

Reducing impact of stress in patients with psychiatric disorders – a pilot study on the effects of swimming with wild, free dolphins in virtual reality

W Veling¹, M J Sjollema², B C Brada³

¹Department of Psychiatry, University Medical Center Groningen ,
Hanzeplein 1, Groningen, THE NETHERLANDS

^{2,3}The Dolphin Swim Club,
Beemdgras 32, Leeuwarden, THE NETHERLANDS

¹w.veling@umcg.nl, ²contact@thedolphinsswimclub.com, ³benno@brada.nl

¹www.umcg.nl, ^{2,3}www.thedolphinsswimclub.com

ABSTRACT

In this pilot study, a 360° video VR relaxation program (VR Relax) is being developed in order to reduce the impact of stress in patients with depressive, anxiety and psychotic disorders. The relaxing effect of an underwater VR experience with wild, free dolphins will be compared to the effect of an VR experience with natural surroundings such as beach, open fields and dunes and to a 2D experience with video clips of natural surroundings.

1. INTRODUCTION

Stress is defined as demands on individuals that tax or exceed their resources to manage them (Selye 1956). Physical or psychosocial stress elicits physiological, emotional and behavioral responses, which are often adaptive, but also can increase vulnerability to disease. Heightened stress reactivity plays a central role in theories of onset and course of psychiatric disorders, as it has been related to both onset and recurrence of mood, anxiety as well as psychotic disorders (Monroe & Harkness 2005; Phillips *et al.* 2007).

There are two options for altering the impact of stress in daily life: reducing exposure to environmental stress or diminishing personal reactivity to stress (Myin-Germeys & van Os 2007). Personal stress reactivity may be altered by changing negative cognitive schemas or reducing level of arousal, tension and rumination. Changing negative schemas with cognitive behavioral therapy (CBT) requires great effort of therapists and patients. Effect sizes of CBT on symptoms are modest in depressive disorders (Cuijpers *et al.* 2010) and schizophrenia (Jauhar *et al.* 2014). Focusing awareness on the present moment and relaxation by breathing exercises, imagery visualization and progressive muscle relaxation may be more directly targeted to breaking the vicious circle of stress reactivity and psychiatric symptoms.

Relaxation therapy is effective for reducing stress, anxiety and sleeping problems (Manzoni *et al.* 2008), has some effects on level of depressive symptoms (Jorm *et al.* 2008), and has hardly been investigated in patients with psychotic disorders (Vancampfort *et al.* 2013). Virtual Reality offers opportunities to improve relaxation interventions. VR exposure treatments have been developed for various psychological and psychiatric problems, including anxiety and psychosis (Oprış *et al.* 2012; Veling *et al.* 2014). For reducing stress, arousal and tension, exposure should be to a relaxing environment, such as a walk on a beach, scuba diving amidst wild, free dolphins. A combination of visual and auditory stimuli in VR can be used to create an immersive experience that is stronger than the individual's current mental state of distress and anxiety. Recently, a few preliminary VR stress management studies were published, suggesting that this is a promising approach for relaxation and stress recovery, with high potential for further development (Annerstedt *et al.* 2013; Gaggioli *et al.* 2014).

2. METHODS

2.1 Development of Intervention

In this pilot study, we will develop a 360° video VR relaxation program (VR Relax) for reducing impact of stress in patients with depressive, anxiety and psychotic disorders. Feasibility, user-friendliness and immediate effects on subjective and objective stress reactivity will be investigated.

A multidisciplinary team with researchers, clinicians, VR video experts and intended end-users will develop the intervention. Parts of the VRelax program will be developed in sprint cycles of three weeks:

- a. Development of first prototype in scrum – all team members
- b. Testing of first prototype – two clinicians and two end-users
- c. Development of second prototype in scrum – all team members
- d. Pilot study in order to investigate feasibility and proof of concept, as preparation for a larger randomized controlled trial (RCT).

