A Behavior Analysis Tool Using Pitch Presentation Training Virtual Reality Simulation (Serious Game) By Employing Brain Computer Interface Technology

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Meisam Taheri
Gifu University

Kevin Tan
Inland Norway University of Applied Sciences

A BEHAVIOR ANALYSIS TOOL USING PITCH PRESENTATION TRAINING VIRTUAL REALITY SIMULATION (SERIOUS GAME) BY EMPLOYING BRAIN COMPUTER INTERFACE TECHNOLOGY

M. Taheri, K. Tan, A. Aske

Inland Norway University (NORWAY)

Abstract

Giving presentations can be challenging for many students due to a variety of reasons. Identifying and overcoming the obstacles and problems associated with presenting can help individuals to become more confident and better presenters. Becoming a skilled and good presenter takes practice and effort. Some common mental obstacles that make presenting difficult for some people include fear of public speaking, lack of confidence, and difficulty in organizing thoughts. In this research we designed a tool that enables educators and students to train and practice their presentation in an immersive Virtual reality (VR) setup. This simulation allows the presenter to interact with the panel sitting in front of them, get feedback and rehearse the presentation any number of times. The simulation incorporates questions posed by a virtual panel, with their complexity tailored to the user's chosen difficulty levels. The conductor of the simulation can activate responses that offer real-time feedback to the presenter. To assess the tool's effectiveness, we acknowledge the importance of capturing biometric responses to gauge the presenter's anxiety and stress levels during the experiment. To tackle this challenge, we've employed a brain-computer interface (BCI) to monitor stress levels for each presenter in every session. By analysing the results from multiple training sessions, we can showcase how the tool effectively assists presenters in overcoming mental obstacles and enhancing their presentation skills.

Keywords: Virtual Reality, simulation, brain-computer interface, BCI, VR, presentation.

1 INTRODUCTION

Presenting information effectively is a crucial skill in today's educational and professional settings. However, for many individuals, the prospect of delivering a presentation can be daunting, plagued by various obstacles that hinder their ability to communicate ideas with confidence and clarity. These obstacles often manifest in the form of public speaking anxiety, lack of self-assurance, and difficulties in structuring and articulating thoughts. Recognizing the significance of conquering these impediments to become proficient presenters, this research endeavours to introduce a novel tool aimed at fostering presentation skills through immersive VR and BCI technologies. To better train and prepare the individuals to conquer the challenges they are facing regarding presentation, we developed a tool in VR that allows users to practice different scenarios and be tested and observed by a supervisor. The biometric data generated from BCI can help the conductor of such simulations to analyse the behaviour of a presenter before, during and after each session. Collecting these data can help presenter and conductor to better understand where and which situations needs to be focus on and be improved. Tracking the progress and proof of improvement and effectiveness of tools can be validated using this simulation as well. In this paper, we will explore the development and implementation of this VR-based presentation training tool, as well as the methodology for measuring biometric responses. Through experimentation and analysis, we seek to contribute valuable insights into how VR technology can be harnessed to foster confident and proficient presenters, enabling individuals to overcome the challenges associated with presenting and excel in their academic and professional pursuits. We discuss some of the challenges associated with public speaking and how the developed tool fostering practice and refinement of presenters' skill.

2 RESEARCH STATEMENT

To evaluate the efficacy of this novel tool, it is imperative to conduct a qualitative and quantitative evaluation of the presenter's emotional condition during the training sessions. To address this pivotal aspect, we have integrated a Brain-Computer Interface (BCI) to measure the presenter's levels of stress and anxiety throughout each session. Through the systematic collection and analysis of biometric data across multiple training sessions, our objective is to enhance empirical substantiation of the tool's

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capacity to aid presenters in overcoming psychological impediments and augmenting their presentation proficiencies. This research aims to answer the question: Can the combination of VR technology and BCI effectively improve presentation skills and reduce stress levels in individuals?

