ICCMIT 2019 Conference

EMOTIONS IDENTIFICATION UTILISING PERIODIC HANDWRITING ON MOBILE SURFACES

VIKTORS ZAGORSKIS,
ATIS KAPENIEKS,
ALEKSANDRS GORBUNOVS

DISTANCE STUDY EDUCATION CENTRE AT RIGA TECHNICAL UNIVERSITY

NACIONĀLAIS ATTĪSTĪBAS PLĀNS 2020

EIROPAS SAVIENĪBA
Eiropas Savienības struktūrfondi un Kohēzijas fonds

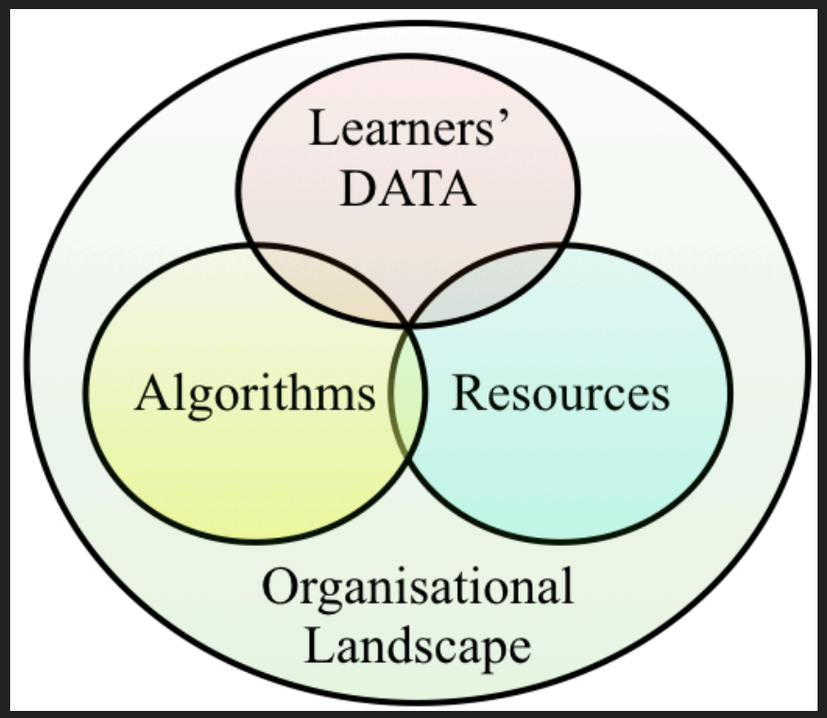
I E G U L D Ī J U M S T A V Ā N Ā K O T N Ē

ACKNOWLEDGEMENT

This research has been supported by a grant from the European Regional Development Fund (ERDF/ERAF) project Technology Enhanced Learning E-ecosystem with Stochastic Interdependences - TELECI, Project No.1.1.1.1/16/A/154

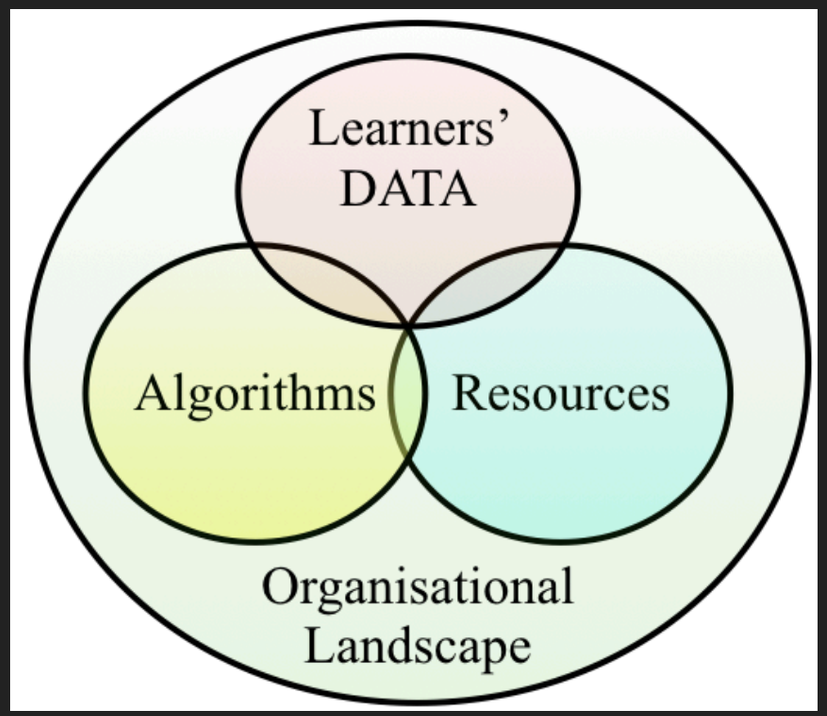
EMOTIONS IDENTIFICATION UTILISING PERIODIC HANDWRITING ON MOBILE SURFACES

The Landscape



- **Exist complex models to understand and explain cognition processes in the human brain**
- **The logged raw behavior data is just an initial learners' footprint in Virtual Learning Environments (VLEs)**
- **Exploratory Data analysis methods can help to deepen the understanding of cognition processes in students' brain.**
- **Continuous evaluation of the Quality of e-learning courses is a challenge.**

EMOTIONS IDENTIFICATION UTILISING PERIODIC HANDWRITING ON MOBILE SURFACES



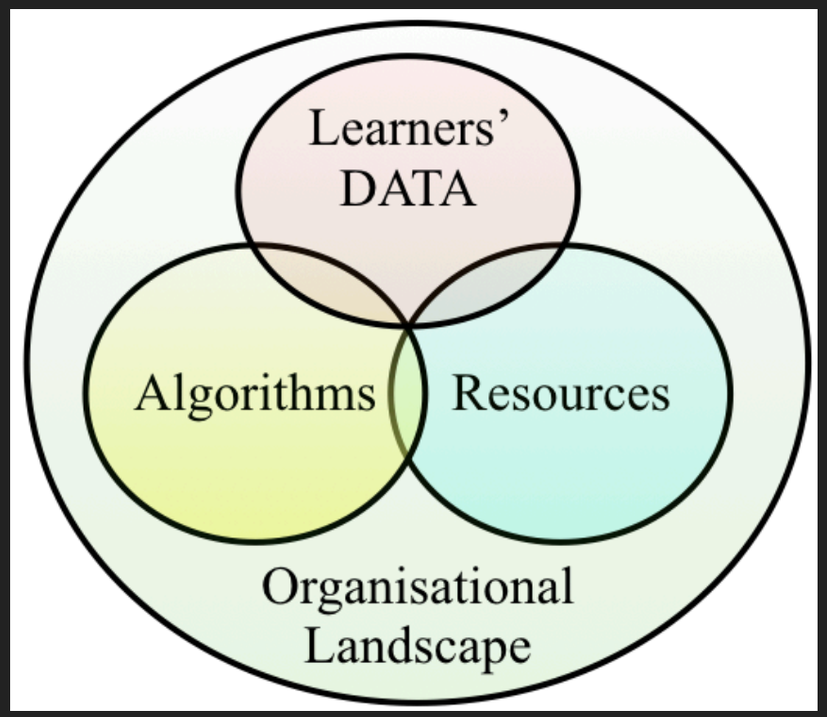
.. since emotions are more fundamental than thoughts

Research Objectives are

- **To Identify variety of learners' boredom in the learning process**
- **To do it utilising handwriting data**
- **To identify the potential to increase the Quality of an Individul e-learning process**

