Simulating cold sensation without actual cooling

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Credit: AI-generated image (disclaimer)

Our skin plays a key role in perceiving temperature and the surroundings. For instance, we perceive the chill of the outdoors when our cheeks blush with cold, and we sense the onset of spring when our skin warms up gradually.

However, getting exposed to the same stimuli repeatedly, makes us accustomed to the stimuli, making it challenging to sense new sensations. This process, known as "temperature acclimatization," can interfere with our ability to gauge temperature changes in a virtual reality (VR) environment while switching scenes.

In a new study, researchers have developed a non-contact technology for simulating a cold sensation that continually generates thermal experiences while maintaining nearly constant skin temperature. This innovative approach leverages human body's natural sensitivity to rapid temperature changes. The research is published in the journal *IEEE Transactions on Haptics*.

The technology employs a combination of cold air flow and a light source to instantly switch between a quick cold and a gentle warm stimulus, inducing a cold sensation while maintaining the skin temperature fluctuations close to zero. Evaluation results have demonstrated that this system can provide a virtual cold sensation without any actual change in temperature. Moreover, the researchers have succeeded in replicating a cold sensation of the same intensity as one would experience with continuous skin temperature changes.

This technology offers a novel perspective on simulating skin sensations without altering the body's physical state. It has the potential to enable immersive experiences in the world of VR, including the Metaverse, by offering not only instantaneous thermal sensations like a sudden cold breeze but also persistent thermal experiences over extended periods, akin to those encountered during international travel.

More information: Jiayi Xu et al, Integration of Independent Heat Transfer Mechanisms for Non-Contact Cold Sensation Presentation With Low Residual Heat, *IEEE Transactions on Haptics* (2023). DOI: 10.1109/TOH.2023.3324754

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