3 THE CHALLENGE OF EFFECTIVE PRESENTING

Effective presenting skills have a crucial role in a variety of academic and professional situations, including meetings, interviews, conferences, trade exhibits, and job fairs [1]. The art of presenting and public speaking goes beyond simply conveying facts; it requires the ability to actively engage, educate, and persuade the audience. This diverse method is dependent on a combination of skills, including mastery of public speaking, self-confidence, and the ability to arrange and present ideas. However, many people fail to acquire these skills, which tend to be hindered by public speaking anxiety, a lack of self-confidence, and difficulties arranging their thoughts. These psychological barriers can greatly hinder their capacity to successfully communicate ideas, limiting their potential in both professional and personal situations. Students commonly struggle with negative memories of previous public speaking experiences [2]. Aside from the fear of public speaking, students commonly struggle with communicating their ideas successfully during oral presentations [3]. Furthermore, the anxiety of being the focus of attention, which fosters stage fright and psychological distress, is a recurring problem [4]. Engineering students are not immune to these difficulties, with some expressing concern that their limited linguistic proficiency may impair their ability to explain complex concepts and procedures, limiting their ability to demonstrate their technical knowledge and theoretical understanding [5]. Anxiety and stage fright can occasionally cause short cognitive blockages during presentations, resulting in temporary loss of ideas or an interruption of the presentation's flow [6].

4 THE ROLE OF IMMERSIVE VIRTUAL REALITY

In response to discussed challenges, our research aims to develop the pedagogical and technical approach aimed at enhancing presentation skills. We have devised an innovative tool that harnesses immersive Virtual Reality (VR) technology, providing educators and students with an immersive and unique training environment. This VR simulation immerse presenters within a true-to-life environment, facilitating interaction with a virtual panel situated in front of them, offering an authentic presentation experience. Most importantly, this tool empowers presenters to practice their presentations repeatedly, resulting in a dedicated rehearsal and refinement. A study within the field of engineering education revealed that students gain considerable benefits from recording a rehearsal of their presentations [7]. Numerous studies have demonstrated that immersive VR environments can help individuals overcome public speaking anxiety and improve their overall presentation skills [8,9,10,11,12]. The designed tool enables users to record their sessions and review them at their preferred pace. This approach allows students to find different aspect of their presentation and weakness, aiding them to reduce the communication anxiety and enhancing communication efficacy. Indeed, according to the findings of Sülter et al., technology, including Artificial Intelligence (AI), virtual reality, and mobile applications, exhibits the potential to alleviate students' public speaking anxiety [13].

5 REAL-TIME FEEDBACK AND INTERACTION

Within the VR simulation environment, presenters could interact with a virtual panel that presents questions of diverse complexity levels, as per the user's preference. Immediate feedback is triggered by a simulation facilitator who prompts reactions throughout the presentation, thus, providing valuable guidance and assessment. This dynamic engagement fosters a realistic and engaging learning experience. This is facilitating the improvement of presenters' capacities in overcome cognitive barriers and sharpen their competencies. Through the real-time acquisition and analysis of data, computer-assisted evaluation affords educators and learners the means to gain insights into the strengths and areas of improvement in student performance, thus enabling timely adjustments to pedagogical strategies [14].

6 MEASURING BIOMETRIC RESPONSES

To evaluate the effectiveness of this innovative tool, we recognize the need to quantitatively assess the presenter's emotional state during the training sessions. To address this crucial aspect, we have incorporated a Brain-Computer Interface (BCI) to measure the presenter's stress and anxiety levels throughout each session. By collecting and analysing biometric data over several training sessions, we aim to provide empirical evidence of the tool's efficacy in assisting presenters in conquering their mental obstacles and enhancing their presentation skills.

7 METHODOLOGY

7.1 Simulation Development

In this section, the different aspects of design and development of the virtual reality pitch presentation simulation tool will be reviewed. This discussion will encompass key attributes, including interactions with a virtual panel, the option to tailor difficulty levels to individual preferences, and the incorporation of real-time feedback mechanisms.

Figure 1. Simulation interface

7.2 Virtual panel interactions

Within this simulated environment, users engage with a virtual panel positioned before them to facilitate an authentic presentation experience. The simulation incorporates four diverse virtual panels, each characterized by unique personalities and dialogue responses. These panels showcase personalized motion-captured animations and recorded vocal responses meticulously synchronized with their respective animations. These virtual panels manifest idle motions that signify their active engagement in observing and listening to the presenter. All animations are refined to attain the highest degree of fluidity and realism. The nature of the responses generated by the virtual panels is based upon factors such as the difficulty levels of the presentation, the specific slides being presented shown in Fig.1(4), and the prevailing mood. This diversity and individuality of the virtual panel members, comprising two male and two female representations, are visually depicted in Fig.1(1), along with a corresponding breakdown of each panel member's name and associated actions or responses as delineated in Fig. 1(2).