EMOTIONS IDENTIFICATION UTILISING PERIODIC HANDWRITING ON MOBILE SURFACES

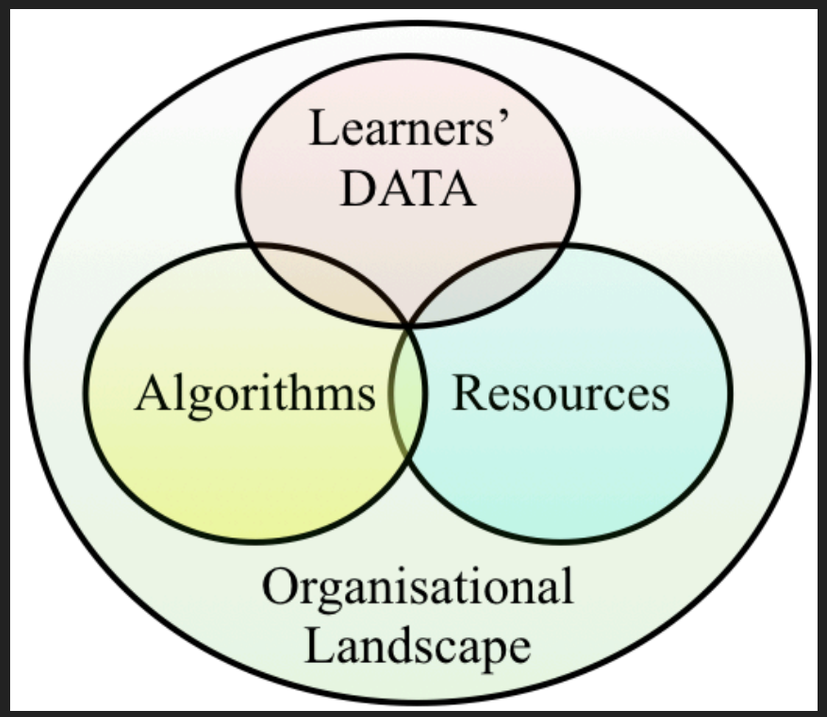
RQs



- (RQ1) - is it possible to utilise mobile surfaces with the aim to provide implicit measures of boredom state building machine-learning model using keystroke identification?
- (RQ2) - does indirect data acquisition method allow get data variability related to the boredom?

EMOTIONS IDENTIFICATION UTILISING PERIODIC HANDWRITING ON MOBILE SURFACES

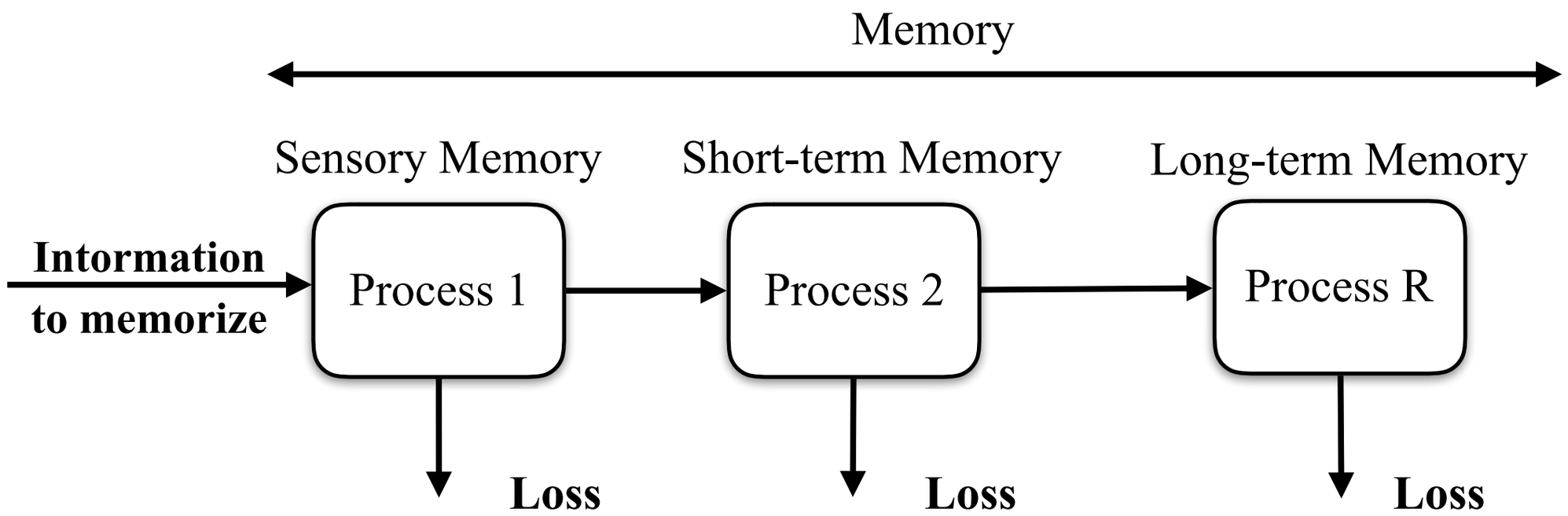
RQs



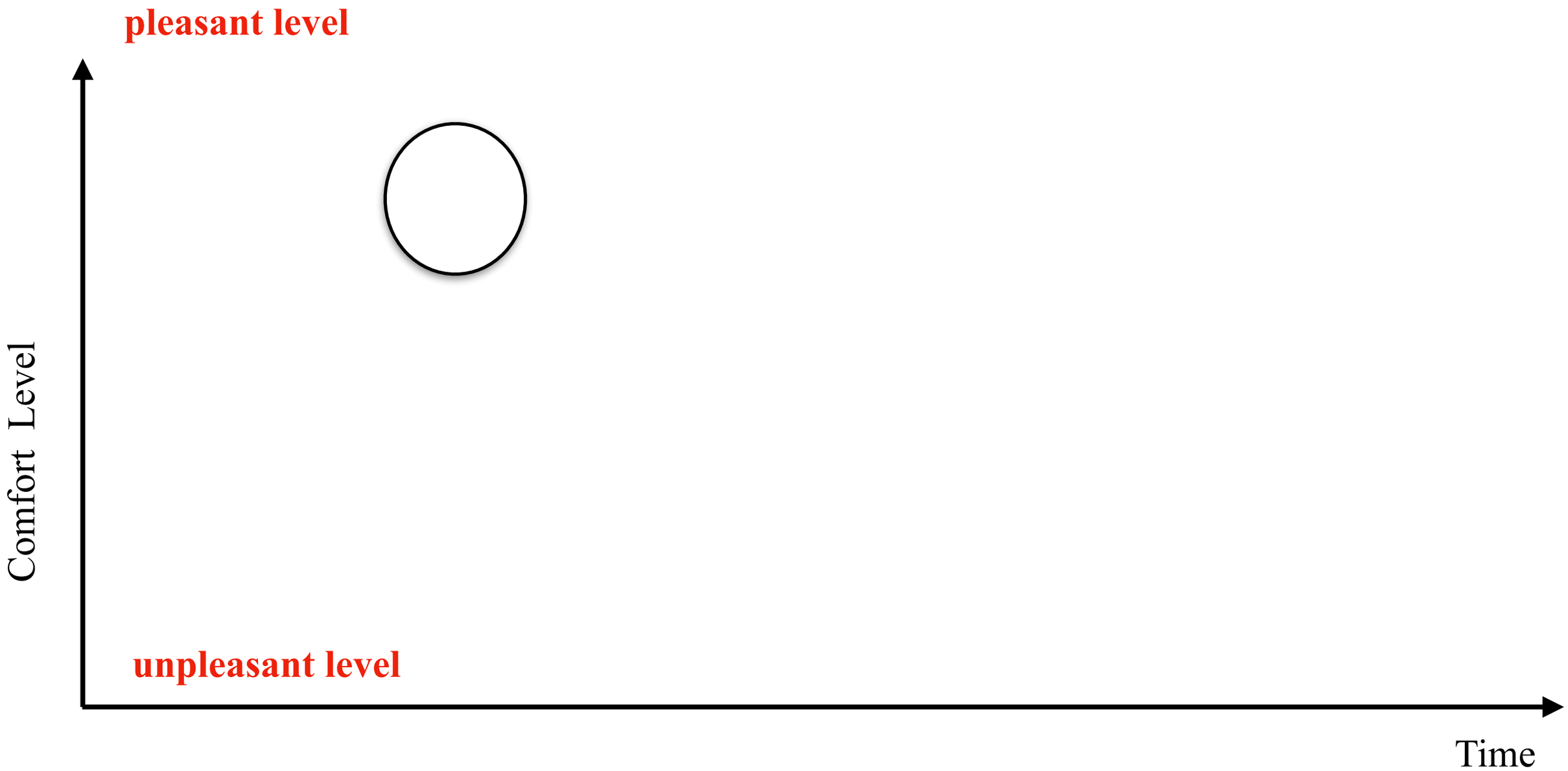
- (RQ1) - is it possible to utilise mobile surfaces with the aim to provide implicit measures of boredom state building machine-learning model using keystroke identification?
- (RQ2) - does indirect data acquisition method allow get data variability related to the boredom?

