Reader Engagement

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ABSTRACT

This is a work-in-progressproject.The purpose of this research is to help increasing the readers' level of engagement using a multimedia approach. Previous studies have shown that active reading engage readers to keep reading as an interactiveway of learning. However, reading is a very personal experience for each reader due to readers' understanding and different points of views. This project focuses in giving the reader the best reading experience even when the reading is not interesting or in this case boring. This project propose an interactive multimedia reading approach in order to increase the reading engagement level of the subjects using the Brain-Computer Interfaces as a measurement of the engagement level among the participantsto trigger a video to pop out when readers' the engagement level has reached a low engagement.

Categories and Subject Descriptors

K.3.3 [**Computers and Education**]: Computer and Information Science Education – *computer science education, literacy.*

General Terms

Human Factors.

Keywords

Engaging/ interactive readings, Brain-Computer Interface, Emotiv

1. INTRODUCTION

E-book readers and tablets have developed a great read interest among people. With its development these devices have enjoyed a fast increment in popularity. This project aims to stimuli the e-book reading experience. The objective of this project is to engage the reader when the reader is reading an uninteresting topic, but the reading is mandatory. The hypothesis is while a reader is reading something uninteresting; they do not capture as much information as they can, so by incrementing the level of engagement, the reader will be able to get more information. The procedure to follow will be when the participant level of engagement has dropped reaching the low engagement baseline, a video will pop out in order to help the participant level of engagement increase until the participant engagement has reach a high level of engagement.

After that, the video would disappear leaving the participant level of engagement in a level enough to keep him/her reading the e-book.   In order to accomplish this goal, a system has to be created with the purpose to make the interaction between the engagement levels from the Emotiv Control Panel to trigger the video to pop out when the participant level of engagement has dropped under the baseline.

For this particular studies a first approach have been found. The interaction of three software will help to extract the data from the Emotiv Control Panel and stream it to Mind Your OSCs which will use the Open Sound Control Protocol (OSC) to get the data to Max/Msp to create the application to make the video pop out.

2. BRAIN-COMPUTER INTERFACE

Brain-Computer Interfaces (BCIs) enable subjects to communicate by intentionally modulating their brain's electromagnetic field. This field can be recorded outside the brain by methodologies such as Electroencephalograhy(EEG),Magnetic Resonance Image (MRI) orFunctional Near-Infrared (fNIRS) analyzed with the aid of machine-learning algorithms, and then translated into commands that may be used to control computers or neuroprostheses [1]. EEG measures and records the electrical fields produced by neuronal activity, which are also called brain waves [2]. The Electroencephalograhy is a popular non-invasive brain imaging method because of its lower cost (compared to fMRI), portability and high temporal resolution [3]. On this research a non-invasive EEG device is being used. The Emotiv EPOC is a high resolution, neuro-signal acquisition and processing wireless neuroheadset. It uses a set of sensors to tune into electric signals produced by the brain to detect user thoughts, feelings and expressions [4]. While this technology is in its infancy, there have been major strides in the area allowing researchers to investigate potential uses [5].

There are three approaches to measure EEG signals: the invasive method, which requires a surgery in order to implant an array of electrodes in the cortex layer of brain. The advantageof this method is that it has the highest quality signal. The disadvantageis that it is very expensive, it tends to crate a scar tissue and it requires a surgery. The partial method requires a surgery in order to implant a ship on the layer of brain, but the ship will rest on the scalp. The advantageis that it has better signal resolution than the non-invasive BCI. As well, it has less risk to create scar tissue and its disadvantage is the same from the invasive method. On the other hand, thenon-invasive method in which a number of electrodes are attached to the scalp does not require a surgery and it is just a device that can be mounted on a participant head. The advantageof this method is that it does not require a surgery but the disadvantage is that the signal quality is not as high quality as the invasive or partial method.

BCI methodologies are often categorized as being either active or passive. An active approach uses neural signals to actively control or interact with a computer or machine. The Passive approach is observatory and used primarily to gather information while

performing a particular behavior or task [6]. This research will be using passive BCI to measure the level of engagement of the participant while reading an article, which at the same time will be using active BCI making a video popping out. The use of these two methodologies potentially will help to accomplish the objective of letting the reader engage enough to keep reading and retaining information even if the reading is not interesting for the reader.

