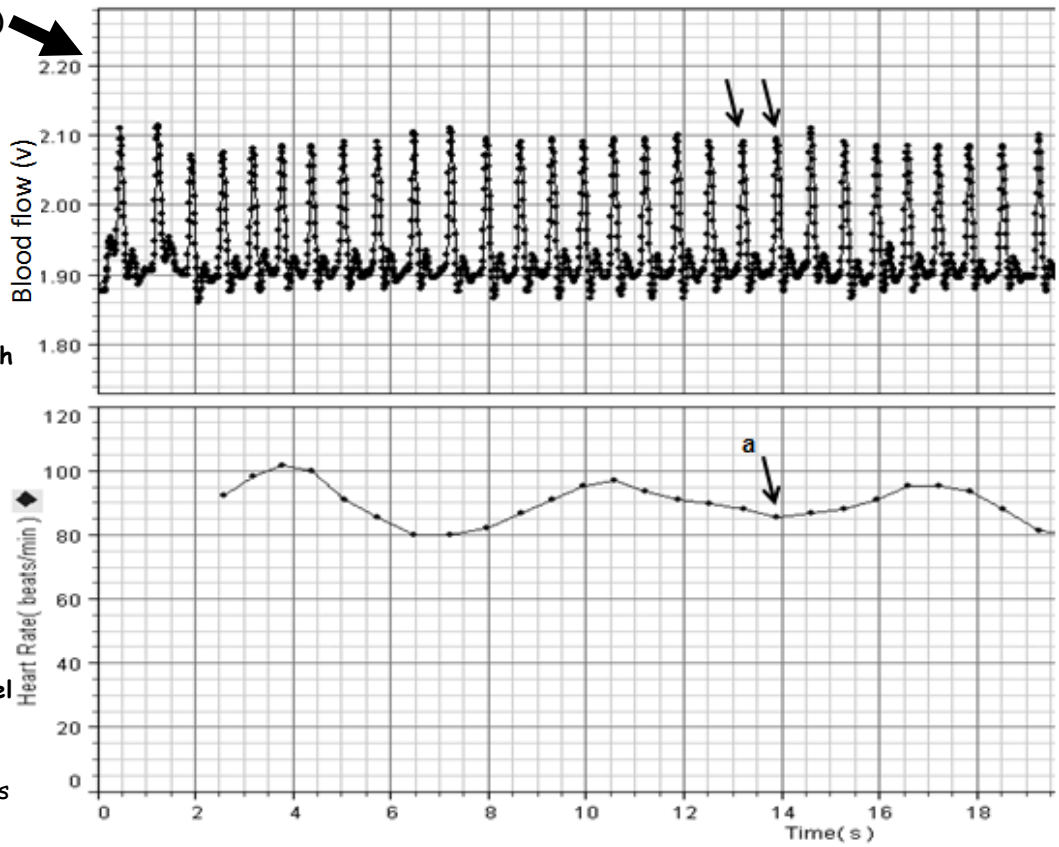
An artefact is a **value/measurement that is "contaminated"** and that do not represent what you actually want to measure: the equipment may be broken; not calibrated properly; your subject may be behaving in a way that does not allow the equipment to register data properly; etc.... You cannot use this measurement and be confident that it represents what is happening physiologically in your subject. If your value is "tainted", you have to discard it. You cannot use it in your data analysis.

Example of a good quality recording:

This **(on the right) is a good quality recording** of the heart rate of a human subject.

The **top channel** displays the **blood flow pulsing** through the finger of my subject. **Each dots** represent a **data point (voltage) coming from the finger probe.** These dots are the **real data** coming from your subject.

The **bottom channel** displays **the heart rate** of your subject. These dots are **NOT the real data** coming from your subject.



Rather they are an **interpretation by the computer of the data found in the channel above**.
The computer detects the tips of the peaks (see arrows) in the top channels, **measure the time interval between 2 peaks** and **convert it into a heart rate value** (see a) using the equation:

