Data set for comparison between two biosignals acquisition systems – BioNomadix and BITalino

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Introduction

The data was collected in order to compare quality of the signal acquired by two devices – BITalino (Da Silva, Guerreiro, Lourenço, Fred, & Martins, 2014) and BioNomadix (BIOPAC Systems Inc., Goleta, CA, USA). An additional goal was to create a data set and further analyze it.

Materials and methods

Participants

23 volunteers from the general population participated in the study.

Procedure

The experimental study was conducted in Nano-Games Lab (https://nano-games.com/research-development/) in February-March 2019. Firstly, participants were equipped with apparatus (BioNomadix, BITalino) for measuring physiological variables (ECG, EDA). Then, they were informed about the task they were to perform.

The study was a computer procedure written in PsychoPy (Peirce, & MacAskill, 2018). Participants were asked to assess 60 pictures displayed on the screen. The pictures were chosen

from Nencki Affective Picture System (NAPS, Marchewka, Żurawski, Jednoróg, & Grabowska, 2014). 30 highly arousing pictures and 30 low arousing pictures have been implemented into the PsychoPy (Peirce, & MacAskill, 2018) procedure. The pictures were sorted as follows:

- 20 pictures highly arousing,
- 20 pictures low arousing,
- 5 series of 2 highly arousing pictures and 2 low arousing pictures.

After 5 second exposure to a picture, the question 'how much arousing is it?' was displayed on the screen. Answers were given on the Likert's scale (1-7).

During whole procedure, BITalino and BioNomadix devices were acquiring data (sampling 1000 Hz). The beginning of BITalino acquisition was implemented into procedure and it starts with the first picture.. BioNomadix was started by researcher manually.

Measures

BioNomadix (BIOPAC Systems Inc., Goleta, CA, USA**).** Wireless system allowing to measure physiological variables. One of the most popular devices available on the 'research market'. A golden standard in physiological studies For purposes of the study a BIOPAC MP160 system was used (BIOPAC Systems Inc., Goleta, CA, USA). Both the electrocardiogram and electrodermal activity were sampled at 1000 Hz with a BioNomadix BN-ECG-2 and a BioNomadix BN-PPGED, respectively (BIOPAC Systems Inc., Goleta, CA, USA) Data were stored with AcqKnowledge 5.0 software (BIOPAC Systems, Goleta, CA, USA).

BITalino (Da Silva, Guerreiro, Lourenço, Fred, & Martins, 2014**).** Low-cost biomedical data acquisition system. An open-source hardware for education and physiological research. (r)evolution Pleugged Kit BT was used in the study. The apparatus allows researchers to acquire signals from six channels. Both the electrocardiogram and electrodermal activity data was read with 12 bits signal resolution.

PsychoPy (Peirce, & MacAskill, 2018**).** Open-source software written in Python allowing scientists to design behavioral experiments.

Nencki Affective Picture System (Marchewka, Żurawski, Jednoróg, & Grabowska, 2014**).** A base of 1356 images divided into five categories (people, faces, animals, objects, and

landscapes). NAPS is used in emotional research programs because of proven ability of each picture to induce emotional states.

Results

Data acquired by BITalino and by BioNomadix were merged into one data frame. In order to unify signals, the ECG peaks were found and data was merged by the first ECG peak in datasets. A package of .csv files was prepared to analysis and data visualization.

Each .csv file contains:

- 1. column – index
- 2. column – epoch time
- 3. Column – ECG acquired by BITalino (raw units)
- 4. Column – EDA acquired by BITalino (raw units)
- 5. Column – EDA acquired by BioNomadix (microSiemens)
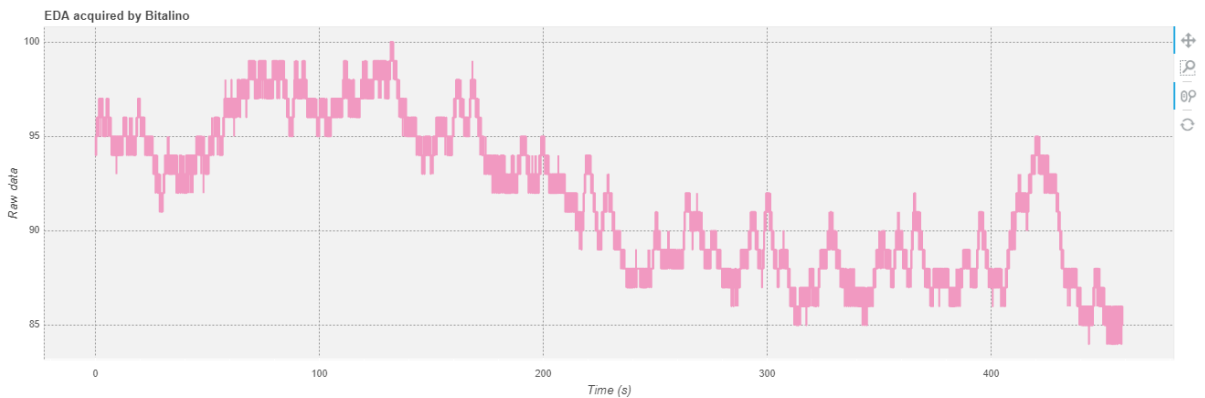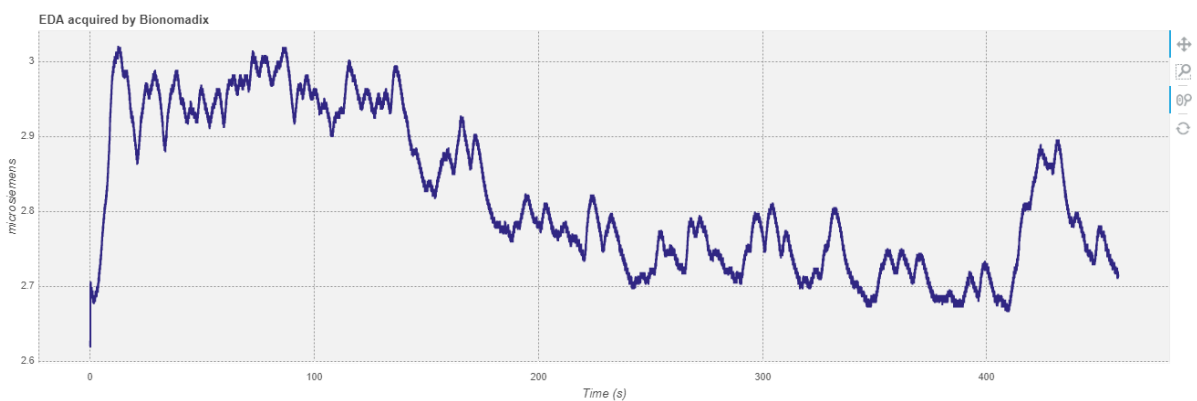- 6. Column – ECG acquired by BioNomadix (miliVolt)

