# New array measures vibrations across skin may help engineers design tactile displays

EurekAlert!

CAMBRIDGE, Mass - In the near future, a buzz in your belt or a pulse from your jacket may give you instructions on how to navigate your surroundings.

Think of it as tactile Morse code: vibrations from a wearable, GPS-linked device that tell you to turn right or left, or stop, depending on the pattern of pulses you feel. Such a device could free drivers from having to look at maps, and could also serve as a tactile guide for the visually and hearing impaired.

Lynette Jones, a senior research scientist in MIT's Department of Mechanical Engineering, designs wearable tactile displays. Through her work, she's observed that the skin is a sensitive — though largely untapped — medium for communication.

"If you compare the skin to the retina, you have about the same number of sensory receptors, you just have them over almost two square meters of space, unlike the eye where it's all concentrated in an extremely small area," Jones says. "The skin is generally as useful as a very acute area. It's just that you need to disperse the information that you're presenting."

Knowing just how to disperse tactile information across the skin is tricky. For instance, people may be much more sensitive to stimuli on areas like the hand, as opposed to the forearm, and may respond best to certain patterns of vibrations. Such information on skin responsiveness could help designers determine the best configuration of motors in a display, given where on the skin a device would be worn.

Now Jones has built an array that precisely tracks a motor's vibrations through skin in three dimensions. The array consists of eight miniature accelerometers and a single pancake motor — a type of vibrating motor used in cellphones. She used the array to measure motor vibrations in three locations: the palm of the hand, the forearm and the thigh. From her studies with eight healthy participants, Jones found that a motor's mechanical vibrations through skin drop off quickly in all three locations, within 8 millimeters from where the vibrations originated.

Jones also gauged participants' perception of vibrations, fitting them with a 3-by-3 array of pancake motors in these three locations on the body. While skin generally stopped vibrating 8 millimeters from the source, most people continued to perceive the vibrations as far away as 24 millimeters.

When participants were asked to identify specific locations of motors within the array, they were much more sensitive on the palm than on the forearm or thigh. But in all three locations, people were better at picking out vibrations in the four corners of the array, versus the inner motors, leading Jones to posit that perhaps people use the edges of their limbs to localize vibrations and other stimuli.

"For a lot of sensory modalities, you have to work out what it is people can process, as one of the dictates for how you design," says Jones, whose results will appear in the journal IEEE Transactions on Haptics. "There's no point in making things much more compact, which may be a desirable feature from an engineering point of view, but from a human-use point of view, doesn't make a difference."

Source: http://www.eurekalert.org/pub_releases/2013-06/miot-nam061313.php [1]



**Links:**
[1] http://www.eurekalert.org/pub_releases/2013-06/miot-nam061313.php