

How can Haptic Feedback have a meaningful impact?



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Reading time 9 mins

Key Points

- Touch is the most persistent of all our senses. We have more than 3,000 touch receptors in our fingertips alone

- Haptic technology has enabled the design of devices with a real human-centered design approach
- Haptic devices allow us to touch, feel, and manipulate objects in a virtual world, e.g. Virtual Reality Training for medical students to practice cutting on virtual patients
- Haptic feedback comes in the form of vibration, temperature, pressure, sound, or electrical pulses that we can feel on our skin
- Haptics have a meaningful impact on various sectors, from healthcare and medicine; to education, and assistive devices for people with disabilities
- Fears that haptics could one day replace human touch are unfounded

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Our experience of life is primarily sensory. Without them, we wouldn't be able to see danger

approaching or appreciate a beautiful sunset; be alerted by the smell of gas or feel that rush of feel-good hormones when someone we love hugs us. In an increasingly digitised and electronic world, haptic feedback is an emergent technology that uses our sense of touch to give us tactile feedback from objects we engage with. For example, icons on a smartphone that vibrate when touched.

The skin is the largest organ in the human body and has the most nerve endings, so it stands to reason that touch is one of the most persistent of our senses. While the rest of our senses are located in the head, touch is everywhere and helps us experience cold, heat, contact, and pain ^[1]. Tactile or haptic feedback can be defined as ‘any form of non-verbal communication involving touch’ ^[2].

Fun facts about haptics

Devices that allow us to touch, feel, and manipulate objects in a virtual or online world are already being used in effective and meaningful ways – which we’ll discuss in more detail shortly. But did you know:

- Haptic has Greek roots that date back to 1890 – the word haptikos meaning ‘able to come into contact with’
- It’s also known as 3D Touch or kinaesthetic communication
- A study showed that participants can recall objects purely through touch [94% of the time](#)
- One of the first devices to use haptic feedback, in 1989, was a [vibrating pinball machine](#)
- The [Teslasuit](#), which can cost as much as \$13,000, will let you feel everything from pounding music and rainfall to bullets and rugby tackles in virtual reality (VR)
- Each [fingertip has more than 3,000 touch receptors](#) which probably explains why haptic gloves are the most common application for this type of tech
- Haptics can enable you to give hugs to people who are miles away – and receive them too!

Haptic modalities and categories

Haptic feedback refers to how haptic technology (i.e. the technical applications that create the stimulation) communicates tactile information to its users ^[3]. In other words: how does the device communicate with your skin?

This feedback can be grouped into five different categories:

- Vibrotactile: Vibrations such as what is used on touchscreens, steering wheels, and gaming consoles
- Kinetic/Force: Used in car video games and simulators where a steering wheel is forced to turn in a user's hands to simulate the sensation of cornering a vehicle.
- Devices like the Teslasuit that mount on the body and create the feeling of mass, movement, shape, and pressure are included
- Electro tactile: Electrodes on the skin's surface produce electrical currents stimulating nerves. The feedback can simulate a broad range of sensations depending on intensity, frequency, and placement, e.g. vests embedded with electric sensors that help deaf people to feel the music
- Ultrasound tactile: Soundwaves are used to send sensations through the air and directly into users' hands. Users can thereby interact with virtual objects without needing to wear accessories
- Thermal: Temperature-based haptic devices manipulate the flow of electric currents and allow us to perceive hot and cold

Haptic devices can further be grouped into three main types ^[4]:

- Graspable: Devices such as joysticks that create kinaesthetic feedback to engage our nerves, muscles, tendons and joints, e.g. human-controlled robots
- Wearable: Most commonly used in VR and augmented reality (AR) applications and provide feedback via temperature pressure or vibration
- Touchable: Smartphones that give vibration feedback in response to movements (e.g. rotations and taps), and more recently, the ability to feel the texture of clothing materials such as wool or silk before buying online

Top 5 tactile technologies with meaningful impacts

Because the most common examples of haptic devices involve vibrating smartphone icons, joysticks, and full-on bodysuits, it's tempting to dismiss them as non-essential. However, haptic feedback is a game-changer in sectors such as health and wellness, education, industrial and medical training, and improving accessibility for people with disabilities – and their game is only getting stronger.

Haptics can positively impact [human factors in wearable design](#) and are fast becoming one of the key interaction modalities that designers build into wearables.

1. **Robot-Assisted Minimally Invasive Surgery (RMIS):** Devices that give kinetic (force) and tactile (touch) feedback allow surgeons to operate on patients remotely and are particularly useful in situations (e.g. earthquakes) where people needing assistance are in tight spaces. Using haptic feedback to control these robots has been shown to reduce operation time and tissue damage; while increasing accuracy and dexterity ^[5]
2. **Medical Training on Virtual Patients:** Students can learn how to perform various standard procedures (e.g. suturing and cutting) as well as complex ones which they might never see – but will need to perform flawlessly if the time arises – in virtual [medical reality](#).
3. **Haptics-Based Burn-Care Treatments:** A virtual reality training system that creates a scenario whereby trainees are presented with a [simulated burn patient](#). They can interact with the patient's leg, a marker, scalpel, iodine and cleaning pads to complete the procedure and receive an evaluation
4. **Haptic Technology in the Classroom:** Improved science, technology, engineering, and math (STEM) outcomes when using devices with haptic feedback ^[6]. Key research findings concluded that children can transfer learning from haptic games designed to teach STEM concepts to specific real-world tasks
5. **Haptic-Assistive Technologies for Disabilities:** Tactile senses are an essential means of communication for people who can't see, hear or speak. From the [FeelSpace Vibro Belt](#) that helps blind people navigate outdoor spaces independently; to [neo-sensing smartwatches allowing deaf people](#) to experience sound, haptics are changing lives.



Will haptic feedback replace the human touch?

Every technological advancement – especially where automation is involved – comes with a corresponding human, fear-based reaction that machines will replace them. While this fear is normal, it's also unfounded. People will always prefer one-on-one human contact, but in situations where that's not possible or feasible (nobody wants to be stitched up by a freshly graduated medical student), haptics are the next best thing.

Take, for example, the [HugShirt](#). It's made using [electronic textiles](#) with haptic motors positioned around the upper body and arms. These create vibrotactile patterns that create the sensation of a caress or a firm hug. Wearers can receive hugs from a distance via an app to which the sender is connected. Both would prefer to do so in person, but Covid and long-distance relationships have proved that alternatives are essential.

Even surgeons, who choose this profession for a reason, would prefer to operate on patients themselves. Again, that's not always possible – especially when the patient is in a remote location, trapped in a tight space, or at risk of spreading an infectious disease.

We're excited to see how haptics will develop in the future, what that future will feel like, and the role our company will continue to play in it.

What about you? Are you as excited about haptic technology as we are? Please send us your comments below – we love hearing from you!

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