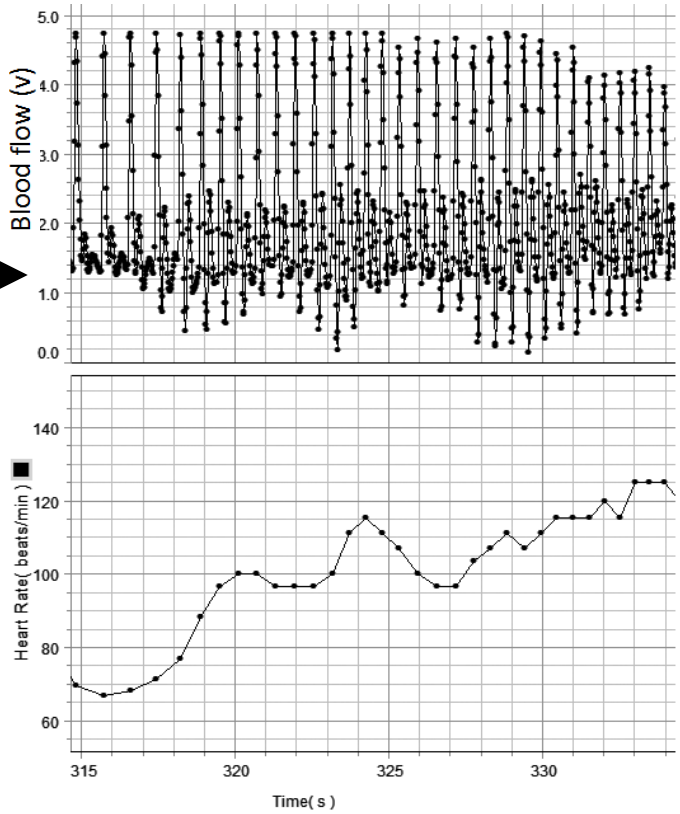
HR (b/min) = [(# of intervals)x60]/duration (sec)

I used the XY tool to determine the time interval between the 2 peaks in the top channel (0.71 sec); # if intervals is "1": ***HR (b/min) = [(1)x60]/0.71 = 85*** *This is the value the computer calculate in the bottom channel (see a).*

It is very "easy" for the computer to

detect the peaks associated with heart contractions and the top and bottom channels match with each other. I am confident that the values displayed in the bottom channels represent truly the heart rate of my subject.

Another example of a good quality recording is given on the right.
The bottom channel shows that the heart rate of the subject changes from 66 beats/min to 125.
The recording of the blood flow (top channel) is very clear, the peaks are well define and again, I am confident that the values displayed as heart rate represent the fluctuation of the heart rate of my subject.

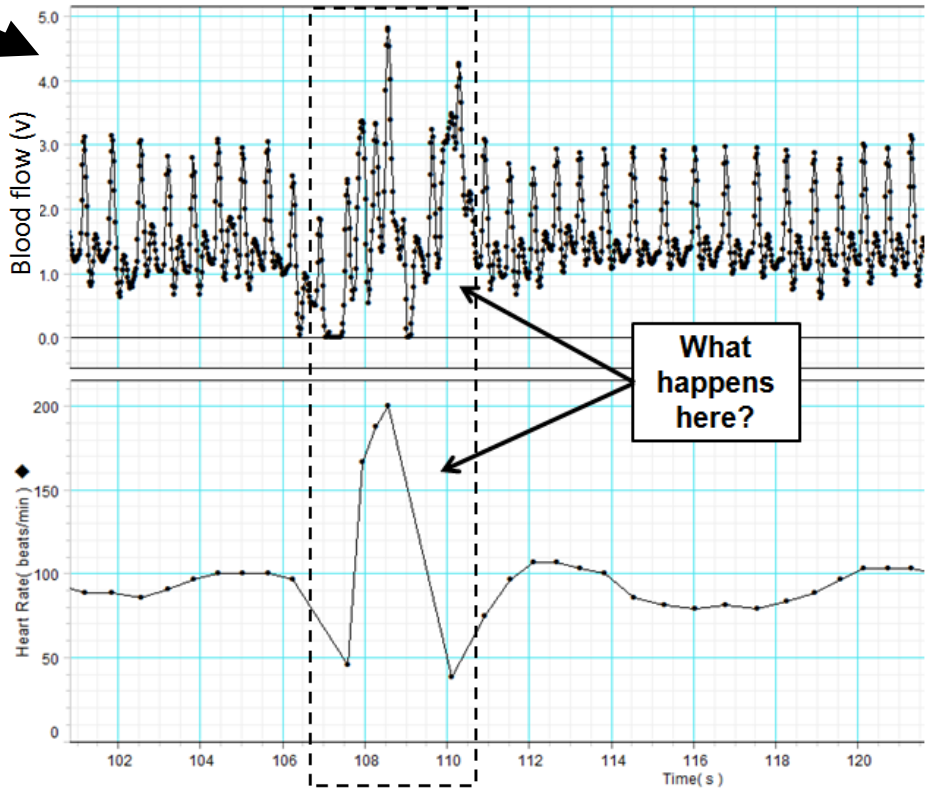


Example of artefacts

Look at the graph on the right.
The bottom channel suggests that the heart rate of this subject went from 50 beat/min to 200 and back to 50.

If you look at the top channel, you will see that the peaks are erratic. What is recorded there is an artefact: the subject moved her hand and the blood flow didn't get picked up properly by the finger probe.

The 5 data points in the bottom channel have to be deleted.