7.3 Responses and difficulty levels

The tool provides a range of question complexity levels and virtual panel moods, enabling the facilitator to initiate suitable responses as required. These levels consist of two tiers: "easy" and "hard." The "easy" level entails more gentle and supportive responses, while the "hard" level aims to present the presenter with more challenging and puzzling questions, accompanied by more diligent responses. The questions posed can either be broad inquiries or relate directly to the content of the slides being presented by the user, Fig.1(3) illustrates the current slide being presented by the user. Fig.1 (2) provides an illustrative representation of the associated responses for each panel member. These responses encompass two distinct categories: "distracted/bored" and "interested/focused," with variations set upon the difficulty level. When dealing with an easy level, the responses exhibit a more encouraging and less stringent tone compared to the challenging levels. This approach is designed to alleviate the presenter's stress, fostering a heightened focus on skill acquisition and tool utilization, thus establishing an environment that promotes the presenter's sense of safety and comfort. Subsequent to a series of initial attempts, once the presenter becomes proficient with the protocol and the progression, then the difficulty level evolves, with a greater emphasis on refining presentation style and delivery.

7.4 Real-time feedback

Responses within the simulation are activated by the simulation conductor, triggering immediate feedback to the presenter. These responses are categorized into two distinct types: general responses and specific responses, both of which can be initiated by the simulation conductor while the user is engaged in their presentation, as presented in Fig. 1. General responses primarily are action-based reactions that correspond to the type of presentation being conducted by the user. The conductor can engage with designated buttons, as illustrated in the figure, to evoke a response from a chosen virtual panel. On the other hand, specific responses are directly linked to the slides and are organized according to the difficulty levels. The conductor possesses the capability to provide instantaneous feedback by selecting and activating a specific response.

7.5 BCI integration

To assess biometric responses, a Brain-Computer Interface (BCI) was employed to measure specific parameters, particularly stress levels, during presentation rehearsals. Initially, it was imperative to establish a baseline by capturing the presenter's normal or relaxed physiological state to calibrate the gathered data. The acquisition of this baseline state facilitated the subsequent evaluation of stress and excitement levels in the presenter. Fig.2 visually represents the biometric data that can be acquired through the utilization of the BCI, involving the collection and analysis of brain-derived signals. Of particular significance is the emphasis on stress levels (ST), as depicted in Fig. 3, wherein the presenter's normal state, averagely signaling at approximately 30Hz on the Y-axis of the graphs, is presented and highlighted.

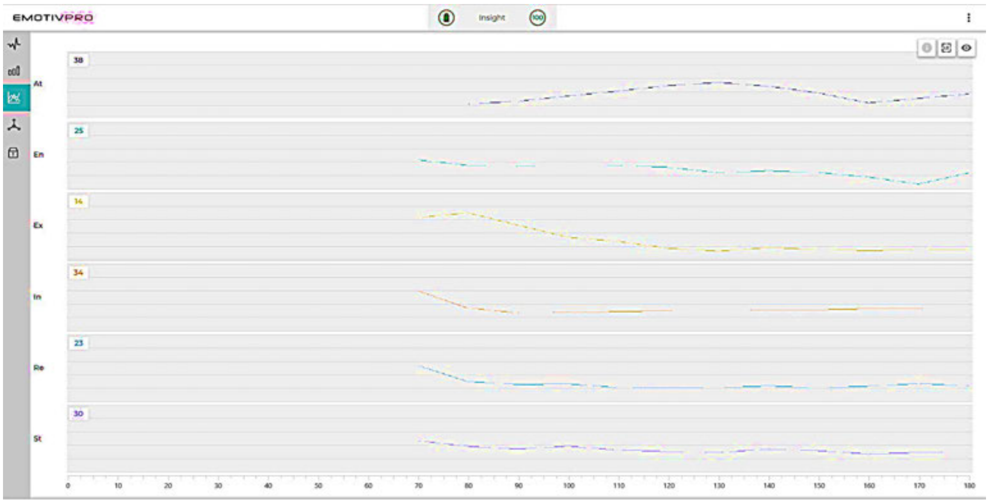

Figure 2. emotion signals real-time presentation

Figure 3. Stress level signals real-time presentation

7.6 Experimental Design

In the initial phase of our research, a series of experiments were undertaken to assess the efficacy of the VR pitch presentation tool. The participants, comprising both students and professionals, engaged in multiple training sessions using the VR tool, which aided to familiarize them with its operation and interaction features. Thereafter, participants were provided with comprehensive explanations regarding the training sessions and data collection methodologies. Their feedback and expectations concerning the tool were solicited prior to their exposure to the simulation, with a subsequent inquiry into their experiences post-testing. To validate gathered data and feedback from participants our emphasis rested on the analysis of biometric responses acquired through the Brain-Computer Interface (BCI) to ascertain their correlation with skill enhancement.

