Presentation Trainer: a Study on Immediate Feedback for Developing Non-Verbal Public Speaking Skills

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***Abstract*— The increasing accessibility of sensors has made it possible to create instructional tools able to present immediate feedback to the learners. To study how this type of instruction is able to support learning, we developed the Presentation Trainer, a tool whose purpose is to train the non-verbal communication skills for public presentations. In this paper we present our findings about studying immediate feedback based on a first round of user tests with the Presentation Trainer.**

***Index Terms*—Immediate Feedback, sensor-based learning support, non-verbal communication**

I. Introduction

FEEDBACK is one of the most influential learning tools, thus learners' achievements either positive and negative vastly depend on it [1]. The means to present feedback vary greatly and several dimensions of feedback have been identified. One of these dimensions refers to the timing of feedback, which can be delayed or immediate [2]. Most of the studies conducted comparing both types of feedback, concluded that for most learning situations the impact of immediate feedback is more positive, since delayed impact tends to delay the acquisition of needed information [2]. A challenge for immediate feedback relies on the implementation of it, as it requires personal tutors to be constantly evaluating the learner. However, the currently increasing accessibility to sensors [3] has lead to a vast research of tutoring systems able to proportionate this type of feedback.

In this paper we present the first evaluation done of the *Presentation Trainer*, a prototype whose objective is to train the non-verbal communication skills for public presentations. This prototype gives feedback about the posture, body movements, voice volume, and voice cadence of the public speaking trainee. The purpose of the paper is to present our findings conducting a first round of user tests on the Presentation Trainer.

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II. Background

The technique of using sensors to track the learner's current state or behavior in order to provide them with immediate feedback has already been used since the late 1970s. In 1978 sensor-learning support was used to treat Idiopathic Bladder Instability. The changes of bladder pressure were translated into auditory and visual stimuli, making patience aware of them [4]. In those early stages biofeedback has also been used for different things such as teaching people how to relax [5] and how to reduce migraine [6]. An early finding about these type of tutor systems, is that feedback should be consistent, it should either always be presented or not presented at all, partial feedback just increases the confusion in learners [7].

Lately, the pursue of studying new automatic tracking recognition techniques using sensors, has lead to an exploration of different learning fields, which can be supported by immediate feedback tutoring applications. The field of learning sports is one that has received vast amount of support by these applications. Research for immediate feedback application has already been conducted in sports such as cross-country running [8], Karate [9], rowing [10], snowboarding [11] and Taekwondo [12]. In these cases the immediate feedback is presented letting learners know about their current performance. Besides sports, immediate feedback sensor-systems have also been studied for physical rehabilitation [13], treatment of Parkinson disease [14], and treatment of attention deficit disorder [15].

Since presentation skills are fairly important in education and in order to acquire those skills students need sufficient practice and feedback [16], for our study on sensor-support for immediate feedback, we developed the *Presentation Trainer*. A prototype able to analyze aspects of the learner's body language such as amount of movement and posture, and aspects of its voice such as volume and cadence.

III. Presentation Trainer Prototype

A. Software Architecture

The software framework used to develop the *Presentation Trainer* prototype has a layered architecture, composed of 3 layers: the *Sensor Layer*, *Output Layer* and *Integration Layer*. The purpose of the *Sensor Layer* is to use sensors to track the learner while training for a presentation. This layer is constituted of a set of objects all of them derived from the

SensorObject class. Each of these objects is bound to a specific sensor, and is responsible for the analysis of the sensor data according to predefined public speaking rules. The *Output Layer* is responsible to exhibit the immediate feedback about the learner's current performance. It consists of a set of objects derived from the *FeedbackObject* class, which are bound to their corresponding set of *SensorObjects*. The output of these *FeedbackObjects* can be toggled on and off at run time, allowing the study of different feedback representations. The *integration layer* contains the main class of the application. It instantiates the different *SensorObjects* and *FeedbackObjects,* and bounds them together. It is also responsible for logging the state of all the instantiated objects allowing for a post analysis of the learner's presentation. This software architecture allows the exploration of different sensors and feedback representation forms, making it suitable for our study.

B. *Body Tracking*

In order to track the learner's body, the *Presentation Trainer* has used the Microsoft Kinect sensor [16] in conjunction with the OpenNI SDK [17]. This fusion has allowed us to create a skeleton representation of the learner's body, which has been used for the analysis of its posture and movements. For the analysis of the body posture, we predefined some postures that should be avoided while giving a public presentation. These postures are: arms crossed, legs crossed, hands below the hips, hands behind the body and hunchback position. The skeleton representation of the learner's body is compared against those postures and when a match is presented, the posture mistake is fired.

