

Which Mid-Air Haptic Feedback Technique Should We Use for Contact Rendering in Virtual Reality?

Context



Source: Ultraleap

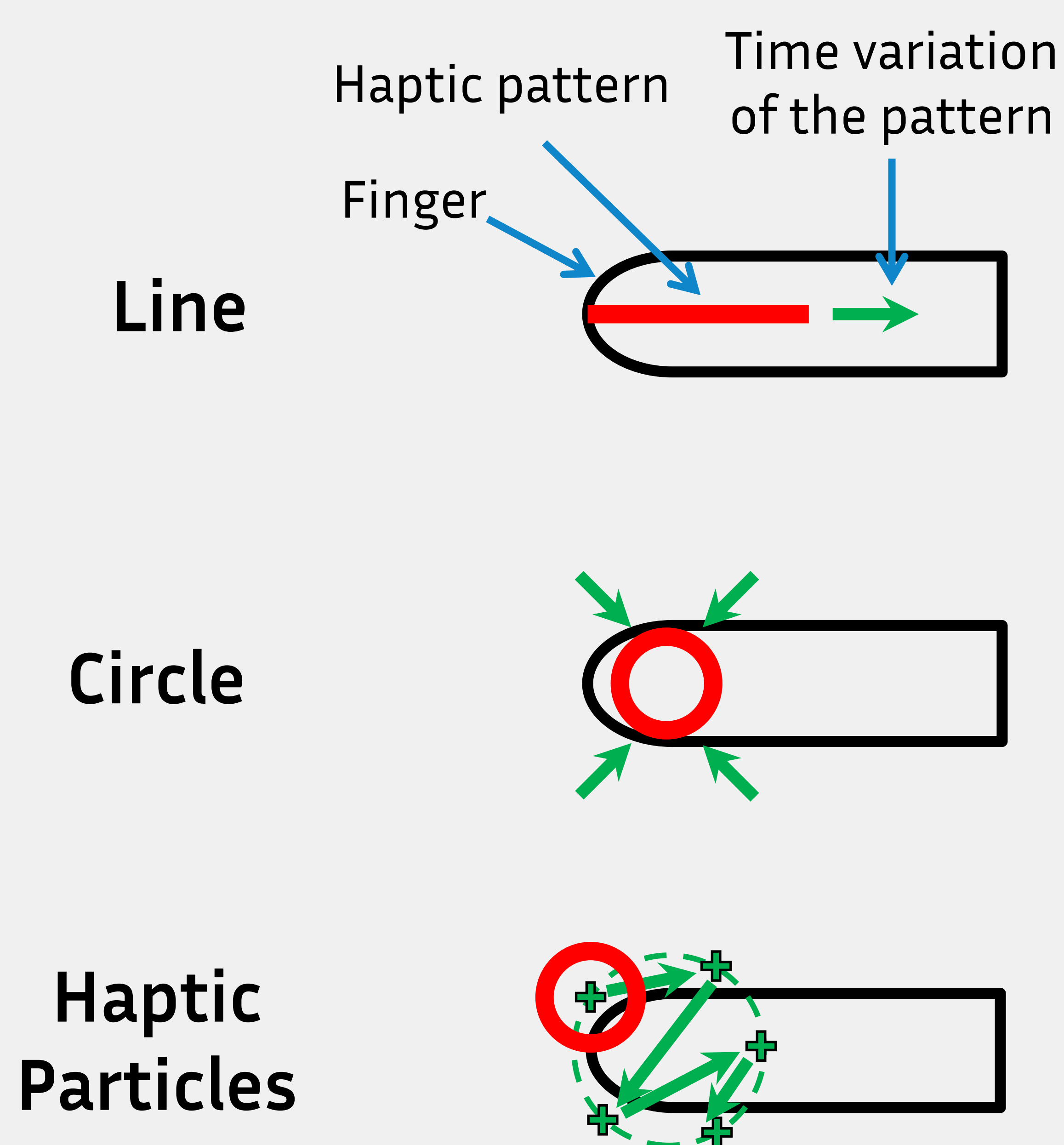
Ultrasound mid-air haptic technologies can generate vibrotactile stimuli remotely, in mid-air, through constructive interferences of ultrasound waves. Yet, the low intensity stimuli provide no resistance to the hand motion.

By default, in **virtual reality**, virtual hands follow real hands, meaning they can go through objects.

