Universität des Saarlandes
Deutsches Forschungszentrum
für Künstliche Intelligenz

Immotion - Exergame for Warm Up Guidance and Motivation

Masterarbeit im Fach Informatik
Master's Thesis in Computer Science
von / by

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angefertigt unter der Leitung von / supervised by

begutachtet von / reviewers

Saarbrücken, November 2017

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Ich erkläre hiermit an Eides Statt, dass ich die vorliegende Arbeit selbstständig verfasst und keine anderen als die angegebenen Quellen und Hilfsmittel verwendet habe.

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Declaration of Consent

I agree to make both versions of my thesis (with a passing grade) accessible to the public by having them added to the library of the Computer Science Department.

Saarbrücken, November 2017 Marko Vujić

Abstract

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Chapter 1

Study Design

1.1 Description of the Experiment

This chapter outlines the evaluation of the second version of the Immotion exergame. This period of testing of our gamified solution is known as pilot testing. The main purpose of this evaluation is to answer the research questions outlined in Chapter One.

1.1.1 Introduction and Goals

Based on the data from the first survey outlined in Chapter 1 and a variety of flow research outlined in Chapter 2, guidelines were followed which influenced our design and development of the second version of the Immotion exergame. In order to evaluate the effect of our solution the user base is divided into two groups: *experimental group* and *control group*. The first, experimental group, is the one that interacts with the exergame directly. Contrarily, the control group is presented with the video of a participant who interacted with the system, and does not engage with the exergame directly. This approach allows us to infer the influence of our gamified solution, as well as, to assess the main differences in completing the required activities between the two user groups.

1.1.1.1 Assumptions

- The participants will be able to perform the requested movements.
- The participants will be able to play the exergame for at least 1 minute.
- The participants will answer all the questionnaires truthfully.
- The software and hardware that is used used will function properly.

1.1.2 Methods

In this section we outline the methodology adopted for the Immotion exergame evaluation. We decide to follow a mixed-methods approach, and by doing so, utilize both qualitative and quantitative data sources in combination.

1.1.2.1 Participants

Total of n = X individuals participated in the study that has been conducted DATE in DFKI. All participants were students from Saarland University. For recruiting participants, posters were distributed in print, and sent through social media and email (Appendix X). Each participant was given X euros for taking part in the study. All of the participants were amateur athletes who engage in some physical activity few times per week. For the study we particularly targeted individuals who exercise in gym or fitness centers and often avoid preforming warm up exercises before more strenuous physical activity. All participants were required to report to the laboratory in gym based clothing, preferably shorts and t-shirt, and all of them performed the required tests in the same location using the same equipment. Before the study, each participant signed a consent form (Appendix X). TODO: This should be updated later with real data.

1.1.2.2 Conditions

Each participant of the study took part in a single test session one hour in duration. During this session, all the participants completed a pre-test questionnaire (Appendix X), after which they performed two exercise sessions, separated by a 10 minutes break. At the end of the session the participants completed a post-test questionnaire (Appendix X). Two conditions were evaluated:

1. Exercising with the game projected on a wall in front of the participant.
2. Exercising without a game with a video of a participant playing the exergame projected on the wall in front of the participant.

TODO: third condition participants who warm up without video or the exergame?
Depending on the group, each participant performed exercise that represent one of the conditions. The participants are assigned to each group randomly. At the beginning and the end of each exercise session, the measurements for participants' ROM are taken. For this purpose, a goniometer is utilized. Additionally, participants' heart rate were measured and recorded using XX. TODO: say the purpose of Microsoft Band.

1.1.2.3 Tasks

In order to interact with the gamified system, the participants in the experimental group were required to perform a set of general movements. By performing these movements, the participant controls the game avatar and, by doing so, avoids obstacles and collects coins. Based on the data collected from the first survey presented in Chapter X, in order to successfully finish the game, only movements that are, first, detectable with high accuracy using only one Kinect device and, second, simplistic enough to be accomplished easily without no prior exercise knowledge or experience were required. The movements the participant needed to perform included:

- right hand movement up,
- left hand movement up,
- jump right,
- jump left,
- jump up,
- star jump, and
- squat.

Participants who were in the control group and did not interact with the gamified system were required to perform the same movements.

1.1.2.4 Design

Write the formal experimental design (e.g., a 2 x 3 mixed factorial design, more specifically a 2 levels of expertise (between subjects) x 3 interfaces (within subjects) design).

1.1.2.5 Procedure

Before the experiment, the lab environment is set up. The Kinect sensor is placed in a correct position, the projector is turned on. In each session only one participant is present and guided by the researcher. The activities each participant followed are:

- The participant completes the pre-test survey.