To calculate the movement, the *Presentation Trainer* compares the current position of the different limbs of the skeleton representation against their previous position in order to find the distance between them and hence the movement of the learner. When the amount of movement after some predefined time falls outside the thresholds, a movement mistake is fired.

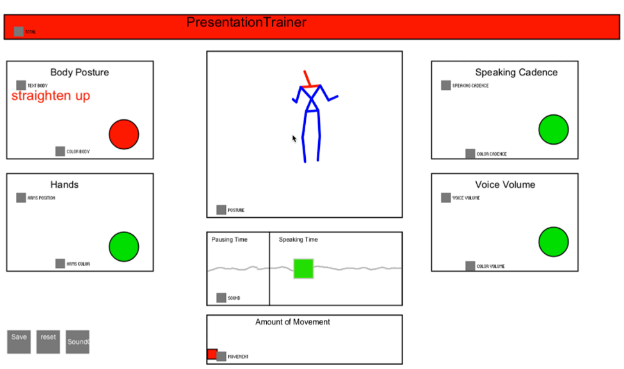

Figure 1: The Presentation Trainer interface indicating the learner to straighten up. Shown up left in the Body Posture module and up center shown in the Skeleton Feedback module.

C. *Voice tracking*

To analyze the voice the *Presentation Trainer* has used the integrated microphone of the computer together with the Minim audio library [18]. For this analysis we have predefined different thresholds regarding the volume value received by the microphone. Values below the low threshold are considered as silence. Once silence is detected the pausing timer starts its tick. Whenever the pausing timer reaches certain time the long pause mistake is fired. The other volume thresholds defined are the low volume and high volume threshold. In case these volume levels are reached, their corresponding timers start ticking. Once these timers pass certain amount of time the *speaking too loud*, or *speaking too low* mistakes are fired. The voice modulation mistake is fired when the volume difference captured by the microphone stays below a predefined threshold for a predefined time.

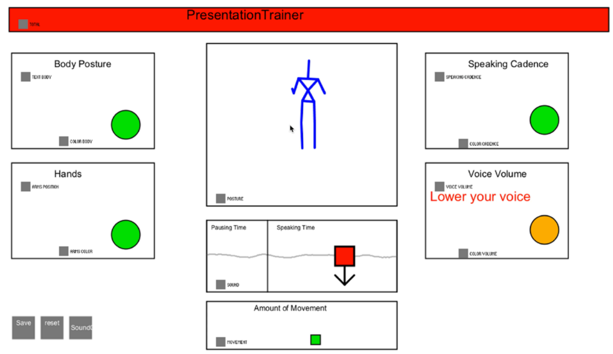

Figure 2: The Presentation Trainer interface indicating the learner to Lower its voice volume. Shown middle center in the Voice Feedback module and bottom right on the Voice Volume Module.

D. *Output Interface*

The output interface that has been used for the first user tests of the *Presentation Trainer* contains 8 different feedback modules. The modules of Body Posture and Hands, are located in the left side of the interface; the modules of Speaking Cadence and Voice Volume, are located in the right side of the interface. Each of these modules presents two different types of feedback representation. A written text instruction on how to correct the learner's mistakes; and a circle, whose color fades from green to red indicating whether the learner is performing correctly or not.

The center of the interface displays 3 feedback modules: *Skeleton Feedback, Voice Feedback, and Movement Feedback*. The feedback given these modules, continuously reflects the learner's actions, and highlights the learner's mistakes. The *Skeleton Feedback* shows the skeleton representation of the user and highlights the limbs situated in a wrong posture. The *Voice Feedback* shows a square, which moves to the right while speaking and to the left while pausing, showing the student's how they are approaching to the long pause or long speaking time. It shows an arrow pointing up indicating to raise the voice volume, an arrow pointing down indicating to lower the voice volume and both of the arrows indicating to module the voice tone. Furthermore, the square fades its color from green to red according to the mistakes performed by the trainee. The *Movement Feedback* module shows a square that moves to the right when the learner is moving and to the left when is standing still. As the square approaches to the edges of the module its color fades from green to red, indicating the user to move more or to stand still.

The last feedback module is located in the title bar of the interface, which fades its color from green to red indicating whether mistakes are being performed or not.

IV. User Tests Set-Up

A. Preparation

Before doing the user test, we introduced the prototype to all of the participants during a presentation, where we explained the tool and its purposes. At the end of the presentation we let the audience give their feedback and impressions about the tool. After the questions and comments session, we asked for volunteers for the user tests.