3. ENGAGING READINGS
Previous studies have tried different approaches in order to increase the User Reading Experience (URE) using a variety of techniques, such as reading agents. interactiverich reading is characterized by a video-based conversational agent that asks questions or makes comments about the current page and is specifically designed to promote engagement with the contents of children's books [7,8]. On this research a video compositing techniques were used to overlay the conversational agent directly over the book contents, creating a magical experience for children by bringing the book to life [9]. As well, any different types of "enhanced" e-books have been developed from highly interactive ones to multimedia-rich ones, but still remain to understand which features can really enrich reading experience and make it more engaging [10,11,12,13]. The main study on these research projectsis to find new ways to make the reading experience pleasurable and engaging. In order to accomplish this goal new approaches are needed. This study attempts to let the URE a different approach, which potentially will increase the engagement levels while reading an article.

4. MEASURING ENGAGEMENT
In order to measure the engagement levels from the participant while reading an article, this researchwill use three measurement methods. The Emotiv Control Panel, which is the software that provides Emotiv company to measure the engagement from 0 - 1, being zero non-engaged at all and 1 meaning really engaged. As well, during the studies the participants are going to be asked about how engage they feel. Figure 1represents the engagement formula, which previous researches have used to calculate engagement [15][16]. E stands for Engagement, which is equal to Beta (β) over Alpha (α) plus Theta (θ); these are the names of brain waves. The Beta wave (β) represents when the subject state of mind is Active. The Alpha wave (α) represent when the subject state of mind is relaxed, tranquil and conscious and the Theta wave (θ) represents when the subject state of mind is sleepy or dreaming. This formula is planed to be incorporating to this research study in the future.

$$ E = \frac{\beta}{(\alpha + \theta)} $$

Figure 1. Engagement Formula

This research is going to try to find any correlation between the Emotiv Control Panel, asking the participants how engage they feel during the study and when implemented in the future the engagement formula.

5. SYSTEM ARCHITECTURE
This project is using the Emotiv EPOC device to measure the level of engagement of the reader while performing a reading. When the engagement level has reached the engagement baseline a video will pop out helping the reader to increase the engagement level, if the readers'level of engagement goes above the baseline, after the video finish playing, the video will disappear leaving the

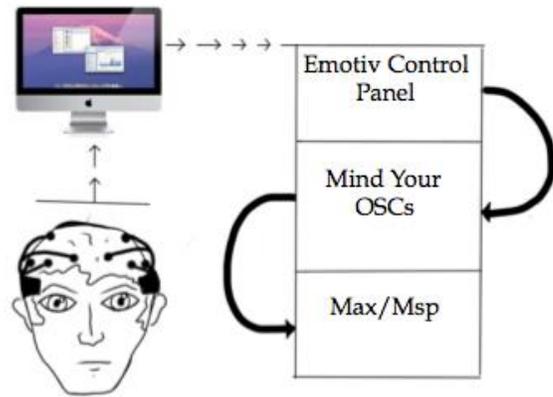participant level of engagement high enough to continue the reading.

Figure 2. System Architecture

Figure 2represents the System Architecture,which is constituted of three software; the Emotiv Control Panel (ECP), Mind Your OSCs and Max/Msp.