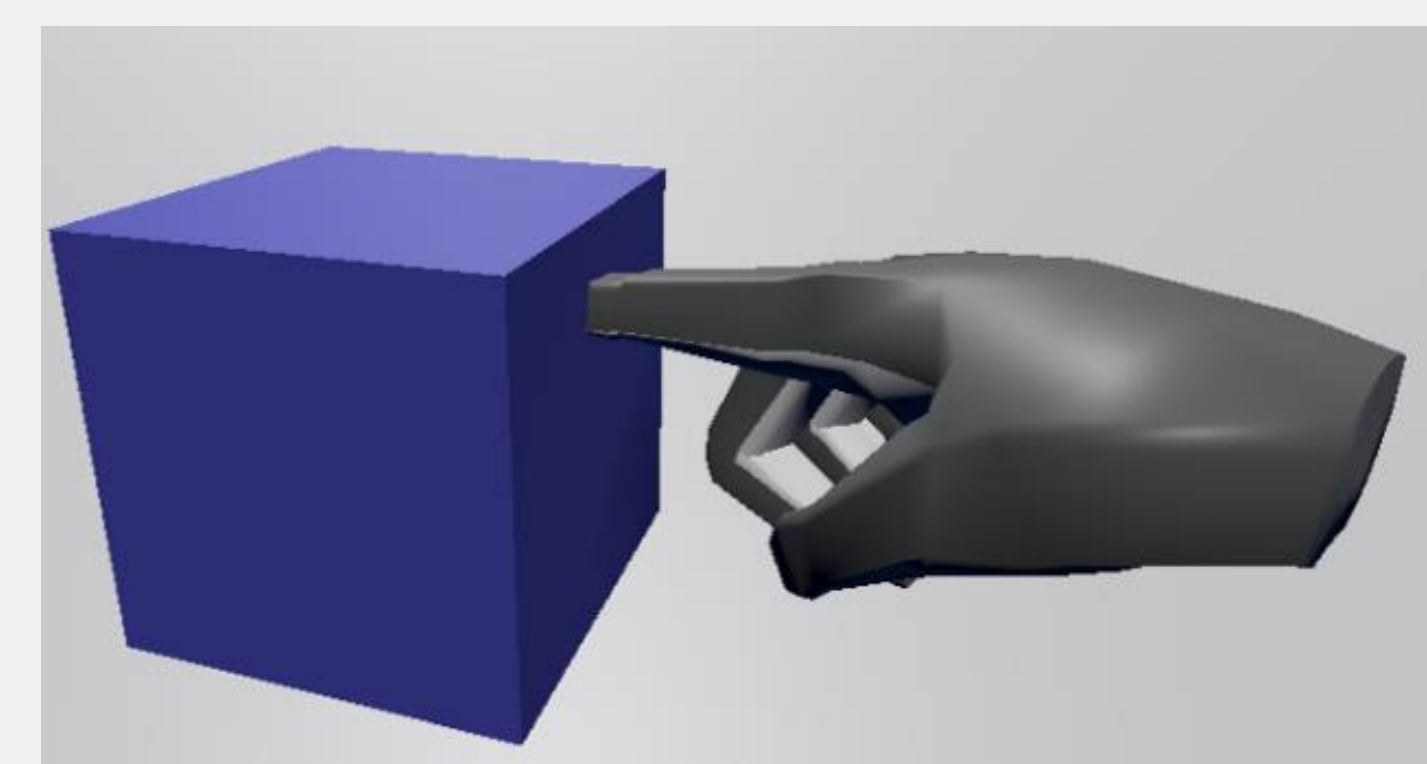
So we aim to use **visual and haptic cues to reduce interpenetration**.