Rows – data; 1msec/sample

Data visualization.

ECG

ECG acquired by Bionomadix

EDA

EDA acquired by Bionomadix

EDA acquired by Bitalino
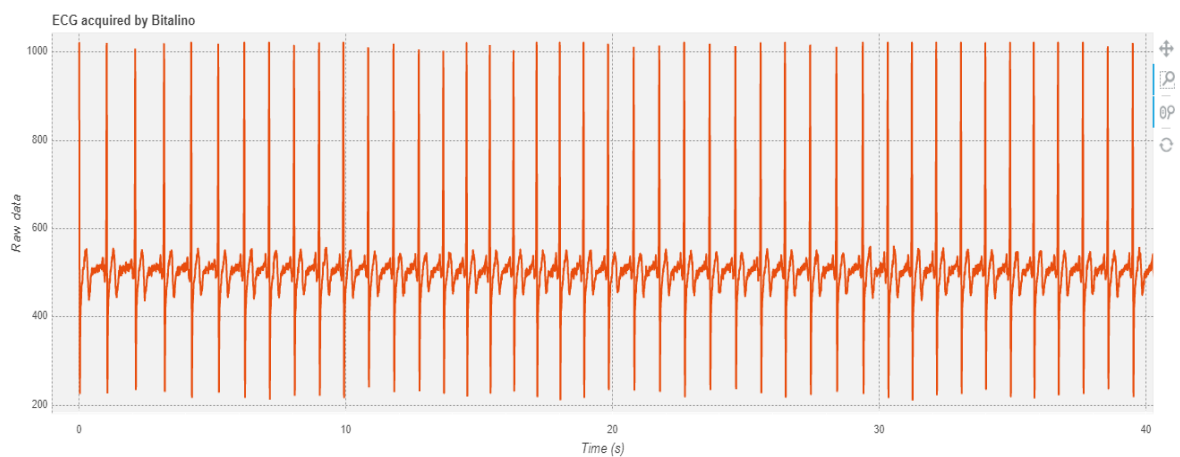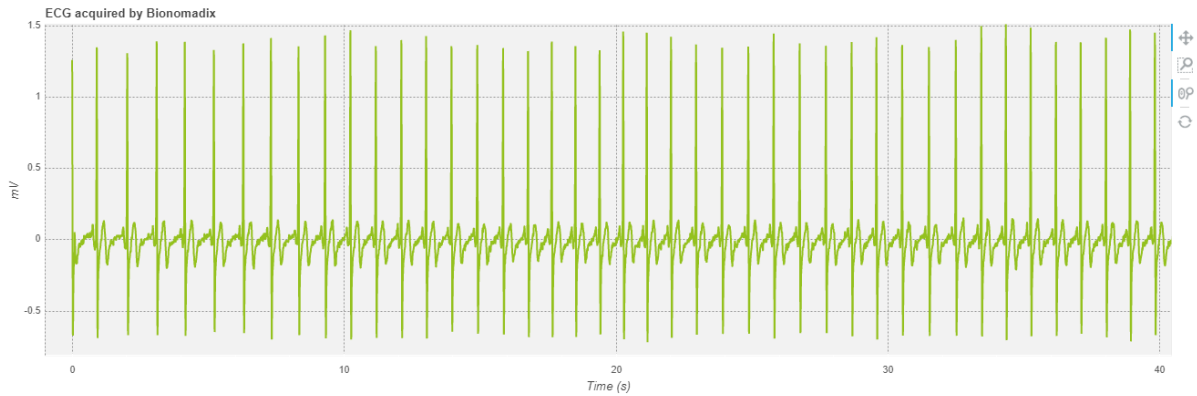
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