- We need to formulate an appropriate hypothesis and apply inferential statistical analysis to explore more from data gathered by the SABI algorithm.

Learner's Forgeting Property

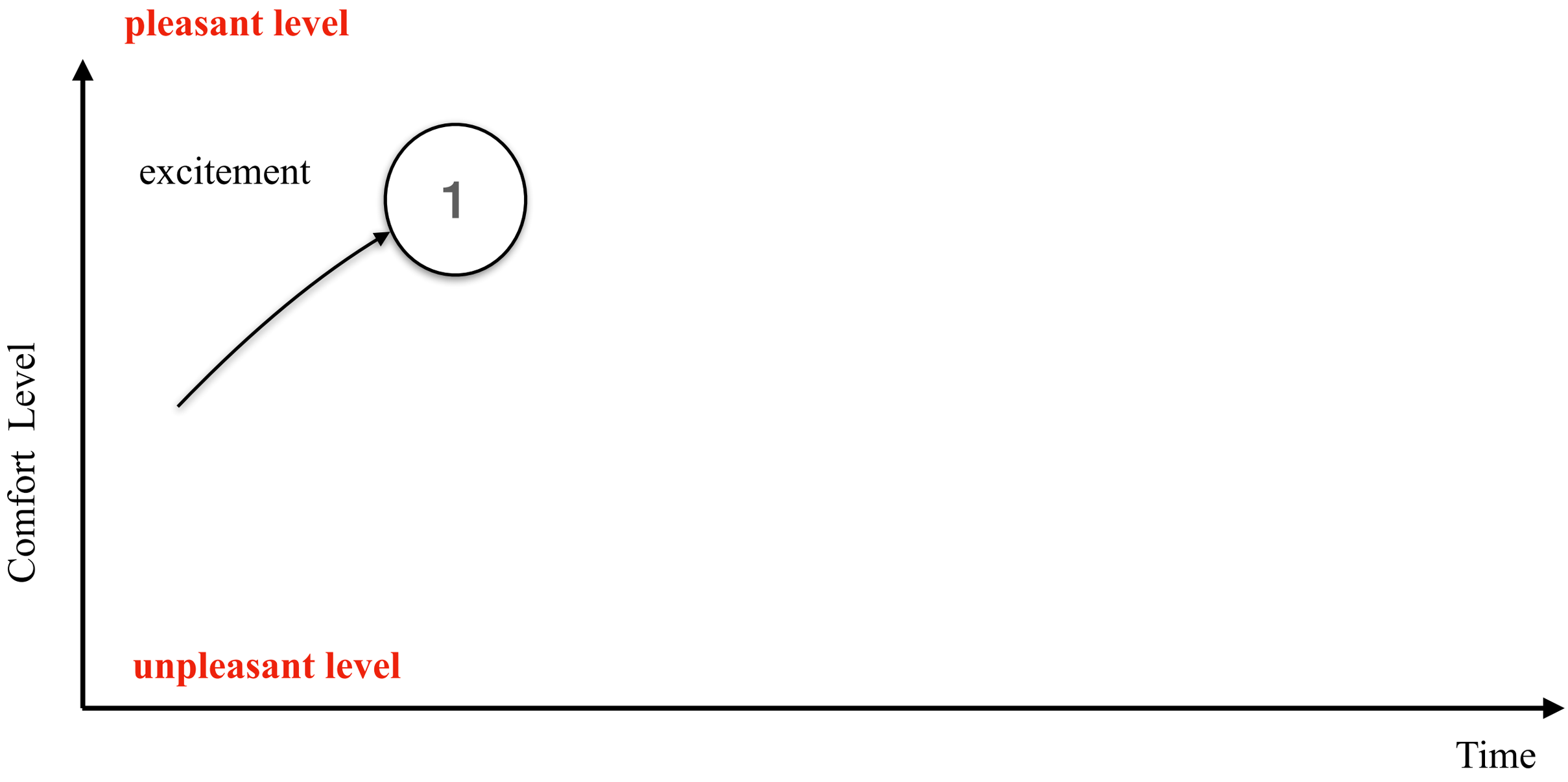


Student's Emotional States



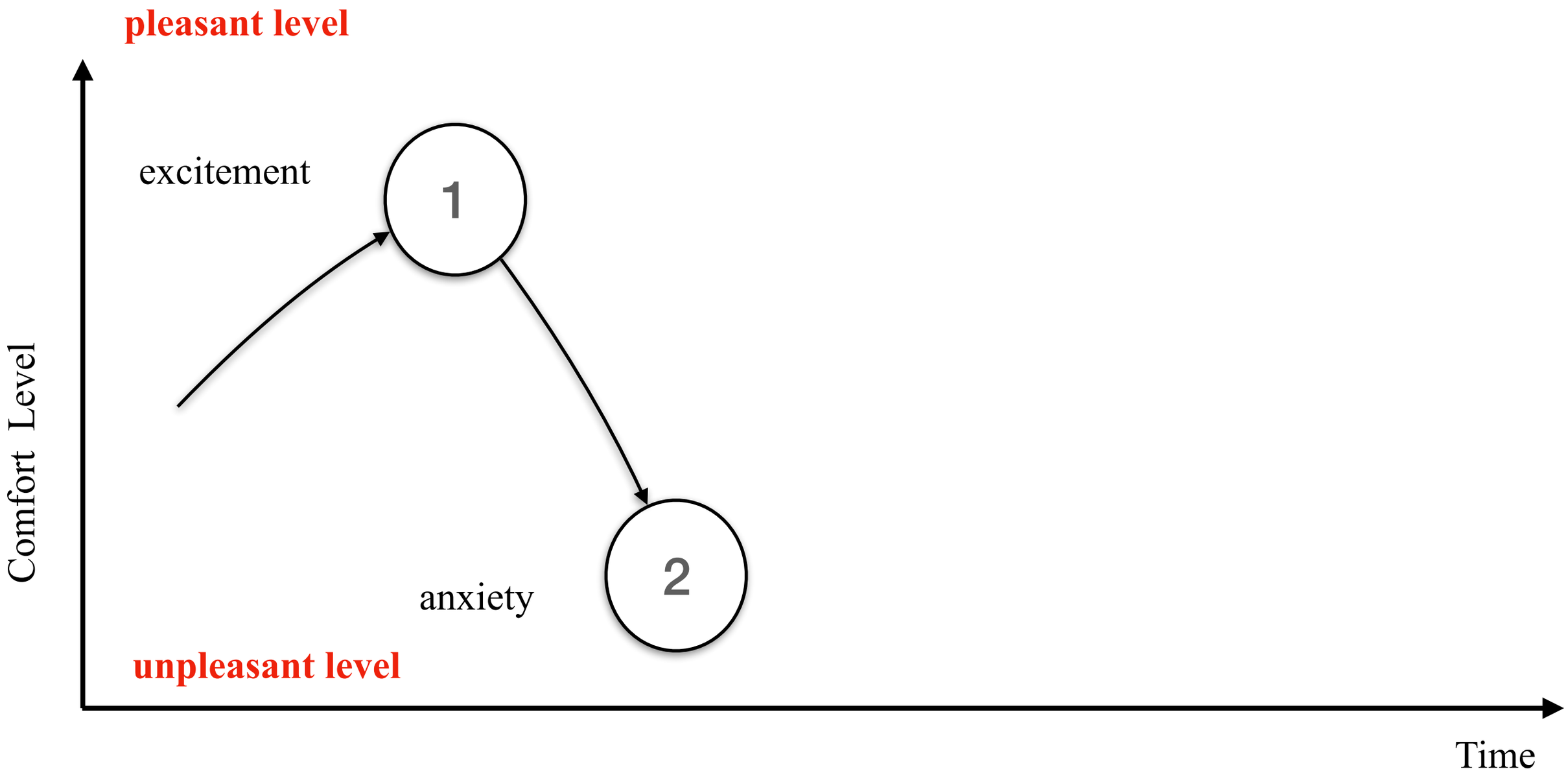
Set of discrete Emotional states and Motivational sequences