7.7 Body language and movement

Besides interacting with simulation in an immersive environment and gathering some sensory information, body language of the participants was observed. The positioning of their body and feet and how they use their body language was observed. Meta Quest 2, the VR headset provides a hand tracking system, which allows the participants to see and track their hands in the simulation. Knowing where their hands are and being able to emphasize their point with their hand movements and gestures. Eyes and head movements were tracked in the simulation to measure and understand better where participants were looking at while questions been asked or if they maintained eye contact with the virtual panel while presenting. This helped the facilitators to better analyze and understand the level of engagement of participants.

In addition to engaging within the immersive simulation environment and collecting sensory data, we also conducted an observation of participants' non-verbal communication cues, specifically their body language. This surrounded the scrutiny of their body and feet positioning, as well as their utilization of gestures and body movements. The Meta Quest 2 VR headset facilitated hand tracking capabilities, allowing participants to visualize and monitor the movement of their hands within the simulation. This feature enabled participants to deliver their points effectively through hand movements and gestures. Furthermore, we tracked participants' eye and head movements within the simulation shown in Fig.1(5), enabling a more comprehensive understanding of their gaze patterns during Question-and-Answer (Q&A) interactions and whether they maintained eye contact with the virtual panel during presentations. This comprehensive analysis served to enhance our comprehension of participant engagement levels and assisted the facilitators in their assessment.

8 RESULTS

Within the context of this project, characterized by the nature of a serious game simulation, a pivotal point involves game testing. This phase entails presenters/students engaging with and systematically study the simulator, identifying issues and shortcomings, and providing subjective assessments regarding the simulator's practical qualities during testing. In the beginning stages of data collection, a qualitative research methodology was adopted, where both presenters and users of the simulation actively provided feedback on their experiences with the simulation. After this iterative process, several enhancements were integrated, resulting in making simulator into its current and better form.

Presenters reported noticeable improvements in their presentation skills and a reduction in stress levels after a series of trial attempts. Ability to work comfortably with the system resulted in increased confidence in their presentation abilities. When immersed within the simulation, presenters expected to be evaluated by the virtual panel, therefor, subjecting themselves to scrutiny and judgment. It is worthy to note that elevated stress levels were observed particularly in response that are more negative and challenging posed by the panel. This highlighted stress obligated them to seek better feedback and strive for superior outcomes through repeated attempts. Additionally, the simulation sessions were recorded and provided participants the opportunity to review and self-analysis their performances. The results and feedback collected from the testing sessions served as a foundational basis for the refinement of the simulation tool and the description of prospective developmental trajectories.

9 CONCLUSIONS

This research addressed some of the challenges associated with giving presentations and proposed an innovative method using Virtual Reality (VR) technology and Brain-Computer Interface (BCI). To tackle obstacles presenters face and understand they behaviour when facing them, we have developed a VR-based presentation training tool that immerses users in a simulated presentation environment. The VR simulation offers several key features to enhance the presenter's skills. Virtual panel interactions provide a close realistic presentation experience by allowing users to engage with virtual panel members who respond based on their presentation quality. By adding gamified elements, adding customizable difficulty levels and eye contact score, the simulation offers both encouragement and challenges to the presenter, thus facilitating skill development over time. Real-time feedback, triggered by the conductor/trainer of the simulation, ensures that users receive immediate guidance and suggestions for improvement during practice sessions. To measure the effectiveness of this training tool and the presenter's progress and behaviour, we have integrated BCI to monitor biometric responses, specifically stress levels, during presentation practice. This BCI technology captures data offers valuable data of anxiety and stress levels of each presenter. By combining VR technology and BCI integration, this research attempts to provide a solution for individuals seeking to improve their presentation skill. The immersive VR experience offers a safe environment for practice, while the BCI data ensure effectiveness of the training tool. This tool holds a potential to empower individuals to overcome presentations difficulties, enabling them to become a better presenter in academic and professional settings. The research is on-going, and the result of the simulation and its effectiveness while in cooperating more biometric data will be discussed in future work.

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