Figure 3shows the Emotiv Control Panel. This software allows the computer to communicate with the Emotiv EPOC device. The participant has to wear the device and take a quick training moving a cube using nothing else, but his/hers thoughts. This software has three detection suites: the affective, cognitive and expressive. This research will be using the affective suite in order to get the participant level of engagement and the cognitive suite for training. The purpose of the training is that the system can recognize the participants' brain waves patterns. The participant will have to do two training. On the firstthe subject will visualize a cube a in a neutral position, the purpose of the neutral position is that the software can establish a baseline when the participant is relax. After this training, the participant will have to start the last training, where the subject will have to push a cube towards the background using just s/he thoughts, the system will help participant with a visualization because it is very hard for a person to imaging to push a cube when actually s/he is not touching anything. The participant will be doing this training for 16 seconds.
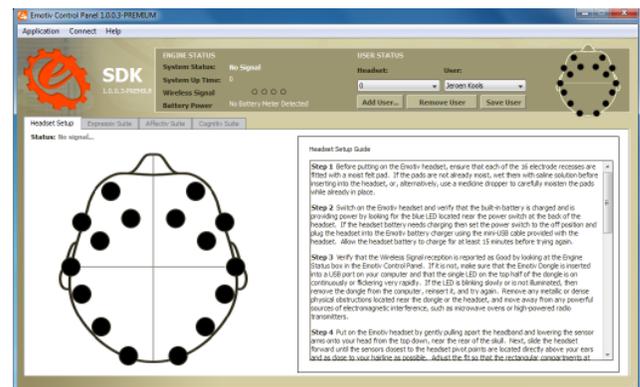

Figure 3. Emotiv Control Panel

Also, an application called Mind Your OSCs is being used. This software displays the numbers from the cognitive, affective and expressive detection suit of the Emotiv Control Panel. This application is vital because unfortunately on the (ECP) the engagement level is represented and displayed using a graph, but not numbers, which is hard to interpret. Using numbers helps for a

better interpretation of the data.

Figure 4represents Mind Your OSCs, which connects to the Emotiv Control Panel and streams its data. As well, this application allows connection to other software using the Open Sound Control(OSC) protocol. This protocol allows the data from the (ECP) on Mind Your OSCs to be sent via OSCs packages which will be unpackaged with a third application Max/Msp.
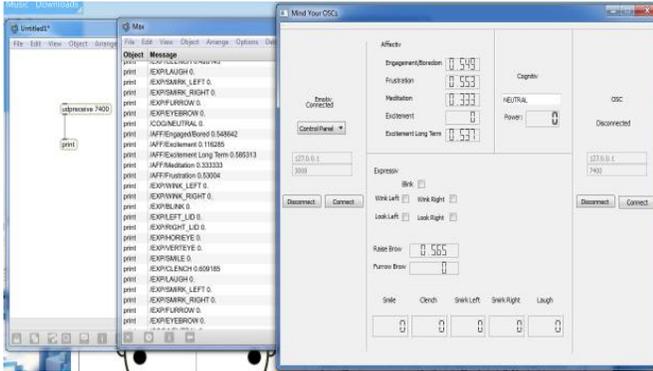

Figure 4. Mind Your OSCs

The last application being use is Max/Msp, which is a visual programming platform for music and multimedia [14]. An application has been created with this software to test whether the level of engagement goes below the engagement baseline established. That event will trigger the video to pop out as is shown on Figure 5.
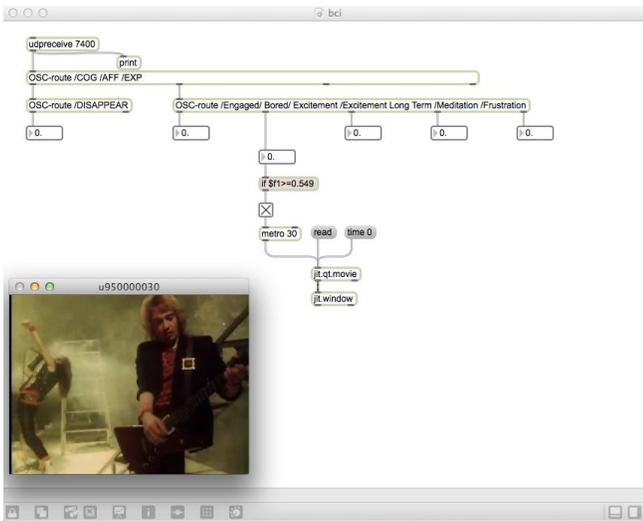