2.2 Set-up

The VRelax program will use a Samsung Galaxy S6 smartphone that is connected to a head mounted display, the Samsung Gear VR (HMD, see Figure). When activated, a virtual coach explains the program and gives instructions for use. A VR company provides two 15-minutes 360° videos of relaxing environments (<http://viemr.com>): an underwater experience with wild, free dolphins (Antonioli & Reveley 2005) and a film in natural surroundings: beach, open fields and dunes (made at the Island of Ameland – NL).

2.3 Pilot study

Pilot study with 30 subjects. Sample size is based on recommendations for a clinical pilot as feasibility and proof of concept study (Hertzog 2008; Thabane *et al.* 2010). Participants will be randomly assigned (10 in each condition) to:

- a. virtual dolphin environment,
- b. virtual natural landscape environment
- c. control condition: 2D video clips of natural surroundings

2.4 Participants

Patients from the clinical departments of UMCG, Department of Psychiatry.

Inclusion criteria:

- Inpatient
- DSM-IV diagnosis of depressive disorder
- Anxiety disorder or psychotic disorder, age >18

Exclusion criteria:

- substance abuse or dependence
- benzodiazepine use > 10 mg / day diazepam equivalent
- Involuntary admission,
- Diagnosis of epilepsy or organic brain damage,
- Insufficient command of Dutch language

2.5 Design

After informed consent, patients are randomized to one of the three conditions. Research assistants will administer baseline measures, including psychiatric symptoms, and subjective and physiological stress measures. Patients will be instructed to use the VRelax tool or watch the video clips twice daily for 15 minutes, once in the morning and once in the evening. The first session will be done in the presence of a researcher and a nurse, for technical assistance and safety. After the first session, subjective and physiological stress measures are repeated, cyber sickness is assessed and user experiences recorded. From the second session onwards, patients will use the VRelax / video clips alone. At day 7, after the last session, a research assistant will repeat the baseline measures, and will conduct a qualitative interview on user experiences.

2.6 Measures

Psychopathology: baseline and after last session: Inventory of Depressive Symptomatology-Self-Rated (Rush *et al.* 2000), Beck Anxiety Inventory (Fydrich *et al.* 1992), Green Paranoid Thoughts Scale (Green *et al.* 2008).

Subjective stress: baseline and after last session: Perceived Stress Scale, a 10-item scale to measure the degree to which situations in the last week have been appraised as stressful (Cohen *et al.* 1983). Before and after each session: ecological momentary assessment single items, assessing perceived stress, anxiety, paranoia, positive and negative affect on a 1-7 ordinal scale (Myin-Germeys *et al.* 2009).

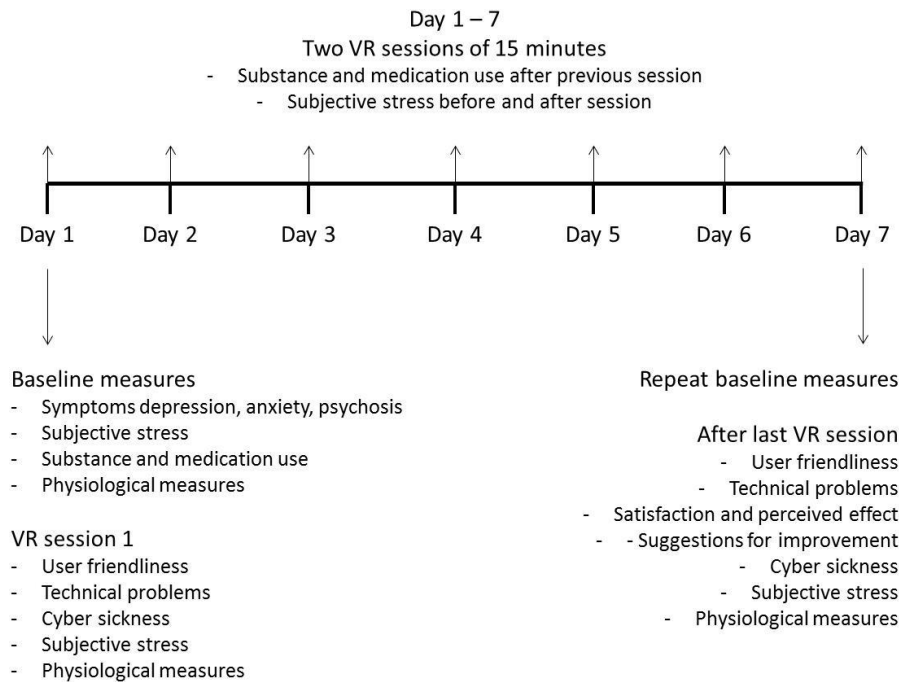
Physiological stress: Heart rate (HR) and skin conductance level (SCL) are recorded on the non-dominant hand in standing position for 5 minutes at baseline before session 1 but after introduction of the VRelax tool, and for 5 minutes after the first and after the last session. Skin conductance level (SCL) is measured using a sensor with two finger electrodes on the middle and ring finger of the same hand with a sampling rate of 10 Hz. Heart rate (HR) is assessed by non-invasive pulse wave measurement using a Nexus 4 with a photo-electric plethysmograph on the index finger.