- The researcher explains the sensors and tools that are required for the experiment, after which the participant puts them on. The sensors used in each session include a heart rate monitor and Microsoft Band. In order to measure the range of motion around a joint in the body, a goniometer is utilized. TODO: use kinect for this?After the researcher confirms that the sensors are placed in a correct position, we start recording heart rate data.
- For each participants the researcher measures the ROM of the following joints using double-armed goniometer: to be discussed.
- After the measurements are completed, the participant rests for up to 10 minutes in order to take the readings of the resting heart rate.
- While the participant rests, the researcher explains and presents the movements that are required from the participant to perform during the experiment.
- When the rest period completes, the participant is asked to practice the required movements.
- In order to avoid starting the game and warm up with already stimulated heart rate, the participant is required to rest for 5 minutes.
- The participant is asked to prepare for the warm up by positioning to the spot marked by the researcher.
- The researcher starts recording the session using to be discussed.
  - If this participant is part of the experimental group, the game starts with the start scene where the participant enters his or her name. After 5 seconds, the game proceeds with scenes in which the participant performs the previously presented movements in order to avoid obstacles and collect coins. The duration of the game is not fixed and it is played up to the point when the participant feels warmed up enough. During the experiment, the warm up procedure performed by the participant is recorded.
  - In case the participant is part of the control group, the video that displays a gameplay performed by another participant who was part of the experiment group is presented instead of the exergame. The participants performs the same movement as in the playing video. As with with the sessions in the experiment groups, the duration of the warm up is not fixed and the video is played up to the point when the participant feels warmed up enough. During the experiment, the warm up procedure performed by the participant is recorded.
- After the participant finished with the warm up, he or she takes a rest. During this period the researcher assesses the ROM of the participant.
- The participant in the experiment group plays the game and the participant in the control group watches the video for the second time with the same content as previously.

- After the participant finished with the gameplay (or video) for the second time, the sensors are removed.
- The participant rests and completes the post-test survey.

1.1.2.6 Apparatus

Describe the physical setup of the experiment (e.g., where was it conducted, on what kind of equipment, etc.)

1.1.2.7 Independent and Dependent Variables

Include exactly how you intend to measure each dependent variable.

1.1.2.8 Hypotheses

Remember to state these in terms of the independent and dependent variables. If it is not immediately clear why you would have a certain hypothesis (it often follows logically from the introduction of the experiment), then include a brief explanation separate from but following the hypothesis. You do not need to state the null hypothesis.

1.1.3 Problems/Limitations

Describe any problems/limitations encountered that will help other researchers avoid or account for them if they decide to replicate your experiment.

1.2 Results

This section is an objective report on what the numbers show. You should not try to interpret the meaning of the numbers in this section. Some of the things you may do here are: report means and standard deviations in neat tables indicate the statistics used and levels of significance include graphs, plots, histograms, etc that tell a story about the actual figures obtained Only critical raw data and summary statistics should be included in the actual report. However, you must keep all your raw data in a separate archival report, should anyone (a reviewer in the case of real scientific reporting) need more detail than is provided in the paper.

1.3 Discussion

Interpret the results. Although you should still try to be as objective as possible, the discussion section should illuminate your critical thinking about the results. Explain what the statistics mean, account for anomalies, and so on.

1.3.1 Interpretation of Results

Discuss what you believe the results really mean. For example, if you find a significant difference for some effect, what does that mean to the hypothesis? Is the different seen an important one?

1.3.2 Relation to other works

How do the results youve obtained relate to other research findings?

1.3.3 Impact for practitioners

As computer scientists, we are particularly concerned with the implications of our findings on practitioners. Should existing interface constructs be designed differently or used in a new context? Do you have suggestions for new designs? How can the findings be generalized?

1.3.4 Critical reflection

Critical reflection is one of the key foundations of science. You should criticize your work (constructively, if possible), indicate possible flaws, mitigating circumstances, the limits to generalization, conditions under which you would expect your findings to be reversed, and so on.

1.3.5 Research agenda

The best experiments suggest new avenues of exploration. In this section, you should reflect and refine your hypotheses, describe new hypotheses, and suggest future research, ie research that you would do if you continued along this path.

1.4 Conclusions

Summarize the report, and speculate on what is to come. Acknowledgements. This section should give thanks to the major people (supervisors, associates) and organizations (sponsoring agencies, funders) that helped you. For example, I would like to thank Ben Shneiderman, whose report framework was used to build this one.

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