Immersive Virtual Environments for the Management of Chronic vs. Acute Pain

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Abstract. Immersive virtual reality (VR) been shown to be an effective treatment for acute forms of pain. Can VR also be used for the management of chronic pain? We are developing novel VR environments for that purpose. As part of that design process, we are also exploring the environmental characteristics that will amplify the effectiveness of VR for chronic pain.

Introduction. An estimated 15-29% of the population currently suffer from chronic pain (see Boulanger et al., 2007); decreases in mobility and social interaction are common sequelae (see Statistics Canada, 2008). We have formed a multidisciplinary research group composed of medical practitioners, neuroscientists, psychologists, computer scientists, and artists. Together, we are involved in several large projects that collectively seek to help individuals living with chronic pain deal with the various aspects of their illness.

Hoffman et al. (2007) have convincingly shown that VR is effective for the treatment of acute pain. In fact, the magnitude of VR-induced analgesia has been shown to be comparable to that of opioids (Hoffman et al., 2007); yet, without the development of tolerance to its analgesic effects (Hoffman et al., 2001).

Given the demonstrated ability of VR to serve as a powerful treatment for acute pain, can similar therapeutic benefits be derived from VR for individuals with chronic pain? And, if so, what would the requirements be for such a VR-based therapy to work? Although VR does work for the treatment of acute pain, there is no guarantee that it would also do so for its pathological counterpart, chronic pain. Accordingly, our focus is on developing VR-based treatments that build on what we know can be effective for the management of chronic pain. One of our current focuses is on VR-based meditative practices, since these interventions have been shown effective for improving major aspects of functioning in sufferers of chronic pain (e.g., see Morone, Greco, & Weiner, 2008).

Methods & Materials. We are currently constructing a VR environment that engages the immersant in a walking meditation: A *Virtual Meditative Walk*. A walking form of meditation was chosen since we wanted to directly address the decreases in mobility that are known to accompany chronic pain while simultaneously using our VR environment to augment learning and encourage adoption of a mindfulness meditative practice.

Participants with chronic pain will be recruited from a complex pain clinic in Vancouver, Canada; testing will occur on site. Participants will be assigned to one of four conditions, each lasting 20-min: VR-Meditative Walk (VR-MW), VR-Only (VR-O), Meditative Walk-Only (MW-O), and Sitting-Only (S-O).

VR-MW participants will be placed on a treadmill with a head-mounted display (HMD). The immersant will enter a VR forest, where they can look around via standard head tracking and move along a path through the forest by ambulating on the treadmill. They will have an audio guide to explain the technique of walking meditation. VR-O participants will be treated the same as those in group VR-MW, except that they will be seated on a chair, be passively moved through the VR forest, and their audio guide will be for a non-walking meditation.

W-O participants will be placed on the treadmill, but will not wear the HMD. They will be allowed to walk on the treadmill with the same walking-meditation audio guide as group VR-MW. S-O participants will sit in the same chair, and have the same audio guide, as group VR-O.

At the end of the 20-min test period, pain modulation in all participants from each of the four groups will be assessed via several pain measures, including Diffuse Noxious Inhibitory Control (DNIC).

Results. Our current hypothesis is that the VR-MW and VR-O groups will demonstrate comparable benefits in the short term. However, we believe that, with repetition, long-term benefits of the VR-MW condition will emerge, over and above the stationary VR-O condition. That is, each successful meditative walk should challenge the patients perception of their mobility impairment and might serve as a desensitizing exposure to what would otherwise be aversive ambulation.

Discussion. Although immersive VR is a provocative potential form of pain relief, the mechanism of its efficacy remains unknown. However, the fact that the analgesic effects of opioids and VR are additive (Hoffman et al., 2007) suggests that VR-induced analgesia is independent of the endogenous opioid system. For the past 15 years, research on VR for pain has focused exclusively on acute pain. Our groups focus on VR for the management of chronic pain is novel and requires a fundamentally different approach--an approach that is focused on the unique etiology and phenomenology of chronic pain.

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