Student's Emotional States



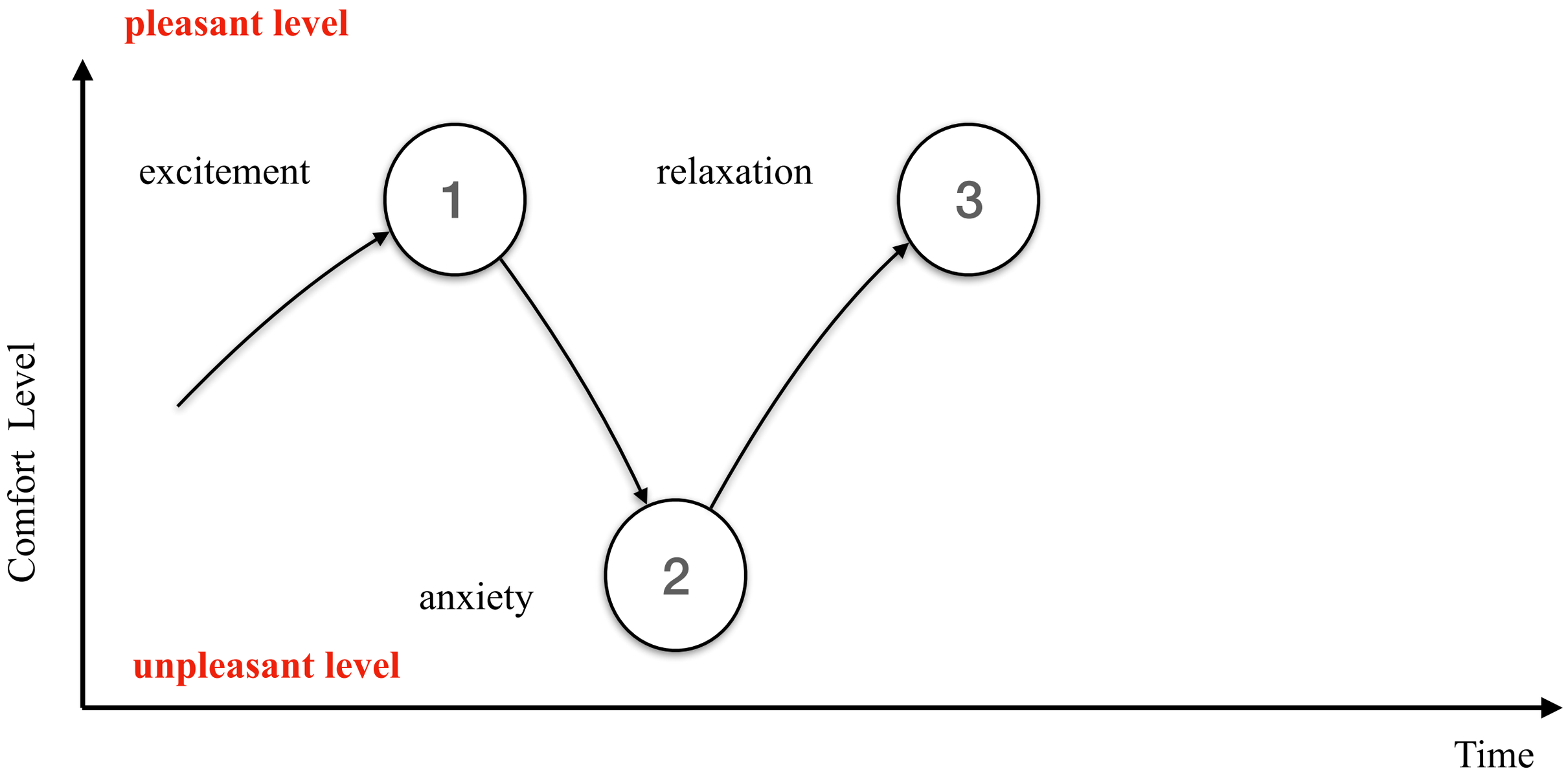
Set of discrete Emotional states and Motivational sequences

Student's Emotional States



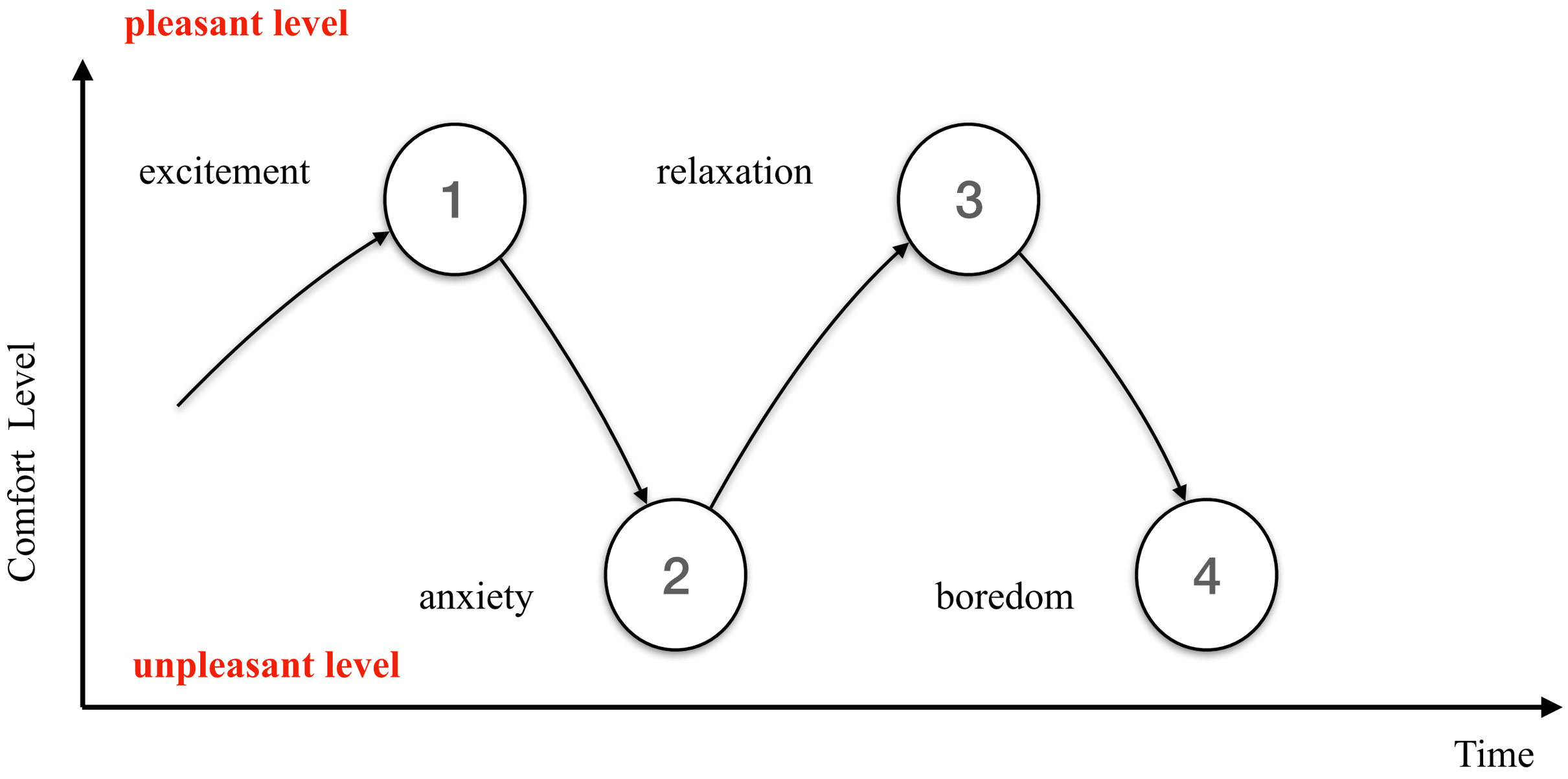
Set of discrete Emotional states and Motivational sequences

