The Observer XT and physiological data

Patrick Zimmerman

Thursday, August 26 2010

Your instructor

Patrick Zimmerman

- Behavioral biology
- Documentation specialist and trainer (patrick@noldus.nl)

Outline of the tutorial

Introduction

- What are physiological data
- How do I work with physiological data in The Observer

Please attend the MindWare Tutorial (Tuesday August 24, 16:00 – 17:30) if you are also interested in physiological data acquisition and synchronization with The Observer

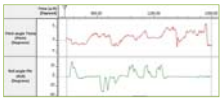
The Observer XT 10 and physiological (external) data

- Importing data
- Selecting data
- Visualizing data
- Analyzing data
- Creating charts
- Exporting data

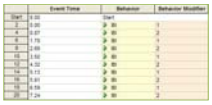
Introduction

What are physiological data

- **External data** – Continuous data sampled at a constant sample rate
  - Blood pressure, heart rate, ECG, EEG, speed, altitude, temperature



- **Event data** – Represented by discrete units
  - Observational data, events from a flight simulator, heart rate variability



Introduction

How do I work with physiological data

- **D**ata **A**c**Q**uisition (**DAQ**) System – External system for acquiring physiological data
  - BIOPAC, MindWare, Data Sciences, Polar, Tobii, SMI
- **Synchronization cable** (optional) – To send the synchronization signal from The Observer XT to the DAQ system
- **The Observer XT** – To import the physiological data file (optionally, including the synchronization signal)

Outline of the tutorial

Introduction

- What are physiological data
- How do I work with physiological data in The Observer - synchronization

The Observer XT 10 and physiological data

- Importing data
- Selecting data
- Visualizing data
- Analyzing data
- Creating charts
- Exporting data

Importing physiological data

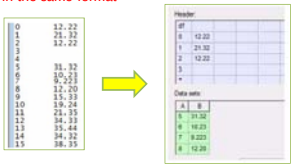
Requirements – Data

- Data must be sampled with a constant sample rate
- Data file must contain information about the sample rate – time column, sample interval or sample rate
- If you have sent out the Observer XT synchronization signal, also import the sync signal

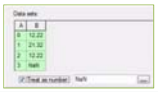
Importing physiological data

Requirements – For separating headers and data

- The file must contain at least 15 lines (excluding headers) in the same format



- Data sets must start on the same line
- Replace missing values and non-numerical values with conventional text such as **NaN** (**N**ot **a** **N**umber)



Importing physiological data

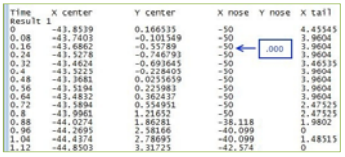
Note

- A missing value is converted to zero in The Observer XT. As a result, it is plotted as zero in the visualization, analyzed as zero and exported as zero
  - this will be fixed in a future release of The Observer XT

Importing physiological data

Requirements – For separating headers and data

- If in the same column integers co-occur with numbers with decimals, this results in incorrect detection of headers

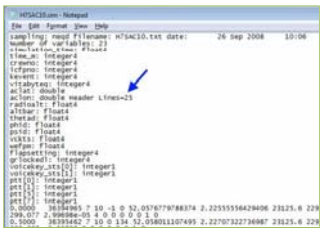


- Fix this by adding decimals to the integer numbers

Importing physiological data

Forcibly separating headers and data

1. Open the data file in a text editor.
2. Add 'Header Lines=[#lines in the header]' to one of the header lines



3. Create a custom import profile using this sample file

Outline of the tutorial

Introduction

- What are physiological data
- How do I work with physiological data in The Observer - synchronization

The Observer XT 10 and physiological data

- Importing data
- Selecting data
- Visualizing data
- Analyzing data
- Creating charts
- Exporting data

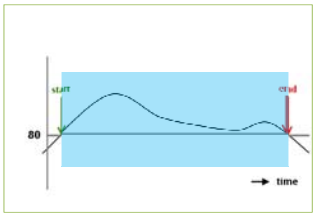
Selecting physiological data

Why select data?