Haptic Feedback

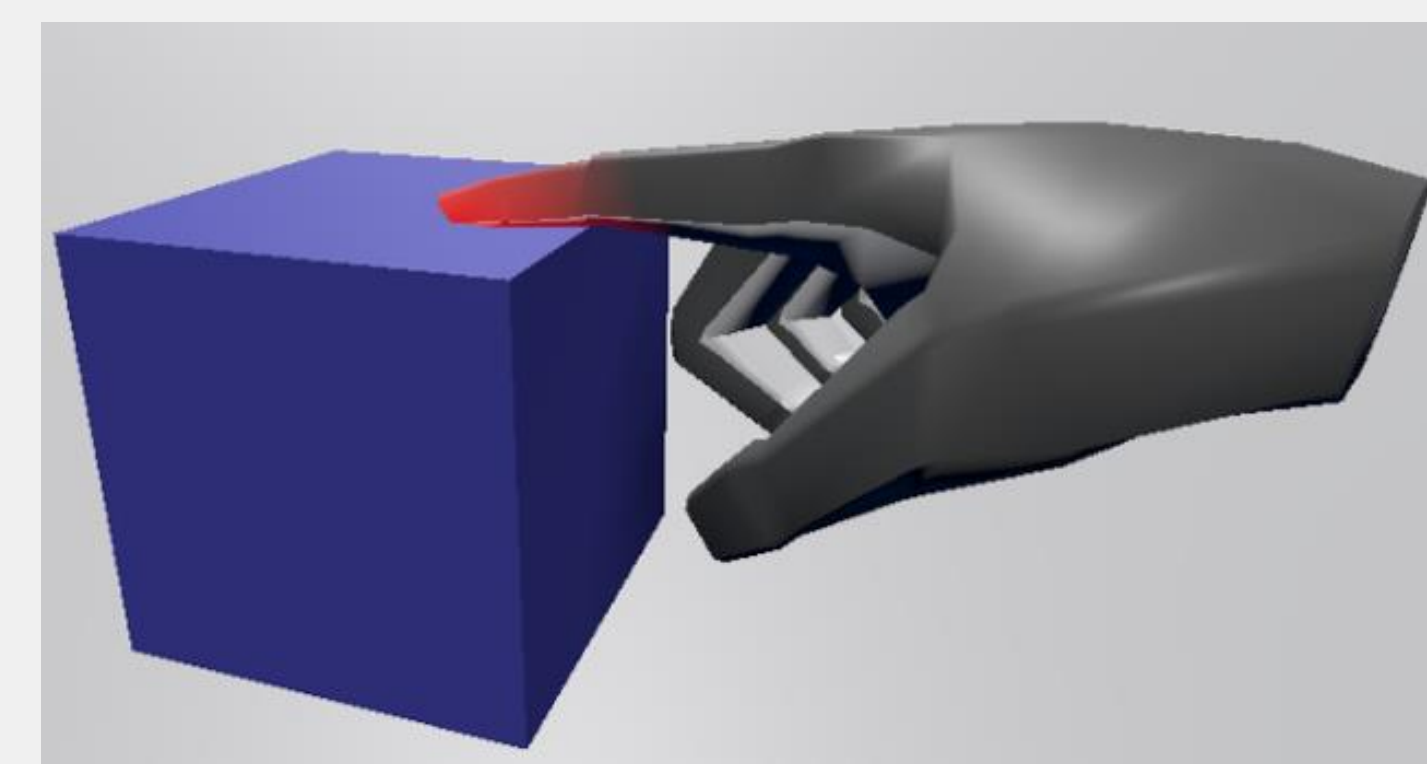
Haptic "animations" play faster as interpenetration increases.