Student's Emotional States



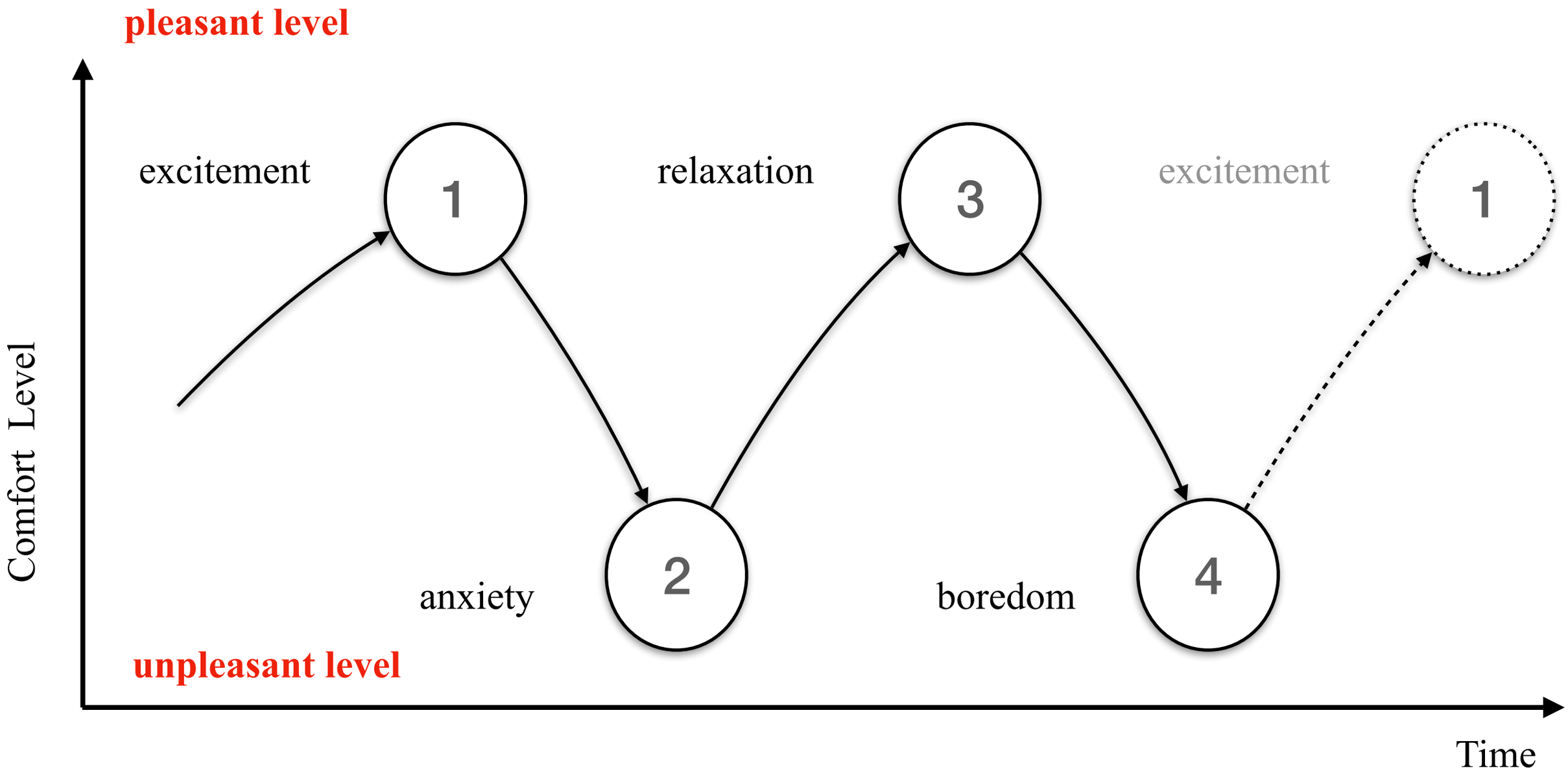
Set of discrete Emotional states and Motivational sequences

Student's Emotional States



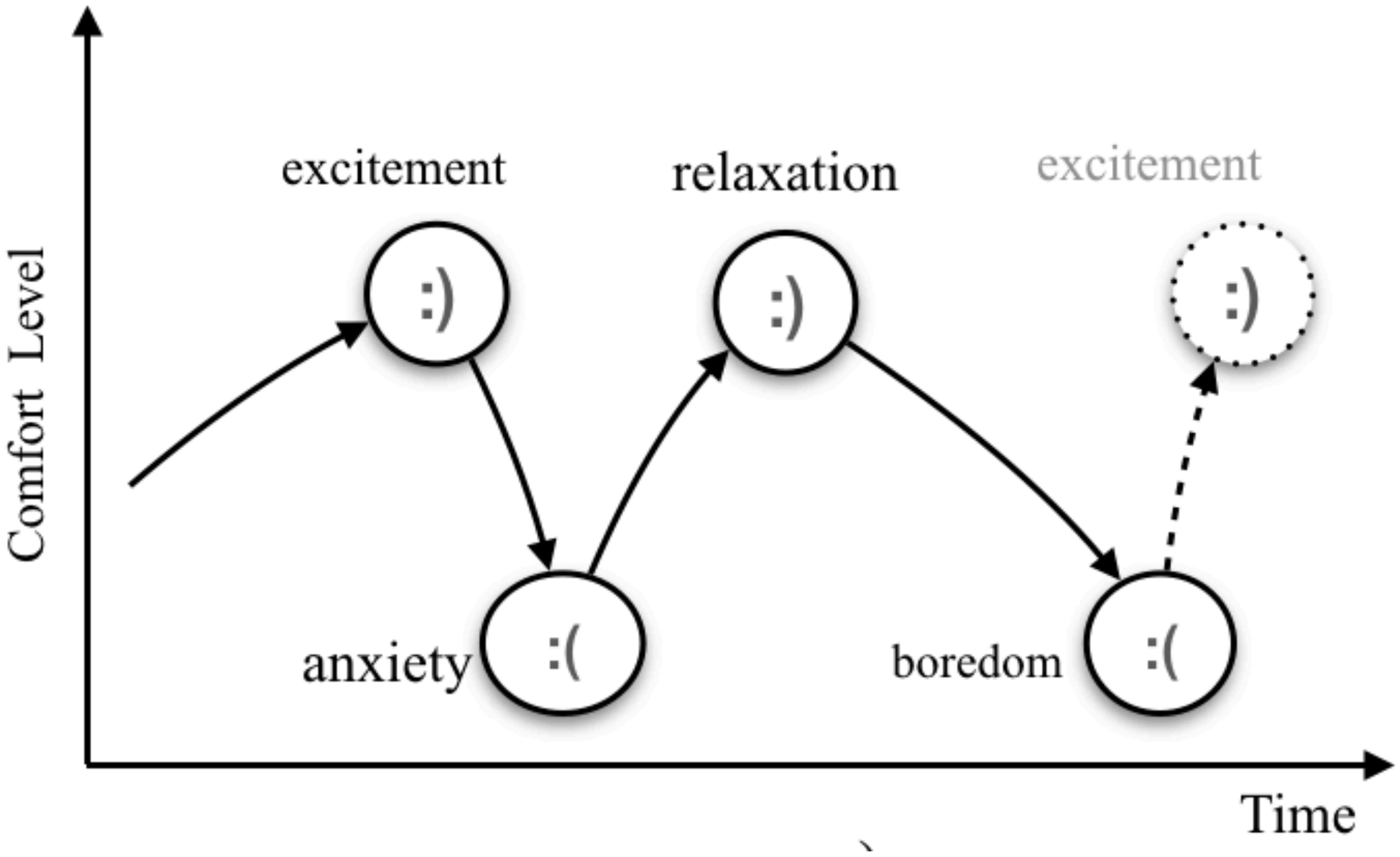
Set of discrete Emotional states and Motivational sequences

