

Thesis compiled by Anton Lövmär, Per Classon

Title of thesis: Biofeedback med EDA i Tetris (Biofeedback with EDA in Tetris)

Opponent: Martin Pettersson

Was it easy to understand the underlying purpose of the project? Comments.

The purpose of the project was defined in the introduction section of the report. The authors present their underlying purpose to explore if EDA measurements are different when run as implicit or explicit biofeedback measurements. They also state that another purpose is to see if the biosensor *Affectiva Q Sensor* can be used as a tool for adequate measurements of stress levels while playing the computer game *Tetris*.

The definition of the project's purpose is easy to locate, and it is very good that the author's decided to make a separate subsection for this. However, I feel the definition itself not to be as clearly presented as you could hope. The section would benefit a lot by having an introductory sentence explicitly stating the purpose. ("The purpose of this project is ...")

Do you consider that the report title justly reflects the contents of the report?

The title of this thesis is *Biofeedback with EDA in Tetris*. Reflecting on the contents of the report I think the title fits fairly well; there are no doubt that the contents explore problems related to the title.

The title is well chosen, but one could argue that this report is in strong need of a subtitle that reflects more to the problem statement. *Biofeedback with EDA in Tetris* really does not say very much what the report actually is about; you have to read the abstract to figure that out. I strongly suggest the authors to choose a subtitle that clearly reflects their problem statement when revising their report.

How did the author describe the project background? Was there an introduction and general survey of this area?

The report presents background topics regarding the sensor used, how gaming biofeedback is used in competitive aspects and also covers mathematical and statistical methods used.

The length and contents of these subsections are pleasing, though I feel the background not covering certain areas that could be of interest for more non-involved readers. The background section mentions nothing about EDA itself and nothing about how the *Tetris* game works. Tetris is a popular video game, however I suspect that not everyone knows the mechanics of the game. Some explanation would suit here. EDA, and the difference between explicit and implicit biofeedback is shortly presented in the introduction section; it would be more suitable to cover these topics more thoroughly in the background section.

To what degree did the author justify his/her choice of method of tackling the problem?/ Is the method adequately described?

The methods used are pleasing to read and I feel that most of them are adequately described. The sections describing test hypotheses and statistical methods are very well written and clearly presented.

There are two things I feel are missing from the method chapter: a more detailed description of the game implementation and a section devoted to justification of methods. In some cases, I feel that justifications for choosing a particular method either is vaguely justified or has no justification at all; there is little presentation of why the authors chose a method in front of another.

Also, the subsection describing the Tetris game could be more precise. The authors mention both implementation methods and methods used in the experimental setup. A better approach would be to divide these contents into two subsections: one devoted for explaining the Tetris game and another explaining the experimental setup.

Did the author discuss the extent to which the prerequisites for the application of such a method are fulfilled?

The method chapter has a strong focus on explaining how the different methods worked and how measurements and statistical information was calculated and does not discuss prerequisites. Prerequisites of various test methods and statistical tests (such as distribution prerequisites and other aspects) are to some degree brought up in chapters devoted results and general discussions.

Because there are many different methods described in the report, I feel the authors made a good choice covering prerequisites and method presumptions more in the discussion chapter, and focusing more on the methods themselves in the method chapter.

Has the author set out his/her results clearly and concisely?

The result chapter of this thesis is very well presented. The authors presents their results in a pleasing order, describing correlations between game difficulty and EDA, presenting all test subjects in table form with all data of interest and concludes by describing a statistical t-test between test groups. The results are well presented by using different forms of tables and plot charts, as well as describing each result component in detail and what it means.

I think this is one of the strongest parts of this essay, and have very few proposals for improvements. In some places the layout may seem a bit confusing, probably due to LaTeX compilation.

Do you consider the author's conclusions to be credible?

The conclusions made are that there exists correlation between EDA values and game difficulty, and that there is no possibility of manipulating EDA values. The conclusions are well referenced to the results section, so it is fairly easy for the reader to change page and look back at the results presentation while examining the conclusions.

Mostly by looking at the results section, I feel the results to be credible. The authors have used statistical methods and various tests in what seems to be a correct way. In the conclusions section they also present some critique against the methods used, mainly that the test user group was too small to make credible conclusions.

Sometimes I feel the conclusion subsection to be a bit hard to follow, and I suggest the authors to shorten it a bit and make it more specific.

What is your opinion of the bibliography? What types of literature are included? Do you feel they are relevant?

I think the bibliography is very impressive for a bachelor's thesis. The contents are a mix of visited websites and scientific reports. It is easy to read and follow, entries follow similar presentation and most of them seem fairly relevant for the report. There was some dead link among the websites, I was however able to search for it manually. Authors, publication dates and other important aspects are all presented. Another thing to note is that the authors presented the day of retrieval for all websites, which provides more credibility.

One thing that might be changed is to divide the bibliography into a section for websites and a section for scientific papers. As for now, the bibliography mixes these two, which may be somewhat confusing if a reader needs to look up something in a hurry.

Which sections of the report were difficult to understand?

The report in its whole was fairly easy to understand, since it was well written and presented. The most difficult parts were the ones describing problem statement and conclusions. My personal feeling was that they were a bit too long and unspecific; I had to read them several times in order to follow.

Other comments on the report and its structure.

The report follows a classical academic structure and is well presented and easy to navigate. The language is mostly very pleasing, apart from a few grammar and spelling errors here and there. I think it was a very good choice to make a separate section for test hypotheses, since they were so relevant for the results.

What are the stronger features of the work/report?

The stronger features include the presentation of the results and the use of statistical and mathematical analysis of the tests used. The language is pleasing and the structure is easy to follow and navigate. The extended bibliography was very well presented, and one could tell that the authors had done fair amount of pre research before conducting the experiments.

What are the weaker features of the work/report?

The statement of the problem could have been more precise, and definitely quite shorter. While reading the report, I several times forgot what the actual problem actually was. The conclusions section has the same problem; it could be shortened and a bit more precise. The title in itself is suitable but lacks information of what problem the report actually studies.

The report lacks a few sections in the background chapter, has no appendices with source code used and makes no discussion of possible further studies in the same area.

What is your estimation of the news value of the work?

There has been a lot of studies in the past that proves EDA to have correlations between stress and levels of arousal, however I suspect very few of them proves this correlation by using interactive biofeedback software such as the Tetris game used in this report. When studying game biofeedback elements for whatever reason, I think this report could very well be used as background and reference for further studies.

Summarize the work in a few lines.

Lövmar and Classon has written a thesis that explores correlations between EDA values and game difficulty in their own biofeedback version of Tetris. They also explore if test subjects deliberately could control EDA values by learning how the game mechanics worked. Methods used are user experiments a long with statistical analysis methods with different hypotheses. The results are believable and clearly presented, and prove that a correlation exists between game difficulty and EDA levels.

Overall, the report is well structured with good language but lacks a few sections and is a bit confusing when presenting and answering the problem statement. One can tell that the authors have spent a large amount of time and effort completing this thesis. If I were to grade this report I would definitely consider one of the higher grades.

Questions to authors:

1. EDA has been proven to correlate with stress levels before. Do your conclusions really prove anything different apart from referring to the Tetris game?
2. The report mentions no possible future research on the same topic. Can you discuss that?
3. Are EDA values from biofeedback games dependable on the sensor used, and is it possible that results could differ by using different equipment?