International Conference on Artificial Reality and Telexistence
Eurographics Symposium on Virtual Environments (2024)
S. Hasegawa, N. Sakata and V. Sundstedt (Editors)

Vibratory-interoceptive stimuli to enhance empathy

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Abstract

Vibration stimuli applied to the upper body, designed to stimulate interoception, can intensify emotional responses when watching videos or music. This study explores whether such stimuli can also enhance empathy. In the experiment, vibratory stimuli were delivered to individual participants while an experimenter exhibited emotional reactions. Nine participants observed a game scene, with vibratory stimulation triggered by the actor's emotional reactions in one condition and absent in another. Results showed that vibration increased empathy and excitement levels.

CCS Concepts
• ***Human-centered computing*** → ***Haptic devices;***

1. Introduction

Mechanical vibration stimuli to the upper body can intensify emotions evoked by emotional content such as videos, likely due to the stimulation of interoception, which is closely related to emotions [MO24]. This study explores this phenomenon to enhance empathy between individuals. Building on Schachter and Singer's work [SS62], where participants with hyperactivated sympathetic nervous systems showed increased empathy, we employ non-invasive, controllable vibratory stimuli to activate physiological responses. In our setup, both the actor and the participant view the same gameplay display, allowing participants to better understand and share the actor's emotional experience. The vibratory stimuli are then delivered to the participant's thoracoabdominal part. No systems have yet enhanced empathy through mechanical stimuli targeting interoception. This study could extend techniques for emotional manipulation in interactive media.

2. Method

2.1. Apparatus

An electrodermal measurement unit and amplifier were used to measure the change in skin conductance response (SCR). For this purpose, electrodes were attached to the distal phalanges of the index and fourth fingers of the participant's non-writing hand. The SCR signals reflect human's physiological arousal, and they typically respond to an emotional stimulus within 1–3 s. The vibratory stimuli to the upper body was provided by a voice coil motor. The motor was affixed to a vest, and firmly placed to the epigastric fossa. The skin conductance unit and voice coil motor were controlled by a data acquisition device and Matlab (R2023a, Mathworks, USA).

The experimenter played Minecraft (Microsoft Corp., USA). A game stage was specifically designed for the experiment. The player combated enemies and explored keys to move on to next stages. The locations of the enemies and keys were randomized so that the events happening in the game would not be fully predicted.

2.2. Procedure and participants

Fig. 1 shows a scheme of the experimental scene. First, participants wore the vest to present vibration stimuli and electrodes to measure SCR. The participant then watched a screen where the gameplay scenes were presented. It should be noted that the game was played by an experimenter.

During the gameplay, the experimenter reacted to in-game events in a way that allowed participants to infer the experimenter's emotions. Typical reactions included verbal expressions such as 'Oh no!' to convey tension or upset when attacked by an enemy. When finding a key to the next floor in a treasure chest, the experimenter said words of joy, such as "I did it!" The experimenter did not bring out words that would directly indicate his emotions, such as "I am very upset," or "This is exciting!"

Vibration stimuli were presented to participants when the experimenter stepped on the foot switch. This vibratory stimulation was conducted in conjunction with the aforementioned reactive words. The duration of the game was adjusted to range 120–150 s, during which the vibration stimuli were presented 25 times on average.

After the game ends, participants evaluated their overall emotional experience during watching the game play. Using a questionnaire, they rated seven different emotions (*dominance*, *upset*, *angry*, *frustrated*, *joyful*, *tense*, *excited*) on a scale of 1 to 9, where