Student's Emotional States



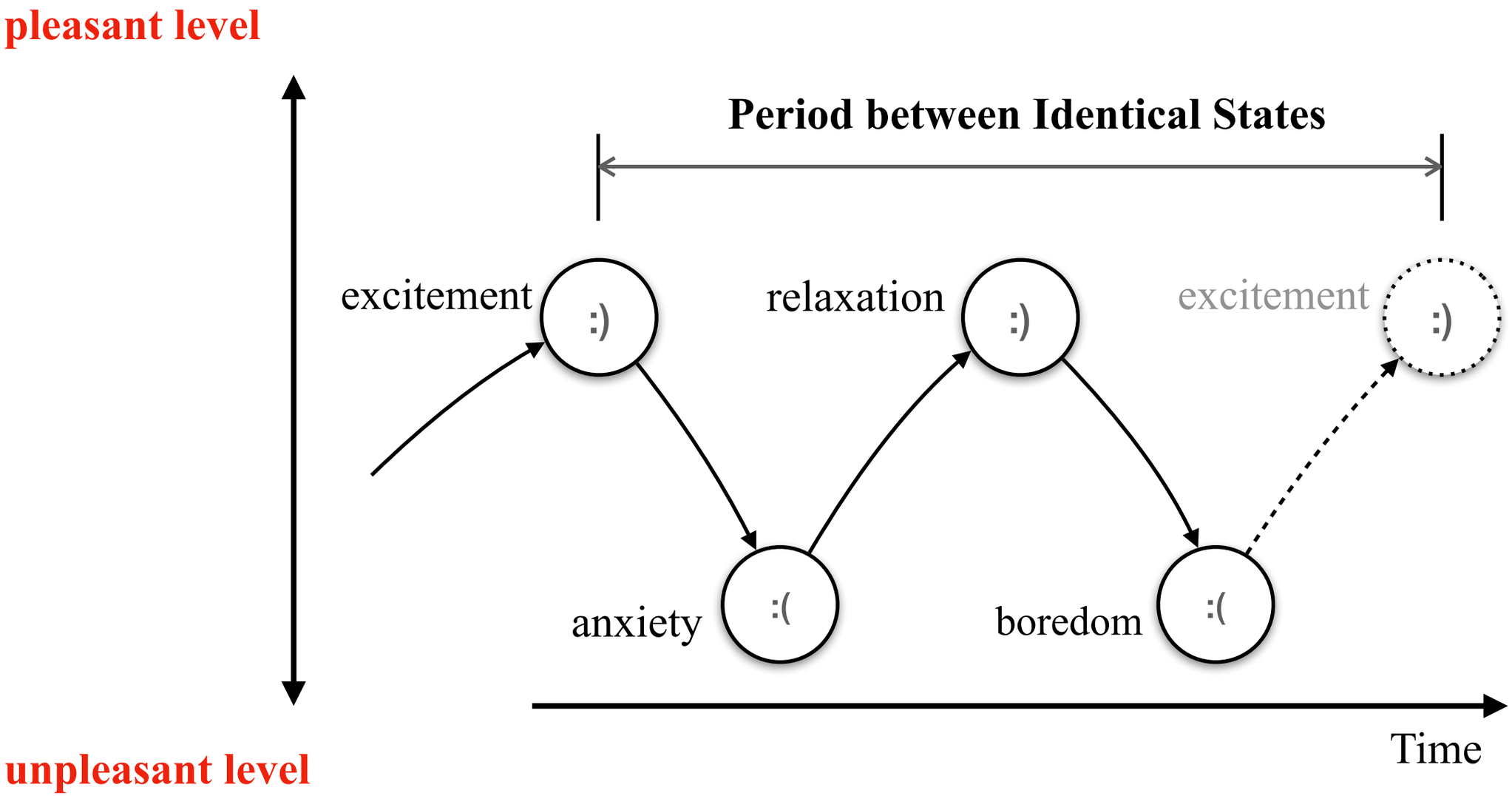
Set of discrete Emotional states and Motivational sequences

Student's Emotional States



Set of discrete Emotional states and Motivational sequences

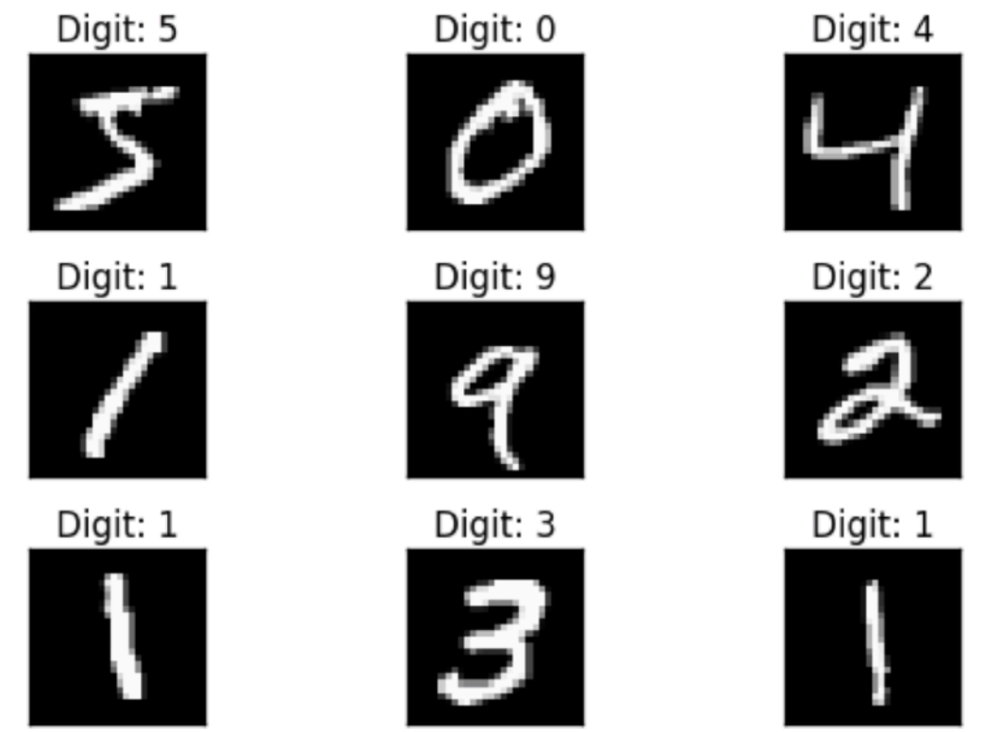
Periodicity



Set of discrete Emotional states and Motivational sequences

MNIST Data Set

```
import keras
from keras.datasets import mnist
```



CROHME: Competition on Recognition of Online Handwritten Mathematical Expressions

https://www.kaggle.com/xainano/handwrittenmathsymbols

Handwritten math symbols dataset

The Algorithm

Simple Algorithm for Boredom Identification - SABI use variables and data models:

- Response Time Window (RTW) - a time window that allows to accept all handwritten symbols entered on the mobile device surface;
- Threshold Time (ThT) - an average task completion time, individually recorded for each user;
- Drawing as a Matrix (DaaM) - a two dimensional array, holding by handwriting sketched drawing captured from the mobile device surface after forming process completion;
- Drawing Start Time (DST);
- Drawing End Time (DET);
- Calibration Timeouts (CalTo) - an array, holding time out settings for each calibration round;
- Drawing Animation (DAnim) - an array, holding drawing process animation over the forming time;
- Reference Drawing (RefD) - a reference to file on the SERVER side that holds the screen displayed on the CLIENT device. The data model for RefD includes screen (a browser window) settings gathered from CLIENT device;

