PsychoPhysioPipeline: A Processing and Analysis Pipeline for Psychophysiological Research

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Software

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Summary

Flow is widely understood as a source of creativity and innovation, physical and mental peak performances, and wellbeing. Individuals who experience flow tend to find the activity enjoyable and intrinsically rewarding (Csikszentmihalyi, Abuhamdeh, and Nakamura 2005). In the research project "Flow-Machines: Body Movement and Sound" (2012-2015) funded by German Federal Ministry of Education and Research (BMBF) we addressed how flow while walking can be supported by means of mobile technology. Using the rewarding effect of flow on the future motivation to walk, Flow-Machines should help to change the sedentary lifestyle.

Our research activities are organized in three interconnected strands a) process-oriented modeling of walking, b) searching for implicit indices of flow while walking and running and c) supporting (flow-) experiences while walking (Hajinejad et al. 2013)). Within the second strand, we searched for candidates for an implicit measurement method of flow-experience while walking and running.

Flow research is mainly based on explicit indices of flow extracted from interview or questionnaires. Future applications have to rely on implicit indices that allow us to design novel experiences and studying dimensions of embodied interaction. An implicit flow measurement measures flow-experiences without distraction the ongoing activity by a second or parallel activity.

In this paper, we present PsychoPhysioPipeline (Bogutzky 2016), a pipeline of several small R programs for segmenting the collected data of the PsychoPhysioCollector (Bogutzky and Schrader 2016), for identifying potential implicit flow characteristics and for their analysis. The pipeline allows researchers to correlate physiological, kinematical and subjective variables, as well as to analyze fluctuations over time. The pipeline supports the calculation of explicit flow dimensions based on the Flow-Short-Scale (Rheinberg, Vollmeyer, and Engeser 2003) and the calculation of the jerk-cost (Hreljac 2000) and the cardiolocomotor phase synchronization (Niizeki and Saitoh 2014) as potential implicit flow characteristics. The pipeline uses the free HRV software Kubios HRV ("Kubios HRV — heart rate variability analysis software." 2014) to compute RR intervals from ECG data and calculate HRV parameters.

The pilot deployment was successfully used in the research project Flow-Machines ("Flow-Machines: Body Movement and Sound", 2012-2015) at the University of Applied Sciences Bremen and funded by German Federal Ministry of Education and Research (BMBF; Förderkennzeichen: 03FH084PX2). Figure 1 shows for example the cardiolocomotor phase synchronization of a participant with low flow-experience in our running study.

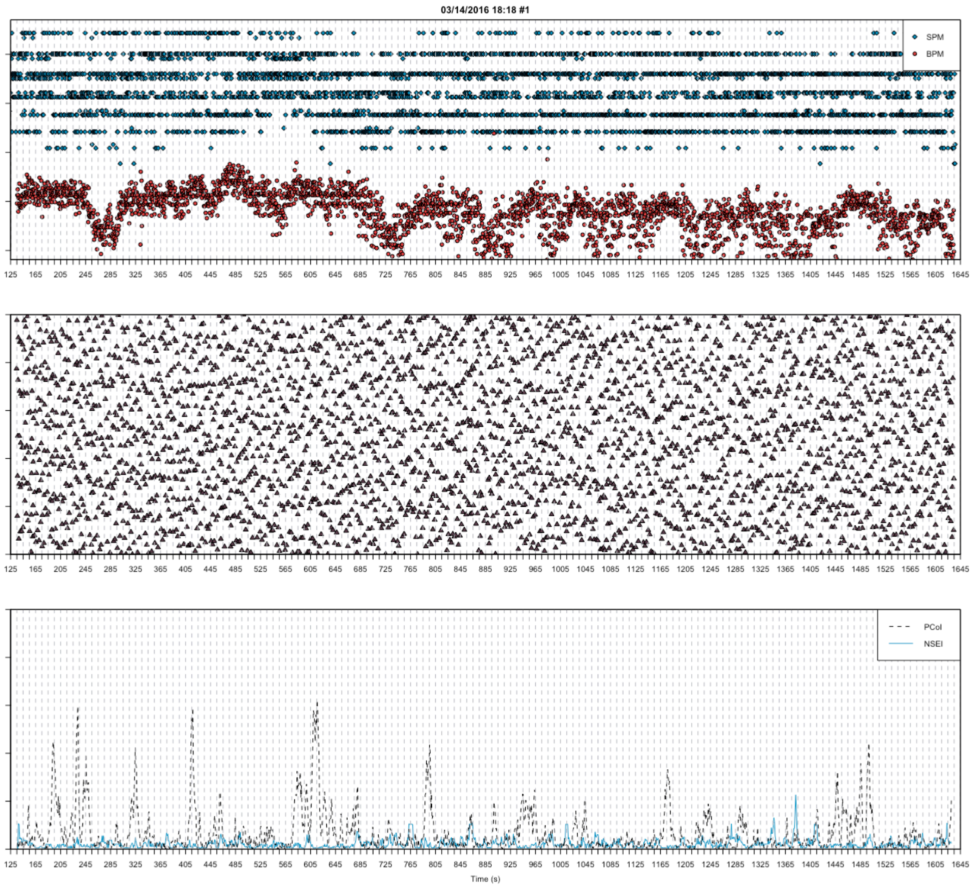

Figure 1: Figure 1: Low cardiolocomotor phase synchronization in a run with low flow-experience

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