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VIRTUAL BODIES, REAL EMPATHY: BEHAVIOURAL, BODILY, AND NEURAL REACTIVITY TO THE OBSERVATION OF PAIN AND PLEASURE ON SELF AND OTHERS IN IMMERSIVE VIRTUAL REALITY

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Background: Empathy is the social ability that allows one to share the emotions and feelings of other individuals. It consists in a variety of components ranging from the self-centred reactivity that maps on the self what we see in others to the other-oriented stance that allows us to understand others through cognition or emotion. However, a clear comprehension of the behavioural, physiological and the neural mechanisms underlying the observation of others' pain and pleasure is incomplete. Moreover, information about role played by the physical and cognitive perspective in affecting these mechanisms is largely unavailable.

Aims: We capitalize on the power of Virtual Reality (VR) to create a specific empathogenic scenario in order to investigate behavioural (VAS ratings), physiological (SCR, Study 1), sensorimotor (MEP, Study 2) and neural (EEG, Study 3) reactivity elicited by observation of pain and pleasure on self and others.

Method: In three different studies, participants were immersed in a virtual reality scenario and observed a virtual: needle penetrating (pain), caress (pleasure), or ball touching (neutral) the hand of an avatar seen from a first (1PP)- or a third (3PP)-person perspective.

Results: In all the studies we found: i) the observation of a virtual body in 1PP always induced a strong illusory sensation that the virtual body belongs to the observe; ii) the observation of virtual stimuli representing Pain and Pleasure induced unpleasant and pleasant sensations, respectively, that parallel with stronger sensation's intensity respect to neutral stimuli; iii) the observation of Pain resulted in increased physiological reactivity and wider amplitude of motor evoked potentials compared to observation of Neutral stimuli. This effect was found in both 1PP and 3PP conditions suggesting that similar neural networks are recruited; iv) the observation of Pain and Pleasure affected the early stage of the cortical processing resulting in a greater negative amplitude of the visual evoked potentials.

Conclusions: Overall, our paradigm opens novel ways to investigate the vicarious experience of virtual stimuli and shed new light on the body and brain reactivity to empathic mapping of pain and pleasure.

Keywords: Virtual Reality, Empathy for pain and pleasure, Transcranial magnetic stimulation (TMS), Electroencephalography (EEG), Illusory body ownership

Publications:

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