Preliminary results

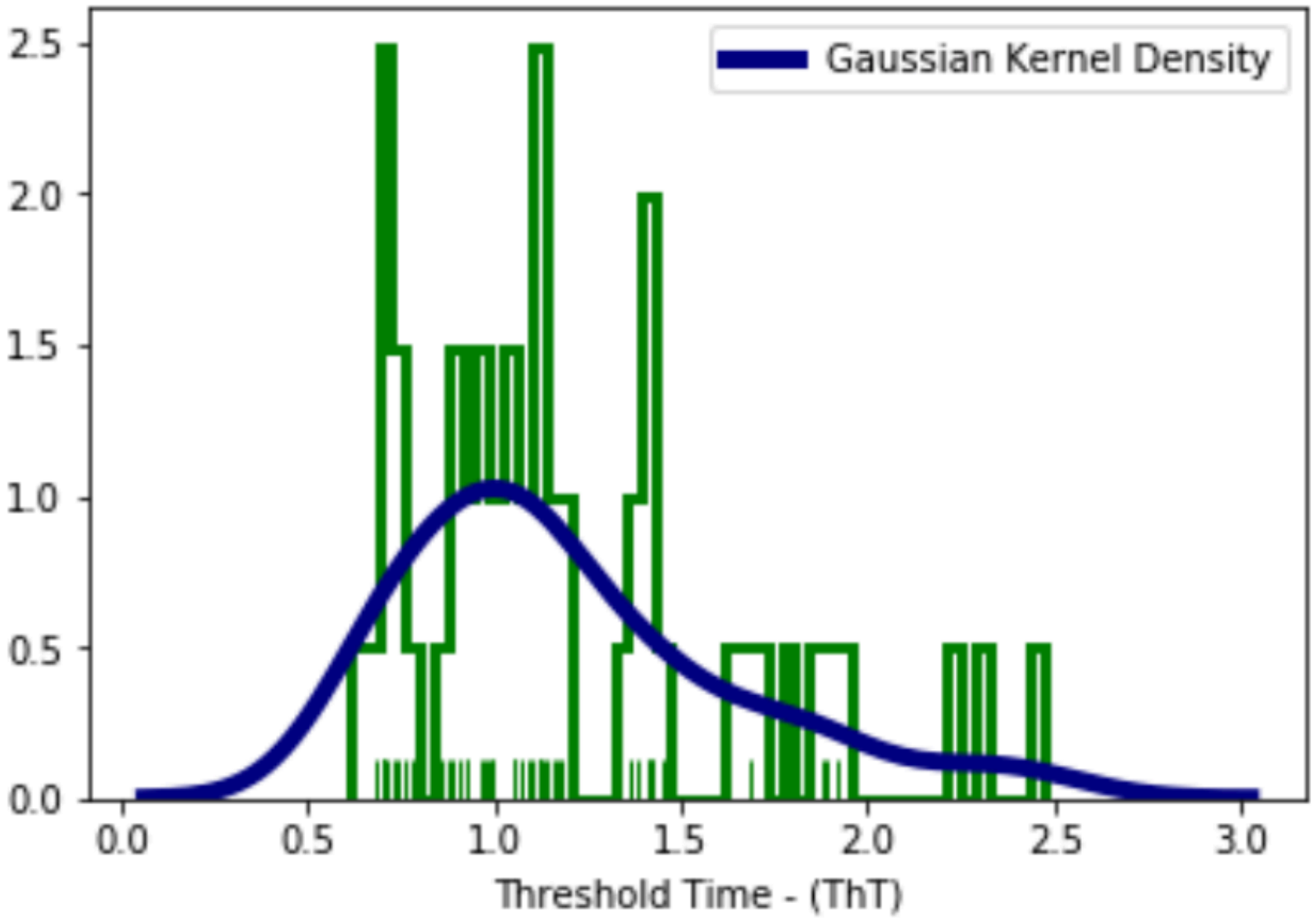


Fig. 3: Histogram of the average completion time for the calibration task. Round two. On vertical axis - the frequency of occurring of threshold time. Users (n=54) draw the symbol "1". Mean value 1.1924, median 1.0957, standard deviation 0.4383.

Preliminary results

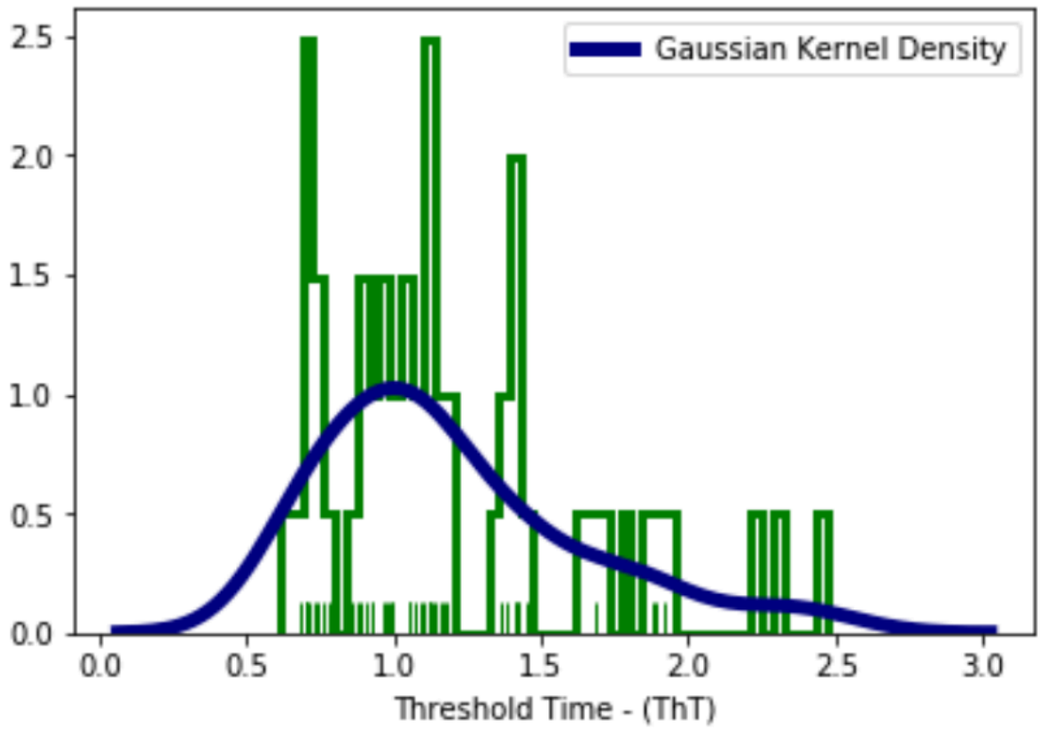


Fig. 3: Histogram of the average completion time for the calibration task. Round two. On vertical axis - the frequency of occurring of threshold time. Users (n=54) draw the symbol "1". Mean value 1.1924, median 1.0957, standard deviation 0.4383.

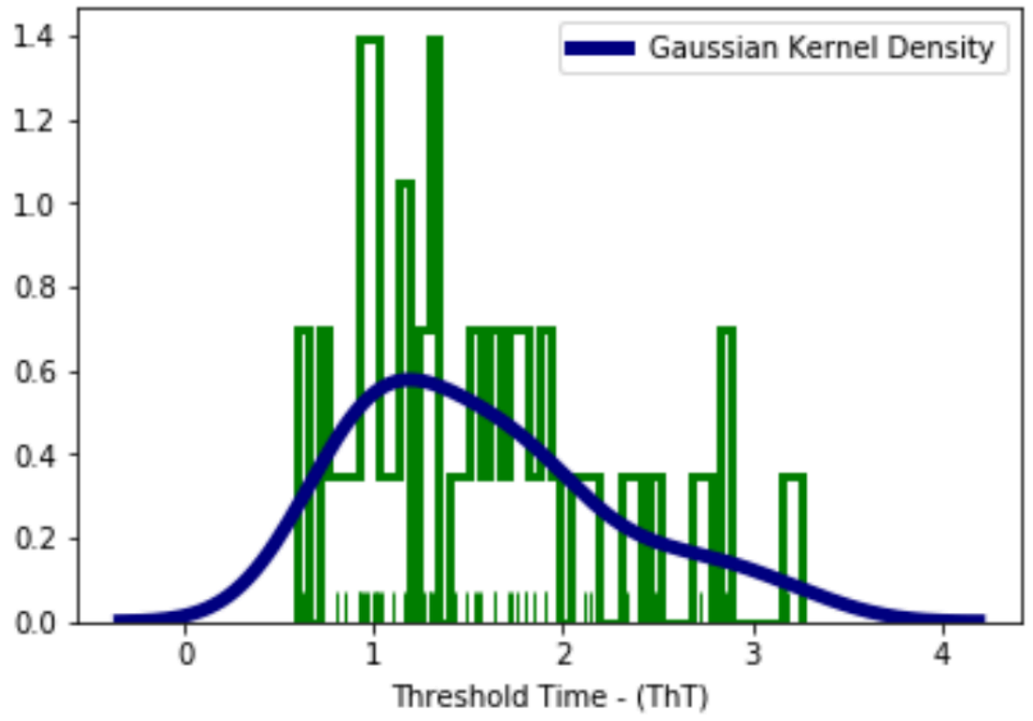


Fig. 4: Histogram of the average completion time for the calibration task. Round two. On vertical axis - the frequency of occurring of threshold time. Users (n=54) draw the symbol "5". Mean value 1.5696, median 1.457, standard deviation 0.6679.

