

# Relevance of the origin of chronic pain when using virtual reality in rehabilitation.

<sup>1,2</sup> Marta Matamala-Gomez, <sup>2,3</sup> Mel Slater, <sup>4</sup> Ana M. Diaz-Gonzalez, <sup>1,2,3</sup> Maria V. Sanchez-Vives

<sup>1</sup> IDIBAPS, Barcelona, Spain. <sup>2</sup> Event Lab, University of Barcelona, Spain. <sup>3</sup> ICREA, Barcelona, Spain. <sup>4</sup> Hospital Clínic of Barcelona.

## Introduction

Immersive Virtual Reality technology has been suggested as an effective tool for pain relief interventions using multisensory feedback with healthy subjects and also with chronic pain patients.

In this study, we investigated the effects of visual feedback, through IVR, by manipulating the morphological characteristics of the virtual arm with two different virtual tests on pain sensations in neuropathic chronic pain patients.

## Methods

We carried out a study with 19 patients grouped in those with **Peripheral Nerve Injury** (10 patients with PNI) as a control group, and those without nerve injury as an experimental group (9 patients with **Complex Region Pain Syndrome type I**). We used different visual feedback conditions grouped in two different virtual pain tests: the transparency test and the size test, by manipulating the morphological characteristics of the virtual arm, while patients were embodied in a virtual body.

After each virtual test exposure patients had to fill in a VR questionnaire.

## Results

- CRPS type I patients reported higher levels of ownership and agency over the virtual arm compared to the patients in the PNI in both VR questionnaires (**Figure 1**).
- No significant differences were found between conditions in the transparency test. However by increasing the transparency of the virtual arm (75% of transparency) CRPS type I patients often reported lower pain ratings (**Figure 2A**).
- The presentation of a normal size of the virtual arm significantly reduce pain ratings in CRPS type I compared with a very large arm size condition (**Figure 2B**).

## References:

- Martini M, Kilteni K, Maselli A, Sanchez-Vives M V. The body fades away: investigating the effects of transparency of an embodied virtual body on pain threshold and body ownership. *Sci Rep*. 2015;5:13948.
- Moseley GL, Parsons TJ, Spence C. Visual distortion of a limb modulates the pain and swelling evoked by movement. *Curr Biol*. 2008;18(22).
- Nierula B, Martini M, Matamala-Gomez M, Slater M. Seeing an embodied virtual hand is analgesic contingent on co-location. *J*. 2017. <http://www.sciencedirect.com/science/article/pii/S1526590017300172>. Accessed February 1, 2017.

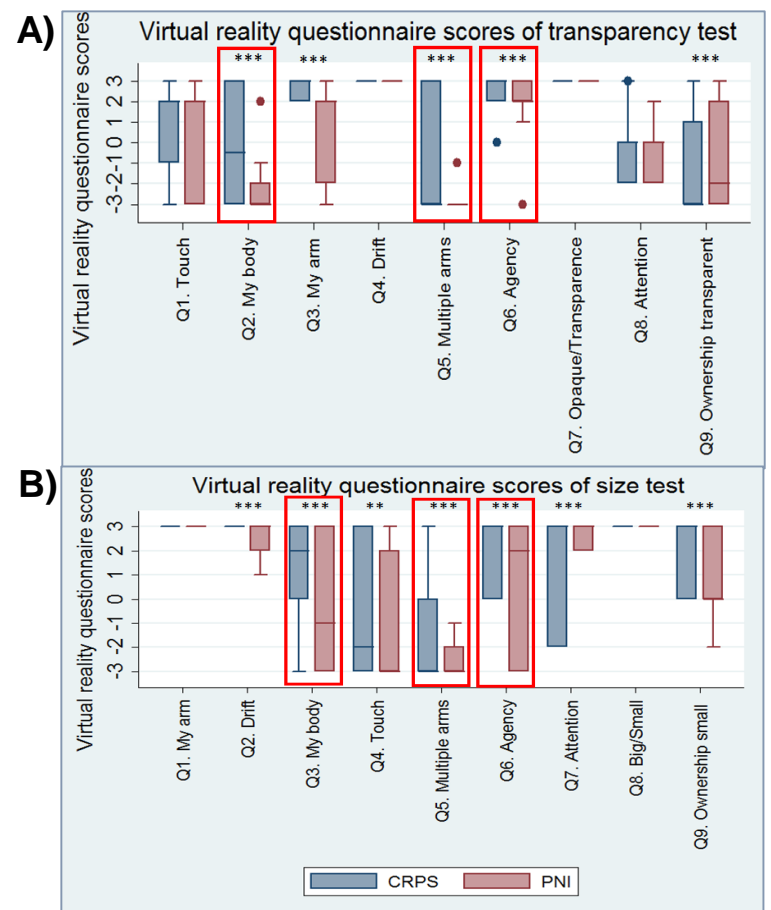


Figure 1. VR questionnaire responses A) VR questionnaire Transparency test B) VR questionnaire Size test

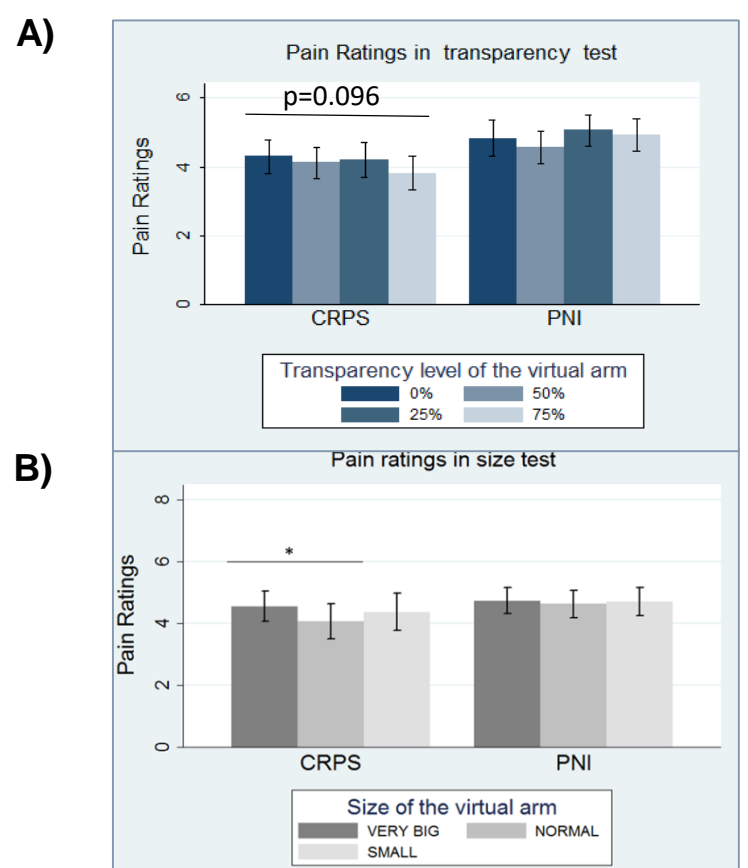


Figure 2. Differences between conditions in A) Transparency test B) Size test

## Conclusions

- CRPS type I patients experienced **higher levels of ownership and agency** towards the virtual body.
- Providing a **normal-size view** of the virtual arm through IVR, **we can reduce pain ratings** in patients with **CRPS type I**.