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# Investigating the Sensory Experience of Virtual and Real Touch During Painful Stimulation

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## Abstract

Research suggests that pleasant touch can influence pain perception by down-regulating the insula and the anterior cingulate cortex, areas responsible for the subjective experience of pain. These brain regions are also activated during the perception of pleasant touches and, interestingly, also when observing vicarious touches on others. In previous studies, we demonstrated that vicarious touch can be observed in immersive virtual reality, also from a first-person perspective (1PP), leading to heightened sensations of pleasantness compared to a third-person perspective. Here, we aimed at comparing the sensations elicited by slow and fast touches perceived in the real world with touches in virtual reality on an embodied avatar in 1PP. Participants received laser stimulation to induce a painful transient sensation while perceiving and observing touches. They were asked to rate the unpleasantness and intensity of pain, as well as the pleasantness of the touches. We found that while touches in the real world were perceived as more pleasant, the pattern of results was consistent between the two conditions: slow touch was perceived as more pleasant than fast touch. Moreover, slow touch reduced the perception of unpleasantness and intensity of the induced pain, particularly in the real-world condition. Our findings suggest that there are similarities between real and virtual touches, and future studies incorporating EEG may help to understand the processes underlying pain modulation. Understanding these mechanisms can contribute to the development of interventions for pain management and enhance our knowledge of the integration between physical and virtual sensory experiences.

**Keywords:** Pleasant Touch, Immersive Virtual Reality, Pain modulation

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