Figure 5. Max/Msp

6. CURRENT APPROACH

This research project has a four steps process in order to collect the data from the participants, which is represented on figure 6.
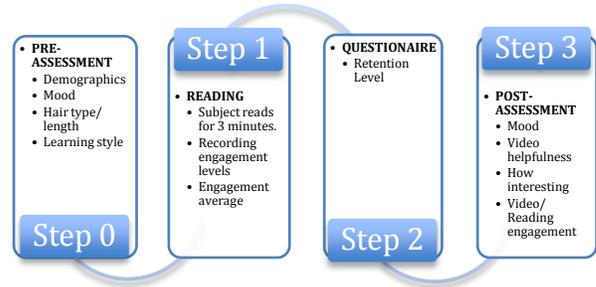

Figure 6. Represents the research process

The studiesstart with step 0, the pre-assessment. On the pre-assessment the participant is going to be asked about the demographics, alsothe mood is being asked because if the participant is happy or sad that mood state might interfere with the engagement, also if the participant is tired the engagementmight not be as high as the beginning that from a participant that is not tire.As well, the type of hair is important for signal purposes. Because it is difficult to mount the Emotiv EPOC device when a participant has an abundant amount of hair because the electrodes from the device might not be touching the participant scalp, which will not give a good signal. The participants are also going to be asked about their learning style, because different people learn using different learning styles, some people can retain more information by watching a video but others can do it by reading an article.

Step 1 is when the subject is going toactually starts reading the article for three minutes, during this period of time the participant level of engagement will be recorded and the average from the participant levels of engagement will be taken. If the participant level of engagement goes below of the engagement baseline 0.549 a video will pop out. While the participant is watching the video the levels of engagement will be taken, and if the average from the participant levels of engagement while watching the video goes above of the engagement baseline the video will disappear leaving the participant levels of engagement high enough to continue reading, but if the participant's level of engagement does not increase, another video will pop out. The participant will be reading for twenty minutes after the time is over, the subject will be given a questionnaire. The purpose of the questionnaire is to measure the retention levels of the participant from the reading. The last step of the research is the post-assessment. The subject will be asked if the video was helpful or not. As well, if the article was interesting or not and what was more engaging if the video or the reading.

7. VIDEO IMPLEMENTATION

The video that is going to be popped out will be related to the reading topic. The purpose of the video is to increase the participant engagement towards the reading that might seem bored to the reader. Using a multimedia approach will aim the reader to get more excited and potentially more engaged towards the reading topic. A similar strategy was used before using an interactive agent to let the user interact with the reader in order to increase the reading user experience [9].

The videos will be chosen from YouTube according to the article topic. The "interesting" scale of the videos will be based on videos ratings.

The article is going to be 6-10 pages long and the participant will have 20 minutes to complete the reading. Depending of the article

topic a variety of videos will pop out, but just once at the time. If the reader engagement level has reached above the baseline, the video will disappear once it has finished playing. After that, the reader will be able to continue reading the article. If that is not the case, another video with more "possible" high level of engagement doses will be popped out until the engagement level has satisfied the high engagement level baseline.

8.LIMITATIONS
Due to time constricts no studies or results could get done during the summer 2012. But the first approach of the study and the creation of the application were done. The studies will begin in fall 2012.

The Emotiv EPOC head set has a limitation; the signal depends of the connectivity between the device and the participant scalp.

9. FUTURE WORK
Due to the time constraints during the summer 2012 time a first feasible approach was chosen in order to test the hypothesis of the research.
"The hypothesis is while a reader is reading something uninteresting, they do not capture as many information as they can, so by incrementing the level of engagement, the reader will be able to get more information."This not necessarily mean that this is the best way to reach the goal, during the fall semester this project will be still in development looking for improvements and different ways to avoid the utilization of three software to accomplish the goal of the project. With a scheme created, it will be easier to finish and modify the software architecture of the project, instead of using three software this process could possible be reduce just by one modifying the Emotiv Control Panel SDK.

The future steps will be to incorporate the engagement formula and create and application and incorporate the system architecture on it, in order be used on a tablet or with smart phones.

This research aims to stimuli the URE towards a better and engaging journey to the reader using multimediahelp and an e-reading experience. Potentially the results from this study will help to create a new system to increase the reading engagement of the readers and their retention level.

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