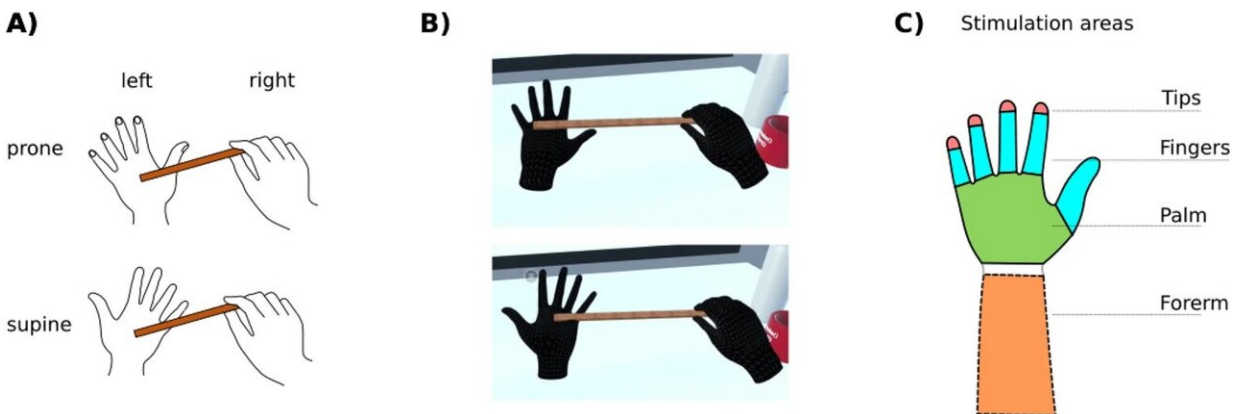


Using virtual reality to research phantom sensations

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(A) Schematic depiction of stimulation with the virtual stick in prone and supine positions. (B) A screenshot of the VR stimulation scene in prone and supine positions. (C) Stimulation sites: fingertips, fingers (phalanges), palm and forearm. The forearms were invisible to subjects (B). Credit: *Scientific Reports* (2023). DOI: 10.1038/s41598-023-42683-0

Virtual reality (VR) is not only a technology for games and entertainment, but also has potential in science and medicine. Researchers at Ruhr University Bochum, Germany, have now gained new insights into human perception with the help of VR. They used virtual reality scenarios in which subjects touched their own bodies with a virtual object.

To the researchers' surprise, this led to a tingling sensation at the spot where the avatarized body was touched. This effect occurred even though there was no real physical contact between the [virtual object](#) and the body. The scientists led by Dr. Artur Pilacinski and Professor Christian Klaes from the Department of Neurotechnology describe this phenomenon as a phantom touch [illusion](#). They [published](#) their results in the journal *Scientific Reports*.

"People in virtual reality sometimes have the feeling that they are touching things, although they are actually only encountering virtual objects," says first author Artur Pilacinski from the Knappschaftskrankenhaus Bochum Langendreer, University Clinic of Ruhr University Bochum, explaining the origin of the research question. "We show that the phantom touch illusion is described by most subjects as a tingling or prickling, electrifying sensation or as if the wind was passing through their hand."

Body sensation arises from complex combination of different sensory perceptions

The [neuroscientists](#) wanted to understand what is behind this phenomenon and find out which processes in the brain and body play a role in it. They observed that the phantom touch illusion also occurred when the subjects touched parts of their bodies that were not visible in virtual reality.

Second author Marita Metzler adds, "This suggests that [human perception](#) and body sensation are not only based on vision, but on a complex combination of many sensory perceptions and the internal representation of our body."

This study involved 36 volunteers wearing VR glasses. First, they got

used to the VR environment by moving around and touching virtual objects. Then they were given the task of touching their hand in the virtual environment with a virtual stick.

Comparison between virtual and suggested touch sensations

Participants were asked if they felt anything. If not, they were allowed to continue touching and the question was asked again later. If they felt sensations, they were asked to describe them and rate their intensity on different hand locations. This process was repeated for both hands. There was a consistent reporting of the [sensation](#) as "tingling" by a majority of participants.

In a control experiment, it was investigated whether similar sensations could also be perceived without visual contact with virtual objects purely due to experimental situation demands. Here, a small laser pointer was used instead of virtual objects to touch the hand. This control experiment did not result in phantom touch suggesting that phantom touch illusion was unique to virtual touch.

The discovery of the phantom touch illusion opens up new possibilities for further research into human [perception](#) and could also be applied in the fields of [virtual reality](#) and medicine. Christian Klaes, member of the Research Department of Neuroscience at Ruhr University, says, "It could even help to deepen the understanding of neurological diseases and disorders that affect the perception of one's own body."

Further collaboration

The Bochum team plans to continue their research on the phantom touch illusion and the underlying processes. For this reason, a collaboration

with the University of Sussex has been started.

"It is important to first distinguish between the actual sensations of phantom touch and other [cognitive processes](#) that may be involved in reporting such embodied sensations, such as suggestion, or experimental situation demands," says Artur Pilacinski. "We also want to further explore and understand the neural basis of the phantom [touch](#) illusion in collaboration with other partners."

The research of Artur Pilacinski and Christian Klaes took place within the Research Department of Neuroscience (RDN). The RDN further develops and consolidates a long-established, outstanding research strength of Ruhr University Bochum in the field of systems neuroscience research.

More information: Artur Pilacinski et al, Phantom touch illusion, an unexpected phenomenological effect of tactile gating in the absence of tactile stimulation, *Scientific Reports* (2023). [DOI: 10.1038/s41598-023-42683-0](#)

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