

# Chronic Pain and the Modulation of Self in Immersive Virtual Reality

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## Abstract

In contrast to “pain distraction” research in immersive virtual reality (VR), we discuss work that enables users to gain a sense of agency over their experience of chronic pain.

## Meditating in Virtual Environments

Many specialists who treat those who suffer from chronic pain have long observed the ways in which mind and body become altered (Gatchen, Peng, Peters, Fuchs & Turk, 2007). Indeed, in pain medicine, the distinction between the two become unsustainable. A patient’s sense of self is affected on many levels, including changes in body image and body schema (Gallagher, 1995).

In the technological development of immersive virtual reality (VR), the simultaneous experience of a “virtual” environment and the “real” environment often lead to new or confounded perceptual experiences. In our studies of the way in which the sense of proprioception is disrupted, for instance, it is clear that a user’s body schema (and sometimes body image) can also be altered. Depending on the length of exposure, this can effect subtle changes in a user’s sense of self (Gromala, 1996). This paper explores some of the ways we understand this occurs by demonstrating the results of our work in pain and VR over the past decade. Unlike most research in pain and VR, ours does not simply seek to “distract” users from pain, but to arm them with a learned capacity to modulate it.

One example is the *Meditation Chamber*, a VR system combined with biofeedback. Developed for those who suffer from chronic pain, it enables users to learn how to meditate and thereby to bring into conscious awareness certain aspects of their autonomic system and interoceptive senses (Shaw, Gromala & Seay, 2007). In doing so, they learn to exert some form of control or agency in their experience of unrelenting pain. Meditation, of course, does not require technology. However, VR offers several advantages or affordances. First, novice meditators learn to change visuals, sound and kinesthetic experiences as their

physiological states continuously change in real-time. Though it is impossible to scientifically measure meditative states per se, a number of physiological measures, combined with first-person accounts, appear to be and have been accepted as reliable indicators. Second, in VR, confounded perceptual experiences result from, for example, “flying” in VR while simultaneously feeling the pull of gravity. Studies in proprioception articulate how this occurs. Most users quickly become accustomed or habituated to the confluence of disparate stimuli. Surprisingly, we have shown this disorientation and accommodation may alter a user’s body schema in the short term, and in some cases, longer terms. In the context of addressing chronic pain, we have also demonstrated that the initial disorientation enhances a novice meditator’s ability to self-modulate their experience of pain.

Quantitative and qualitative testing of over 400 users demonstrate the usefulness of this approach in training those who suffer from chronic pain to learn to modulate their experience of pain. The current extension of this project compares culturally distinct practices of meditation in order to understand if they can affect body schemas and body images of chronic pain sufferers in different ways.

## References

- Gallagher, S. (1995). Body Schema and Intentionality. In Bermúdez, J.L., Marcel, A.J. and Eilan, N. (Eds.), *The Body and the Self* (pp. 225-244). MIT Press: Cambridge, MA.
- Gatchel, R. J., Peng, Y. B., Peters, M. L., Fuchs, P. N. and Turk D. C. (2007). The Biopsychosocial Approach to Chronic Pain: Scientific Advances and Future Directions. *Psychological Bulletin*, 133(4), 581-624. Washington: American Psychological Association.
- Gromala, Diane. (2000). Pain and subjectivity in virtual reality. In Bell, D. (Ed.), *The Cybercultures Reader* (pp. 598-608). Routledge: London.
- Shaw, C.S., Gromala, D. and Seay, A.F. (2007). The Meditation Chamber: Enacting Autonomic Senses. In *Proceedings of ENACTIVE/07, 4th International Conference on Enactive Interfaces*, 405-408, Grenoble, France, 19-22 Nov.