Medication: use of psychotropic and somatic medication in last 24 hours or since last session, information from patient file.

Substance use: self-rated use of coffee, cigarettes, alcohol, illicit drugs in last 24 hours or since last session.

Cyber sickness: Simulator Sickness Questionnaire (Kennedy *et al.* 1993).

User experiences: qualitative interview.



2.7 Research questions

1. Is it feasible to develop a virtual reality relaxation (Vrelax) tool for patients with psychiatric disorders and to conduct an effect study in a clinical setting?
2. What is the user experience of the VRelax tool?
3. What is the effect of VRelax on subjective and physiological stress measures, compared to the control condition, after one session and after two-daily sessions during seven days?
4. Is there an association between change in stress level after seven days and change in level of psychiatric symptoms?
5. Does the type of virtual environment (with and without dolphins) make a difference in effect on stress measures?

3. STATISTICAL ANALYSES

Data will be analyzed using multilevel repeated-measures random intercept regression models with level of stress (subjective and physiological measures) as dependent variable and VR condition as main predictor. Covariates include medication use and cyber sickness.

4. CONCLUSIONS

This paper is about the first set-up for a pilot study on the effects of 360 degrees virtual reality films in reducing impact of stress in patients with psychiatric disorders. Feasibility, user-friendliness and immediate effects on subjective and objective stress reactivity will be investigated. Dolphin assisted therapy is a popular treatment for

children with autism, however without strong scientific evidence, and with dolphins in captivity. An alternative in virtual reality, with wild, free dolphins will be cost effective, dolphin friendly and accessible on demand for every patient.

