Designing a Virtual Reality Exposure Therapy to Familiarise and Desensitise to Environmental Stressors in Airports

Matthieu Poyade
Glasgow School of Art
Glasgow, UK
m.poyade@gsa.ac.uk

Glyn Morris
Friendly Access
Kinloss, Forres, UK
info@friendlyaccess.org

Ian Taylor
Crag3G
Plockton, UK
ian@crag3d.com

Victor Portela
Glasgow School of Art
Glasgow, UK
v.portela@gsa.ac.uk

Keywords: Virtual Reality Exposure Therapy, Virtual Reality, Hidden Disabilities, Accessibility, Airport

1. Introduction

Many individuals living with Autistic Spectrum Disorder (ASD), acute sensory hypersensitivity, mental health conditions and severe anxiety issues have extreme difficulties with heightened noise and/or crowded situations within environments. These sensory cues can act as barriers in public and busy spaces, stopping individuals with hidden disabilities doing what most may think are everyday activities [1,2], and thus placing them at an unfair disadvantage compared to their peers in society.

Recent initiatives have promoted the development of updated guidelines to support those living with hidden disabilities in busy environments such as airports [3]. Social Stories™ which consist of a sequence of images along with situation descriptions [4,5]; and organised pre-visits of facilities as a reasonable adjustment, are two of the most common strategies used to familiarise with critical places. However, these are often not enough to increase individual's confidence and ability to lead a more independent life as they do not contribute effectively to desensitise to environment stressors. Thus, there is a need for a more "out-of-the-box" approach.

Gradual exposure therapy has been successfully applied in the past, to the treatment of fears and phobia, and when conducted in Virtual Reality (VR), allows to gradually desensitize to stress-eliciting objects or situations from a safe and reliable realistically digitally reconstructed environment [6,7]. On the one hand, Virtual Reality Exposure Therapy (VRET) has shown to be particularly effective to treat many anxiety disorders [7], empowering the customisation of the gradual sensory exposure to the patients needs. On the other hand, VR can induce cyber-sickness, and realism often strongly relies on technologies that may not be affordable by most.

This paper presents a prototype of VRET application for mobile devices, which aims to familiarise and desensitise people with hidden disabilities, and more particularly those who live with ASD and anxiety disorders, to the environmental stressors that are typically found in airports. This paper also presents the preliminary outcomes from a usability testing which aimed to assess how a cohort of non-clinical users perceives the prototype of VRET application.

2. Familiarisation and Desensitisation to Environmental Stressors in Airport using VR

The VRET application was designed with the collaboration of 26 volunteers, all living with hidden disabilities, across Scotland, who helped identify environmental stressors that sometimes or often lead them to experience high levels of anxiety and stress, to tailor a realistic sensory immersive experience of an airport environment.

The VRET application, which was developed using Unity 5, is meant to be available to recent Android smartphones users (e.g. Samsung 6 & 7), mounted on an affordable VR headset (£5.99), and provides head tracked stereoscopic visualisation and spatial audio reproduction using the Google VR SDK.

The VRET application drives the user through a series of 4 minutes long sensory controlled experiences in 4 different controlled environments within Aberdeen International Airport (Fig. 1), which has kindly accepted to participate as a case study: (a) the entrance hall; (b) a coffee shop; (c) gender-specific toilets; and (d) the boarding area. The system allows the gradual increase of environmental stressors such as ambient sounds (i.e. loud shop music, people conversation, recorded announcements on speakers and retails equipment noises) and crowd density, making each environment becoming more challenging throughout repeated use.

Figure 1. Digitally reconstructed environments from Aberdeen International Airport**.**

3. User Experience Assessment

A usability test has been conducted on 11 postgraduate students (M = 6; F = 5) from the Glasgow School of Art, with no previous experience in VR. Participants were required to use the application as if they were our typical high-end users for about 20 minutes, authenticating with their email, specifying their gender, and experiencing each of the aforementioned digital environments with no sensory attenuation, while sitting down. Participants were then required to rate a series of statements using a Likert scale: *Strongly Disagree* (1) *–Disagree* (2) – *Neutral* (3) – *Agree* (4) – *Strongly Agree* (5), and to support their choices with comments, in order to determine how user-friendly, intuitive, playful, engaging, realistic and comfortable, the application and setup were.

Analysis of participants' responses showed they enjoyed using the application ($M = 3.727$; $\sigma = 0.467$), finding it easy to use ($M = 4.273$; $\sigma = 0.467$), with a quick learning curve ($M = 4.545$; $\sigma = 0.522$). Both graphical ($M = 3.273$; $\sigma = 0.786$) and audio ($M = 3.273$; $\sigma = 1.104$) realisms were reported to be acceptable offering a *"…nice experience for a mobile phone driven device*", although the motion path of digital avatars and spatial audio needed refinements. The physical setup was perceived to be relatively comfortable ($M = 3.545$; $\sigma = 0.688$) and not cumbersome ($M = 4.273$; $\sigma = 0.467$). However, participants reported through a pre vs. post symptoms questionnaire, to feel eyes strain after using the application, in an almost significant way ($t(10) = 2.23$; $p = 0.053$), but no significant development of cyber-sickness symptoms was observed. Finally, some participants experienced lagging caused by the large number of avatars. Thus, further pathways to high quality visualisation for familiarisation and desensitisation in airports need to be explored. Integrated VR headsets as the Oculus Rift, could be a possible solution and offer opportunities for improving self-awareness by coupling a Leap Motion.

Acknowledgements

This work consists of the development outcomes of the Stage 1 research project "Dynamic Interactive Navigation for Familiarisation and Desensitisation" (SIF-R1-S1-HI-002) which was funded by the Social Innovation Fund jointly supported by the Scottish Government and the European Social Fund.

References

[1] http://www.bbc.co.uk/programmes/p05jldzt
[2] https://youtu.be/OtwOz1GVkDg
[3] http://clahrc-peninsula.nihr.ac.uk/news/2017/01/17/caa-guidelines
[4] KARAYAZI, S., KOHLER EVANS, P., & FILER, J. (2014). The Effects of a Social Story™ Intervention on the Pro-Social Behaviors of a Young Adult with Autism Spectrum Disorder. *International Journal of Special Education*, *29*(3), 126-133.
[5] O'HANDLEY, R. D., RADLEY, K. C., & WHIPPLE, H. M. (2015). The relative effects of social stories and video modeling toward increasing eye contact of adolescents with autism spectrum disorder. *Research in Autism Spectrum Disorders*, *11*, 101-111.
[6] CARDO, R. A., DAVID, O. A., & DAVID, D. O. (2017). Virtual reality exposure therapy in flight anxiety. *Computers in Human Behavior*, *72*(C), 371-380.
[7] MORINA, N., IJNTEMA, H., MEYERBRÖKER, K., & EMMELKAMP, P. M. (2015). Can virtual reality exposure therapy gains be generalized to real-life? A meta-analysis of studies applying behavioral assessments. *Behaviour research and therapy*, *74*, 18-24