B. User Test

The test consisted on giving a short presentation while using the Presentation Trainer as an immediate feedback tool. The people inside of the room during the test were the participant and the examiners. The test started by showing the participants a comic story containing 6 pictures and asking them to give a short presentation about it while using the Presentation Trainer as an instructor.

In front of the participant there were two computer screens one displaying the Presentation Trainer and the other displaying the comic slides of the presentation. Shown as a sketch in figure 3.

After the presentation, participants were asked to fill in a System Usability Score (SUS) test followed by an interview. During the interview we showed the user interface of the *Presentation Trainer* to the participants and asked them questions to find out which components of the interface were the most used, helpful and interesting. We also asked questions on their general opinion about the *Presentation Trainer* and what they would like to get from it in the future.

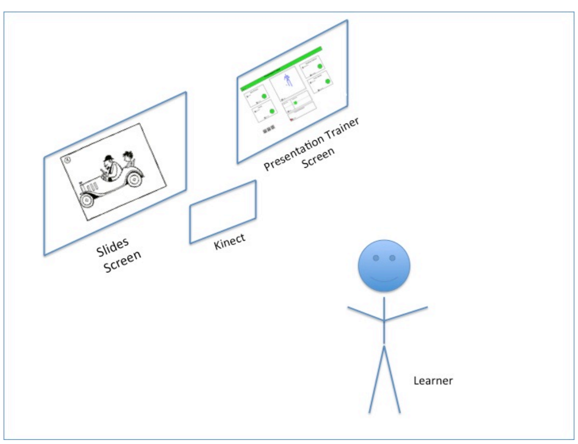

Figure 3: User Test Set-Up.

V. Results

In total we had 6 participants, for the user tests. The background of the participants was either in learning or computer sciences. The average scores for the SUS questionnaire were: 67.5 for SUS, 65.1 for usability, and 77.1 for learnability.

All participants concluded that the most observed element of the interface during the presentation was the *Skeleton Feedback* module and the second most observed was the *Voice Feedback* module. The colored circles were observed but participants did not know how to change their behavior based on them. “I wanted to turn it back to green but I did not know how” was a remark letting us know about this issue. The users have not observed the displayed texts with instructions. Some participants have suggested using icons instead of text to give the instructions.

Participants remarked the overload of information when giving a presentation and being aware of all the feedback at the same time. Therefore it was suggested to use a learning strategy focusing on giving feedback only about one aspect of the trained skills at the time.

Most participants show skepticism about the immediate feedback during the public demonstration of the *Presentation Trainer*. Thus, suggested to use the tracking capabilities of the *Presentation Trainer* to show the learners’ performance and mistakes after the presentation, with the purpose of supporting their learning more effectively and allowing them to reflect about their performance. Nevertheless, after using the tool they all stated their enthusiasm towards the immediate feedback. One of the participants gave us the following commentary stating this point during the interview: “It is funny, I was one of the persons suggesting to focus on giving feedback after the presentation and now I would like to be able see that skeleton while presenting.”

VI. Discussion And Future Work

Participants in the user tests show great enthusiasm towards the *Presentation Trainer*. The remarks about the immediate feedback received were positive and participants liked the idea of using a similar tool to train for their presentations. However, observations executed during the user tests showed that the purpose of the *Presentation Trainer* has only been partially accomplished. Participants did not always adapt their behavior, even when the *Presentation Trainer* was suggesting on doing so. Two variables have been identified for this partial adaptation and learning impact; therefore requiring a special attention for further studies on the effectiveness of the *Presentation Trainer’*s immediate feedback. The first variable is the cognitive load. Not being prepared for giving a presentation, regardless of its simplicity proved to be a fairly complex task, consuming most of the participants’ attention; hence a small percentage of their focus was paid on the *Presentation Trainer*. In order to deal with this problem it is important to determine whether this is an experimental set-up or an immediate feedback issue. For that we plan to do some new user tests, asking participants to prepare for the presentation before using the *Presentation Trainer* for the first time. In case the cognitive load continues to be fairly demanding to focus on the feedback given by the system, strategies to shift the learner's attention towards the *Presentation Trainer* will be explored.

