Motion Sickness Conditioning to Reduce Cybersickness

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ABSTRACT

We present a remote longitudinal experiment to assess the effectiveness of a common motion sickness conditioning technique (MSCT), the Puma method, on cybersickness in VR. Our goal was to evaluate benefits of conditioning techniques as an alternative to visual cybersickness reduction methods (e.g., viewpoint restriction) or habituation approaches which "train" the user to become acclimatized to cybersickness. We compared three techniques - habituation, the Puma method conditioning exercise, and a placebo (Tai Chi) - in a cybersickness-inducing navigation task over 10 sessions. Preliminary results indicate promising effects.

CCS CONCEPTS

• **Human-centered computing** → *User studies*; **Mixed / augmented reality**; **Virtual reality**; *Empirical studies in HCI*.

KEYWORDS

Cybersickness, cybersickness reduction techniques, habituation, motion sickness, conditioning, longitudinal study, virtual reality

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1 INTRODUCTION

Cybersickness commonly occurs in viewing immersive VR with a head-mounted display (HMD) while stationary, and navigating the virtual environment using a method that does not generate physical motion cues (e.g., joystick-based steering) [2]. Various techniques to reduce cybersickness have been developed. Common approaches like viewpoint snapping [2], and field of view (FOV) restriction [3, 10] tend to change the nature of the experience and could limit the creative choices of the system designer. Such techniques alter the users' view of the scene, which could affect user presence and performance, ultimately degrading the quality of VR experiences.

Habituation, repetitive exposure to a stimulus, is an alternative that has shown to work on reducing cybersickness [4]. Similarly, conditioning exercises have also been shown to be effective for reducing motion sickness [5]. Motion sickness and cybersickness have similar symptoms and causes; thus, techniques that treat motion sickness may also work on cybersickness [9]. We study MSCTs and their potential in reducing cybersickness.

2 EXPERIMENT

We conducted a longitudinal study evaluating the use of a MSCT - the Puma method [7] - compared to habituation and a placebo. The workout conditions users through gradual exposure to motion sickness-inducing activities. This workout uses two conditioning exercises, the "spiral" and the "figure eight". There is little empirical evidence supporting claims of its effectiveness in treating cybersickness [6]. Experts have anecdotally suggested its effectiveness in treating motion sickness due to desensitization, despite the unavailability of multicentre trials of this method [5]. We thus employ the Puma method in an experiment to assess its effectiveness in conditioning participants to experience less cybersickness.

We recruited 12 participants aged 28 to 40 years old (mean age 34, 6 male and 6 female). Participants were divided into three groups:

- *Group 1: Habituation* (n=4, 2 male, 2 female): a control group, who experienced VR without any intervention as a baseline
- *Group 2: Placebo* (n=4, 2 male, 2 female): experienced a placebo workout (Tai Chi) and the VR experience. Tai Chi was chosen due to its reputation as a meditative treatment, while the only proven effect of Tai Chi is reducing tension headaches through long repetitive exposures for 15 weeks (30+ sessions) [1]. To eliminate any actual effects, the chosen exercises were basic and introductory to Tai Chi rather than actual training.
- *Group 3: Puma* (n=4, 2 male, 2 female): Used the Puma conditioning method, and the VR experience

Two groups conducted two short (~15 min) sessions per day for 10 days. Each session included a treatment (i.e., conditioning exercise or a placebo) and a VR session. The third (habituation, i.e., control) group completed one VR session per day, with no other treatment. We hypothesized that by the end of the study, participants exposed to MSCT would experience lower simulator sickness questionnaire (SSQ) scores [8] and lower nausea scores than those exposed to habituation or the placebo.

Due to the ongoing COVID-19 pandemic, we conducted the study remotely using the participant's mobile phone and a Google cardboard sent by mail. The study employed a between-subjects longitudinal single-blind placebo-controlled design. There were two independent variables:

- *Conditioning Technique*: Habituation, Placebo, Puma
- *Session*: 1, 2, ... 10

Conditioning technique was assigned between-subjects, while session was assigned within-subjects. The dependent variables included total SSQ scores (Cybersickness level), and nausea scores.

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