Preliminary results

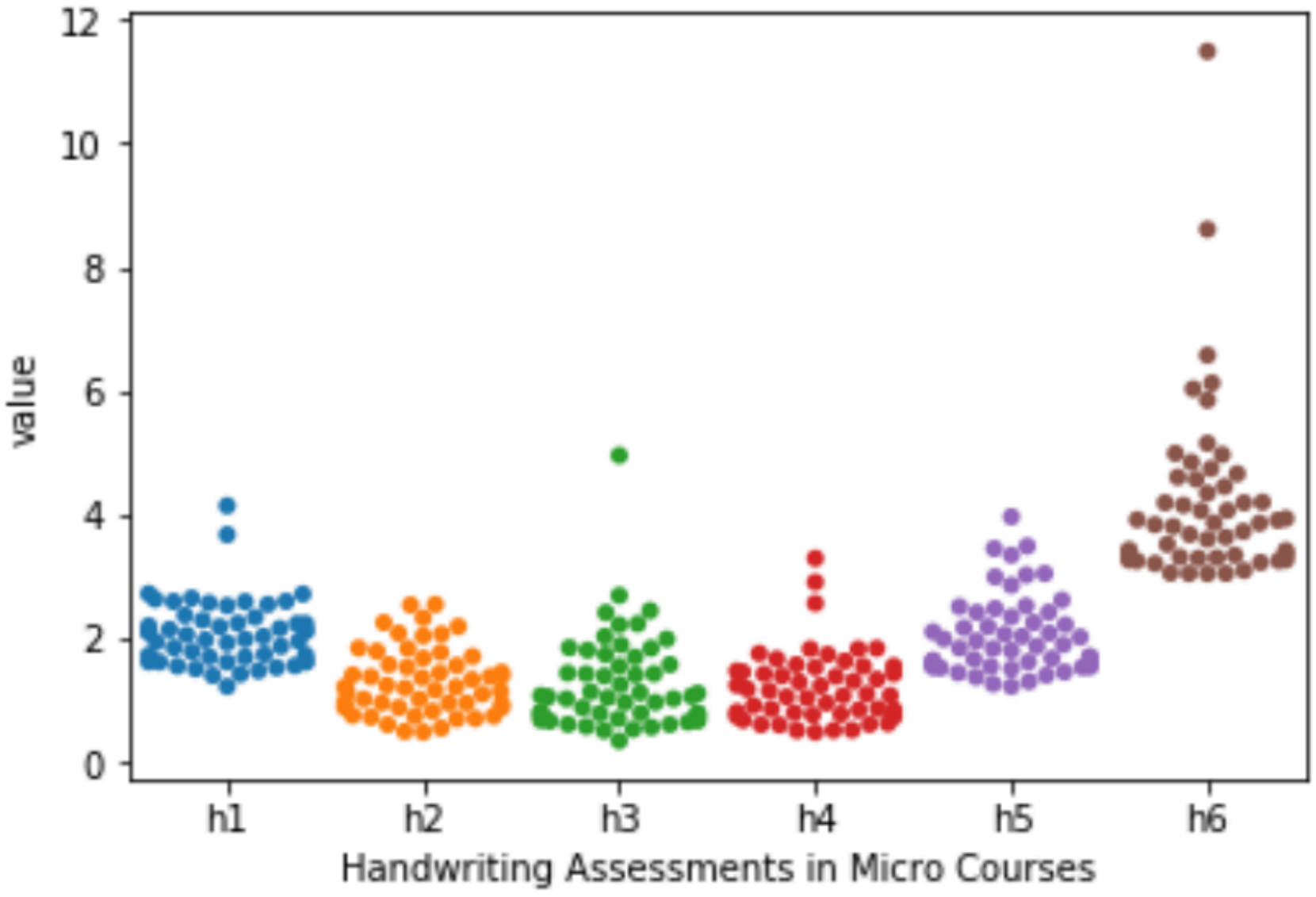
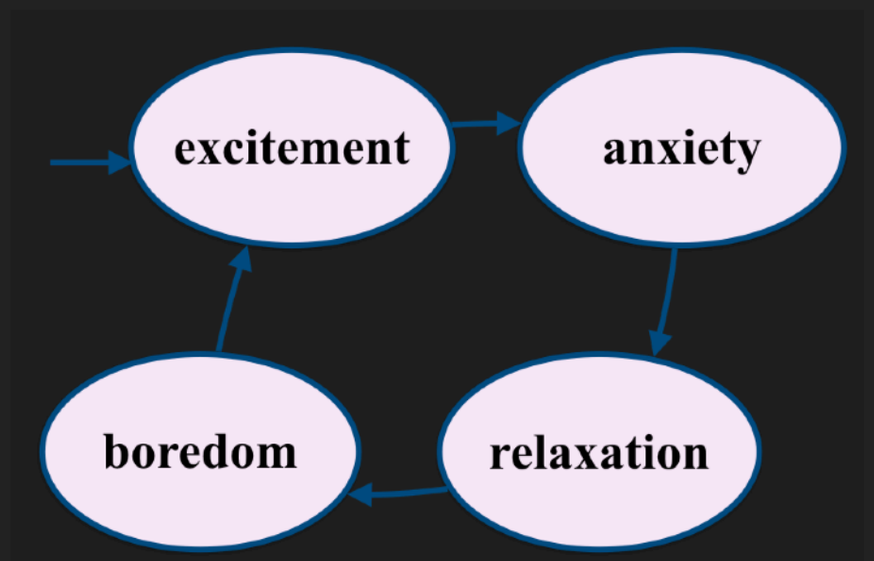


Fig. 5: The real micro-learning course. The variation of average task completion time (ThT) data over the experiment time. Each point represents individual user delay data of interaction with learning content at specified a time moments.

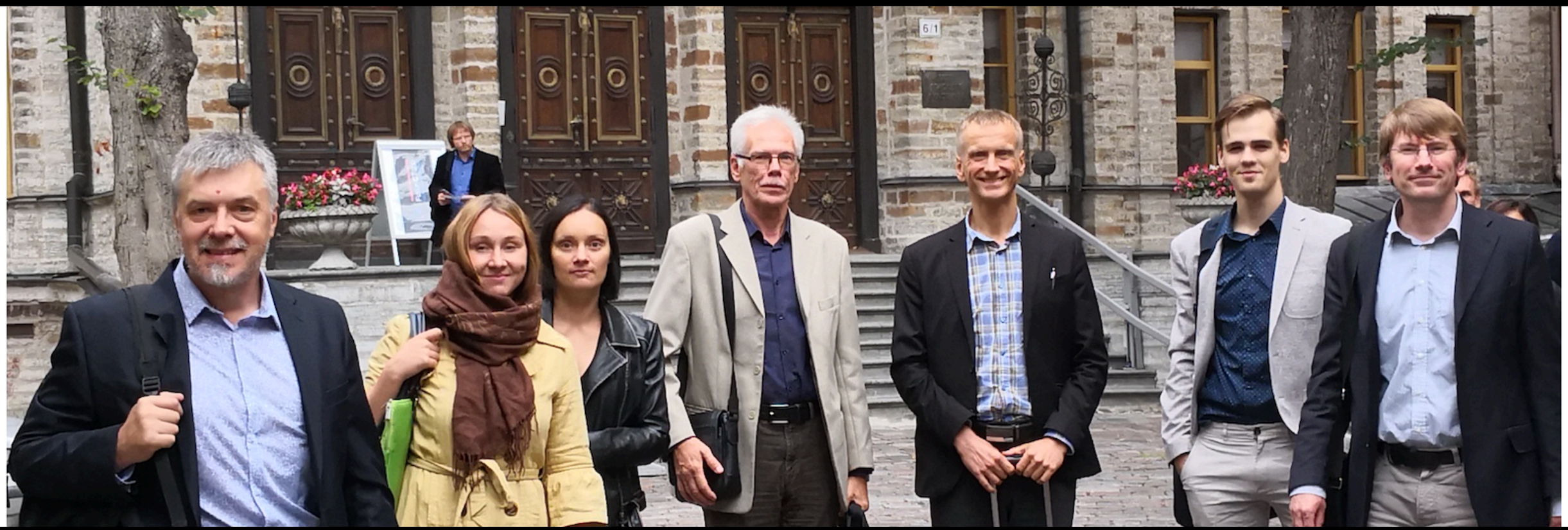
EMOTIONS IDENTIFICATION UTILISING PERIODIC HANDWRITING ON MOBILE SURFACES



Conclusions

The Reasearch will help to

- To engage learners' reducing boredom in the learning process
- Stimulate Internal Motivation of Students
- Increase utilisation of Handwriting Data
- To increase the feedback rate in the e-learning process
- Increase Diversity of Applications - improving the Linguistic Geometry of the Problem Domain



DISTANCE STUDY EDUCATION CENTRE AT RIGA TECHNICAL UNIVERSITY

viktors.zagorskis@rtu.lv

This research has been supported by a grant from the European Regional Development Fund (ERDF/ERAF) project “Technology Enhanced Learning E-ecosystem with Stochastic Interdependences - TELECI”, Project No.1.1.1.1/16/A/154.