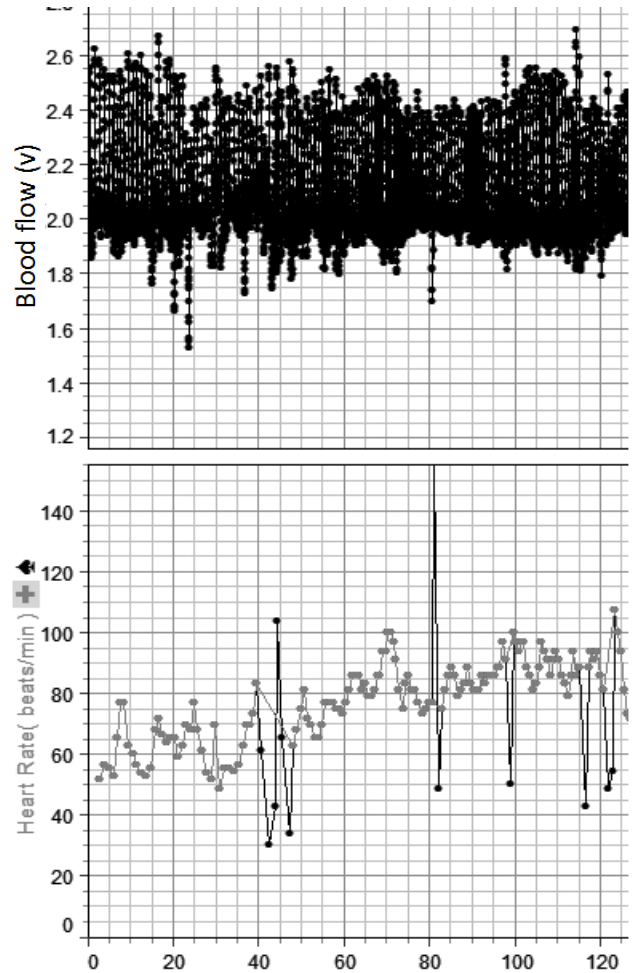
Removing an artefact:

→ You have to justify why you are doing it (explain how you differentiate between artefact and genuine data)

→ To remove a few points from the heart rate trace, highlight them and click on "delete" on your keyboard – **Try it**: observe that in the "Data" frame another measurement appears "Heart Rate (editable).

→ Look at the heart rate channel: I have superposed the edited run (grey) on the top of the unedited run (black). The black points showing up are the values that edited from my data analysis.

→ To superpose the edited and unedited runs on the same channel, drag them into it from the data frame.



31. Play around some more!

This tutorial (Datastudio 101) is designed to give you a good head start in the use of Datastudio. You have not explored all its capabilities yet. Do not hesitate to do so:

- *Explore the icons located at the top of "graph 1"*
- *Explore the different ways to change the appearance of your graph (see 2.13.)*

For extra-help, go to the toolbar at the top of the screen -> Help -> content or search.

32. Sample rate – Not relevant for STAT 450

33. Crashing the system: "Interface is disconnected" – Not relevant for STAT 450

34. LEARNING HOW TO CONNECT THE "REAL" SENSORS AND "VIRTUAL" SENSORS – Not relevant for STAT 450

35. Doing everything yourself from scratch – Not relevant for STAT 450

36. Printing directly from DataStudio

You only can print what you see on the computer screen: "what you see is what you get". Therefore arrange the graph to your liking before printing.

- Go to "file" -> "print" -> "Setup"-> "landscape"
- Go to "Print" -> "Setup"->> Select "HPLaserjet 4L"-> OK

37. Exporting your graph into "Microsoft Word"

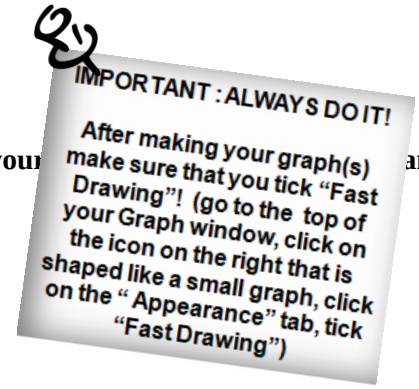
You will only export what you see on the screen. Therefore, set your graph the way you want it to appear in your word document

- Go to "display"
- Click on export picture
- Save as bitmap file
- Then go to your word document and insert it as a picture

If you have window 7, use the "Snipping tool".
This tool allows you to take a picture of any part of your computer screen and paste it in any document you want to.
To find this tool go to "all program" -> "accessories"

38. Close Datastudio!

Stat 450 →Use "Fast Drawing" see note →
It is less memory intensive on your computer and will make your [illegible] and scaling traces on graphs) faster.



Stat 450: you may want to explore the calculator tools to do your data analysis:
Click on the icons indicated by the white arrows.
Go to http://www.pasco.com/support/technical-support/technote/techIDlookup.cfm?TechNoteID=529 for more info - More info to be found in the company website: www.pasco.com

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