5. REFERENCES

- Annerstedt M, Jönsson P, Wallergård M, Johansson G, Karlson B, Grahn P, Hansen AM, & Währborg P (2013). Inducing physiological stress recovery with sounds of nature in a virtual reality forest--results from a pilot study. *Physiology & behavior* 118, 240–50.
- Antonioli C, & Reveley M a (2005). Randomised controlled trial of animal facilitated therapy with dolphins in the treatment of depression. *BMJ (Clinical research ed.)* 331, 1231.
- Cohen S, Kamarck T, & Mermelstein R (1983). A global measure of perceived stress. *Journal of health and social behavior* 24, 385–396.
- Cuijpers P, van Straten A, Bohlmeijer E, Hollon SD, & Andersson G (2010). The effects of psychotherapy for adult depression are overestimated: a meta-analysis of study quality and effect size. *Psychological medicine* 40, 211–223.
- Fydreich T, Dowdall D, & Chambless DL (1992). Reliability and validity of the beck anxiety inventory. *Journal of Anxiety Disorders* 6, 55–61.
- Gaggioli A, Pallavicini F, Morganti L, Serino S, Scaratti C, Briguglio M, Crifaci G, Vetrano N, Giulintano A, Bernava G, Tartarisco G, Pioggia G, Raspelli S, Cipresso P, Vigna C, Grassi A, Baruffi M, Wiederhold B, & Riva G (2014). Experiential virtual scenarios with real-time monitoring (interreality) for the management of psychological stress: a block randomized controlled trial. *Journal of medical Internet research* 16, e167.
- Green CEL, Freeman D, Kuipers E, Bebbington P, Fowler D, Dunn G, & Garety P a (2008). Measuring ideas of persecution and social reference: the Green et al. Paranoid Thought Scales (GPTS). *Psychological medicine* 38, 101–11.
- Hertzog MA (2008). Considerations in determining sample size for pilot studies. *Research in Nursing and Health* 31, 180–191.
- Jauhar S, McKenna PJ, Radua J, Fung E, Salvador R, & Laws KR (2014). *Cognitive-behavioural therapy for the symptoms of schizophrenia: Systematic review and meta-analysis with examination of potential bias. British Journal of Psychiatry* 204, 20–29.
- Jorm AF, Morgan A, & Hetrick SE (2008). *Relaxation for depression. Cochrane Database of Systematic Reviews*
- Kennedy RS, Lane NE, Berbaum KS, & Lilienthal MG (1993). *Simulator Sickness Questionnaire: An Enhanced Method for Quantifying Simulator Sickness. The International Journal of Aviation Psychology* 3, 203–220.
- Manzoni GM, Pagnini F, Castelnuovo G, & Molinari E (2008). Relaxation training for anxiety: a ten-years systematic review with meta-analysis. *BMC psychiatry* 8, 41.
- Monroe SM, & Harkness KL (2005). Life stress, the ‘kindling’ hypothesis, and the recurrence of depression: considerations from a life stress perspective. *Psychological review* 112, 417–445.
- Myin-Germeys I, Oorschot M, Collip D, Lataster J, Delespaul P, & van Os J (2009). Experience sampling research in psychopathology: opening the black box of daily life. *Psychological medicine* 39, 1533–1547.
- Myin-Germeys I, & van Os J (2007). Stress-reactivity in psychosis: Evidence for an affective pathway to psychosis. *Clinical Psychology Review* 27, 409–424.
- Oprış D, Pintea S, García-Palacios A, Botella C, Szamosközi Ş, & David D (2012). Virtual reality exposure therapy in anxiety disorders: a quantitative meta-analysis. *Depression and anxiety* 29, 85–93.
- Phillips LJ, Francey SM, Edwards J, & McMurray N (2007). *Stress and psychosis: Towards the development of new models of investigation. Clinical Psychology Review* 27, 307–317.
- Rush AJ, Carmody T, & Reimitz PE (2000). The Inventory of Depressive Symptomatology (IDS): Clinician (IDS-C) and Self-Report (IDS-SR) ratings of depressive symptoms. *International Journal of Methods in Psychiatric Research* 9, 45–59.
- Selye H (1956). *The stress of life*. McGraw-Hill: New York.
- Thabane L, Ma J, Chu R, Cheng J, Ismaila A, Rios LP, Robson R, Thabane M, Giangregorio L, & Goldsmith CH (2010). A tutorial on pilot studies: the what, why and how. *BMC Med Res Methodol* 10, 1.
- Vancampfort D, Correll CU, Scheewe TW, Probst M, De Herdt A, Knapen J, & De Hert M (2013). Progressive muscle relaxation in persons with schizophrenia: a systematic review of randomized controlled trials. *Clinical rehabilitation* 27, 291–8.
- Veling W, Moritz S, & Van Der Gaag M (2014). Brave new worlds - review and update on virtual reality assessment and treatment in psychosis. *Schizophrenia Bulletin* 40, 1194–1197.