The second variable identified having an influence on the *Presentation Trainer's* immediate feedback effectiveness and therefore requiring further studies, is the feedback representation. By examining the different feedback representations used during the tests, we identified that the ones continuously reflecting the actions of the participants', were the easiest ones to be understood and followed during the presentation. Semaphores captivated the users' attention but its information was not enough to let them know how to adapt their behavior. Finally participants did not perceive the instructional text. Before arriving to conclusions, we first need to make sure, whether these results have been obtained because of the feedback representation and not because of the experimental set-up. Therefore in the next user tests a big screen is going to be used, ensuring that participants are able to easily read the instructional feedback texts.

In the short-term future work we pretend to continue conducting small trials changing the experimental set-up, with the intention to identify the right setting allowing us to later investigate the learning support provided by the *Presentation Trainer.* For these following trials we plan to experiment with different set-ups such as: having participants prepare their own presentation before doing the test. Changing the size of the displayed feedback. Allowing participants to explore the tool before doing the presentation. Lastly we want to study a set-up where first participants will do a presentation having their performance logged and without feedback. Then they will be asked to explore the tool. Furthermore on the last step participants will repeat the presentation, this time receiving feedback.

Summarizing, this study has shown that the *Presentation Trainer* is robust enough to be used in experiments. The user tests revealed that before continuing with our empirical studies on the educational impact of the *Presentation Trainer*, in order to obtain conclusive results, we first need to explore the experimental set-up. Finally the enthusiasm shown from the participants towards the tool ratified us the relevance of our study.

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References

[1] Hattie, J., & Timperley, H., The power of feedback. Review of Educational Research, 2007, pp. 81–112.
[2] Mory, E. H., Feedback research revisited. In Handbook of research on educational communications, 2004, pp. 745–784.
[3] Swan, M., Sensor Mania! The Internet of Things, Wearable Computing, Objective Metrics, and the Quantified Self 2.0. Journal of Sensor and Actuator Networks, 2012, pp. 217–253.
[4] Cardozo, L. D., Abrams, P. D., Stanton, S. L., & Feneley, R. C. L., Idiopathic Bladder Instability Treated by Biofeedback. Review Literature And Arts Of The Americas, 1978, pp. 521–523.
[5] Burish, T. G., & Jenkins, R. A., Effectiveness of Biofeedback and Relaxation Training in Reducing the Side Effects of Cancer Chemotherapy. Health (San Francisco). 1992, pp. 17–23.
[6] Gauthier, J., Bois, R., & Allaire, D., Evaluation of Skin Temperature Biofeedback Training at Two Different Sites for Migraine. Reading, 1981.
[7] Morley, S., Partial Reinforcement in Human Biofeedback Learning ~, 1979, pp. 221–227.
[8] Vales-Alonso J, López-Matencio P, Gonzalez-Castaño FJ, Navarro-Hellín H, Baños-Guirao PJ, Pérez-Martínez FJ, Martínez-Álvarez RP, González-Jiménez D, Gil-Castiñeira F, Duro-Fernández R. Ambient Intelligence Systems for Personalized Sport Training. Sensors. 2010, pp. 2359-2385.
[9] Takahata, M., Shiraki, K., Sakane, Y., & Takebayashi, Y. , Sound Feedback for Powerful Karate Training. Technology, 2004, pp. 13–18.
[10] Baca, A., & Kornfeind, P., Rapid Feedback Systems for Elite Sports Training. Microprocessors, 2006, pp. 70 – 76.
[11] Spelmezan, D., & Borchers, J., Real-time Snowboard Training System. Computing, 2008, pp. 3327–3332.
[12] Kwon, D. Y., & Gross, M. Combining Body Sensors and Visual Sensors for Motion Training. Training, 2005,pp. 94–101.
[13] Brunelli, D., Farella, E., Rocchi, L., Dozza, M., Chiari, L., & Benini, L., Bio-feedback System for Rehabilitation Based on a Wireless Body Area Network. Processing, 2006, pp. 531-536.
[14] Paradiso, J. A., Morris, S. J., Benbasat, A. Y., & Asmussen, E., Interactive Therapy with Instrumented Footwear. Music Therapy, 2004,1341–pp. 1343.
[15] Linden, M., Habib, T., & Radojevic, V., A Controlled Study of the Effects of EEG Biofeedback on Cognition and Behavior of Children with Attention Deficit Disorder and Learning Disabilities I, 1996, pp. 35–49.
[16] Kerby, D. & Romine, J., Develop Oral Presentation Skills Through Accounting Curriculum Design and Course-Embedded Assessment. Journal of Education for Business. Vol. 85, Iss. 3, 2009.
[17] Microsoft Kinect: http://www.xbox.com/en-US/kinect
[18] OpenNI: http://www.openni.org
[19] Minim: http://code.compartmental.net/tools/minim/

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