- Analyze events or physiological data that occurred in a specific time interval
  - Analyze how many times during an observation Willard's heart rate dropped below 80
  - Analyze the total duration of each event which occurred when Willard's heart rate was between 80 and 100 beats-per-minute (bpm)
  - Analyze the mean heart rate when Willard was playing the game

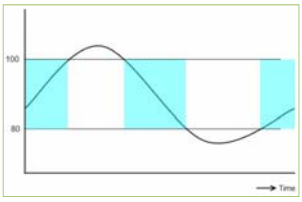
Selecting physiological data

- **Free Interval Selection** – To analyze data from a Start to an End point
  - From when the heart rate rises above 80 bpm to when the heart rate drops below 80 bpm → one or more intervals per observation



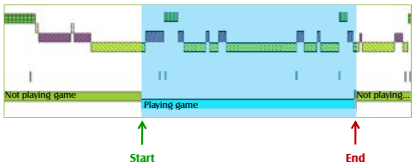
Selecting physiological data

- **Nesting** – To analyze events or physiological data that occur in time periods defined by an event or physiological data range
  - Nest over heart rate with a range between 80 and 100 bpm → one or more intervals per observation



Selecting physiological data

- **Nesting** – To analyze events or physiological data that occur in time periods defined by an event or physiological data range
  - Nest over "playing game" → one or more intervals per observation



Outline of the tutorial

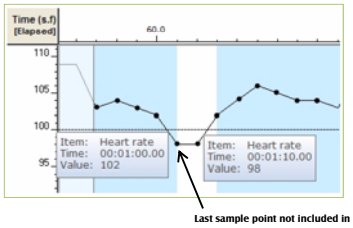
Introduction
- What are physiological data
- How do I work with physiological data in The Observer - synchronization

The Observer XT 10 and physiological data
- Importing data
- Selecting data
- Visualizing data
- Analyzing data
- Creating charts
- Exporting data

Visualizing physiological data

- In the Visualization, discrete sample points are connected by a line, but the physiological data still are discrete

*Nesting – **"Heart rate higher of equal to '100' bpm"***



Outline of the tutorial

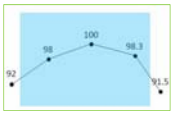
Introduction
- What are physiological data
- How do I work with physiological data in The Observer - synchronization

The Observer XT 10 and physiological data
- Importing data
- Selecting data
- Visualizing data
- Analyzing data
- Creating charts
- Exporting data

Analyzing physiological data

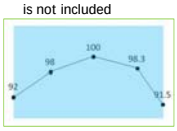
Numerical Analysis

- Calculation is based on the actual sample points, not interpolation



Minimum = 98, Maximum=100, Mean=98.7, Number of samples=3

- A sample point that coincides with the start of an interval is included, a sample point that coincides with the end of an interval is not included



Minimum = 92, Maximum=100, Mean=97.07 Number of samples=4

Outline of the tutorial

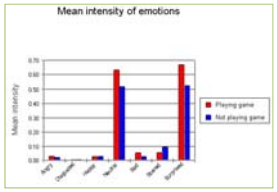
Introduction

- What are physiological data
- How do I work with physiological data in The Observer - synchronization

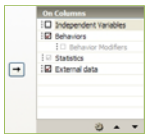
The Observer XT 10 and physiological data

- Importing data
- Selecting data
- Analyzing data
- Creating charts
- Exporting data

Creating charts



- Physiological (External) data **On Columns**
- Statistics **On Columns**
- Groups you want to compare **On Columns**
- Bottom-item in the **On Columns** sheet is used for **Series X Values**



Outline of the tutorial

Introduction

- What are physiological data
- How do I work with physiological data in The Observer - synchronization

The Observer XT 10 and physiological data

- Importing data
- Selecting data
- Analyzing data
- Creating charts
- Exporting data

Exporting data

Combined physiological + observational data

- Exported to a **single** ASCII file
- Observational data are re-sampled based on the sample rate of the physiological data
- For state events, the current state at a sample is exported
- For point events, an event is exported at the next sample
- Physiological data can be re-sampled (linear interpolation) based on the highest sample rate of one of the data sets

Exporting data

Combined physiological + observational data

- Exported data based on data selection ➔ Export Data Profile