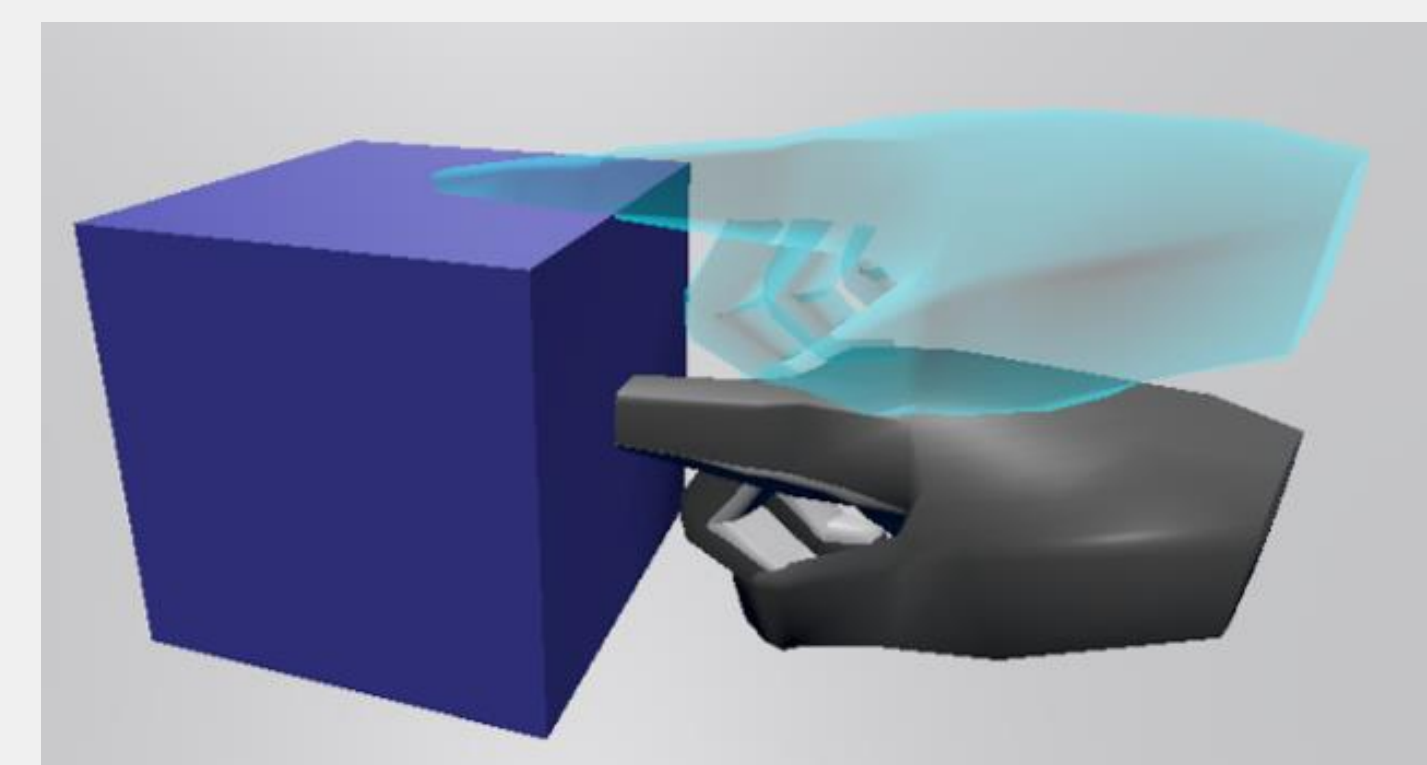
Visual Feedback



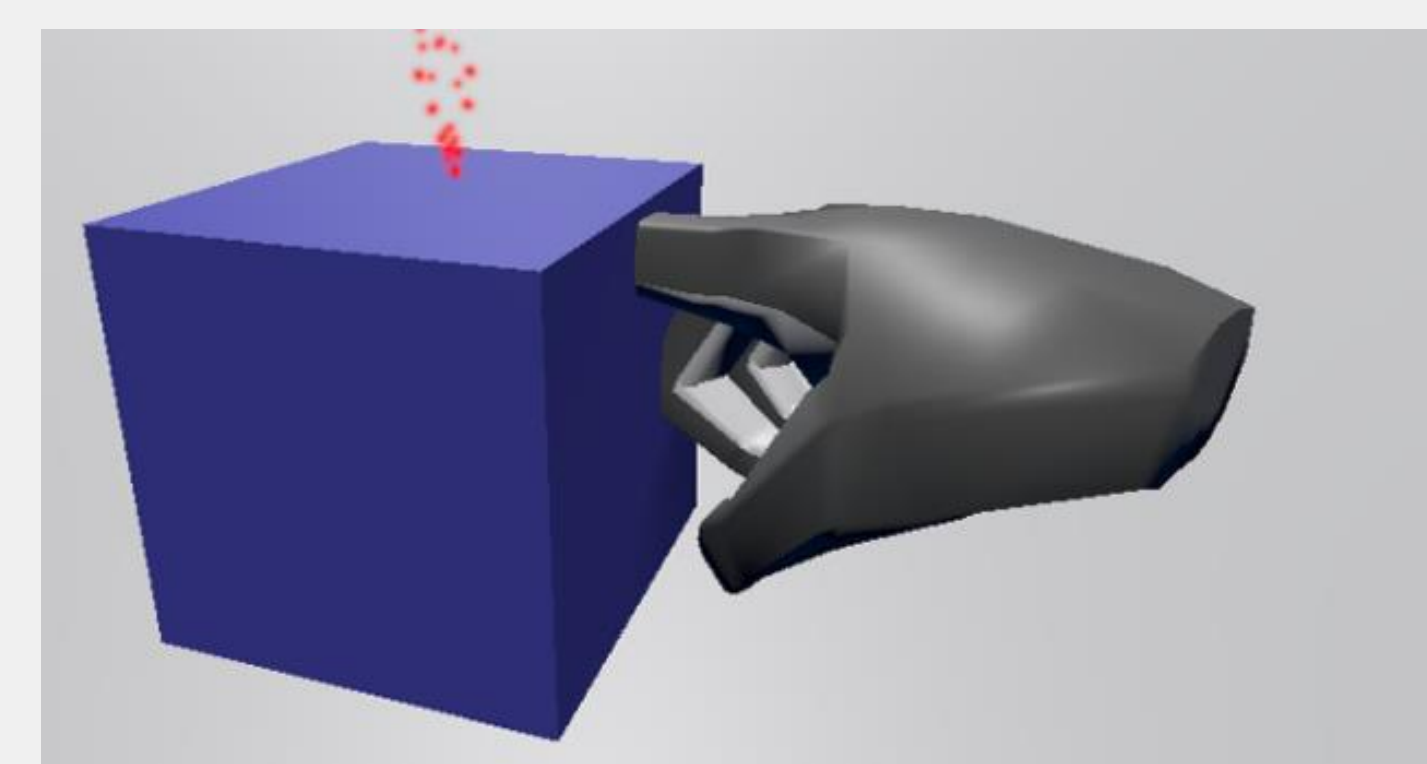
Default



God-Object
Finger
Coloration



Ghost



Visual
Particles

User Study

Goal:

Find the preferred haptic feedback for each visual feedback.

Protocol:

For each visual feedback, experience the object with each haptic feedback and rank them by preference.

- 16 participants
- 20 trials per participant

Results:

The Circle haptic feedback was preferred for all visual feedbacks.

