A NEW SENSE OF DIRECTION

Pushing the limits of touch to guide individuals in stressful situations

Imagine being a firefighter trapped inside a burning building. The smoke is so thick that you can’t see, and you struggle to find your way to the nearest exit and safety.
"We are exploring the sense of touch as a communication channel. We are already familiar with technologies that use this channel in very basic ways, like when we set our cell phone to vibrate."

Or imagine being a soldier in enemy territory who has lost radio contact with your fellow soldiers, and you are searching to find your way back to camp.

Now imagine someone outside the burning building or someone back at the military base camp guiding you to safety as if a hand were on your shoulder, steering you in the right direction.

It may sound a bit farfetched, but it might not be as unbelievable as it sounds thanks to the work of Texas A&M University professor Thomas Ferris.

Ferris, a TEES researcher from the Industrial and Systems Engineering Division, is developing a communication system that, using the sense of touch, would prove invaluable in such scenarios.

“Our research is the next frontier in the area of multimodal communications, meaning communicating with people via multiple different senses, which can be very advantageous for human operators in certain environments,” says Ferris. “In particular, we are exploring the sense of touch as a communication channel. We are already familiar with technologies that use this channel in very basic ways, like when we set our cell phone to vibrate.”

**TAKING ADVANTAGE OF THE SENSE OF TOUCH**

Ferris and his students in the Human Factors and Cognitive Systems Lab are pushing the limits of what can be done with the sense of touch while taking advantage of some of its unique characteristics.

“The sense of touch is really great for giving directions to somebody,” Ferris says. “I can give you navigation instructions orally by saying, ‘Look to your left and take 10 paces.’ I could draw you a map and give it to you. But the most efficient way would be if I could put my hands on your shoulders and essentially push and pull you.

“Using the sense of touch, we can direct people with simple instruction. If you feel a vibration or a push on one side of your body, move in that direction. It is stimulus–response. Very little thought is required in interpreting and acting on the message, so people can react quickly to the message without it demanding too much attention. There are a lot of applications where you need to move somebody as quickly and efficiently as possible.”

To accomplish that goal, Ferris and his students have come up with the CHIAD (Creative Haptic Interaction At a Distance) system. The program supports the ability to essentially tap someone on the shoulder, guide the person in a certain direction, or draw a complex shape on someone’s back—all while standing across the room or even in a different building.

In its early stages, the CHIAD system involves an athletic compression shirt worn by an individual called the “actor.” Vibrating devices on various spots on the shirt allow for the ability to “tap” the actor and move him or her in one direction or the other. The “tap” is made using a simple and cost-effective Wii remote that is in the hands of an individual called the “director.” Using the remote, the director simply gestures in the direction the actor should go. The force of the director’s gesture is also mapped to the intensity of the vibration, so the actor can be gently prodded along or can feel the need to move with various degrees of urgency.

“I could essentially gesture as if I’m tapping someone on the shoulder with the Wii remote and the actor would feel that on the shoulder from a distance,” says Ferris. “We can also have the actor return a haptic message with the use of a second system—something natural and intuitive, like a pat on the back, to communicate that the signal was received. The underlying goal is, we want people to be able to interact without thinking too much.”

**Tactors are small transducers, designed to optimize skin response to vibration. These devices are used to provide communication to replace or supplement audio and visual input, especially under circumstances where audio and visual cues can be missed.**

Easing fears in stressful situations

Allowing such simple interaction, Ferris says, would aid in situations where stress and fear would overcome the person, making clear thinking difficult.

For example, Ferris cites his daily route in getting to his office. Every day he parks in the same spot, enters his building through the same doors and proceeds to his office. The repetitiveness allows him to basically go through the process without thinking about it.

But add another element such as a fire outside his office, and things could change.

“If there is a fire outside my office door and my life is at stake and I am stressed out about it, that tends to narrow your cognition,” says Ferris. “Even though I know there are numerous routes that I could possibly take to escape the building, it will be difficult for me to think of anything other than the same familiar route I take every day. In stressful situations people tend to have a very hard time thinking outside the box or outside of what is very familiar to them.

“The underlying goal is, we want people to be able to interact without thinking too much, especially when their cognition is limited due to high stress levels. That is one of the beauties of the sense of touch. We can interact with each other without having to think too much about encoding a message before I send it, or about decoding the message if I am receiving it.”
Pushing the limits of touch to guide individuals in stressful situations

By Tim Schnettler

Imagine being a firefighter trapped inside a burning building. The smoke is so thick that you can’t see, and you struggle to find your way to the nearest exit and safety.

A new sense of direction

The military can also use Ferris’ system on the battlefield, which according to Ferris could help minimize threats to soldiers’ safety. CHIAD can also reduce the time for the commander to guide the soldier away from such dangers, and it allows the soldiers to keep their eyes and ears focused on other things of interest.

Ferris says that commanders would have “a vantage point that allows them to see things that a soldier cannot see, as well as additional sources of information about the area. They can see these constantly changing areas of threat and where their objective destination might be. Right now, soldiers receive their coordinates auditorily and then consult their GPS. That takes some time.

“If we can shorten the time it takes for someone to communicate the message as well as the time it takes for someone to receive the message and act on it, then that can be a big difference in situations like this. If somebody could just gesture and say, ‘Follow my cues,’ and people could respond that quickly, it would be a big benefit.”

Having seen the benefits of haptic display systems, the military has begun testing several different prototypes. Their systems, however, primarily use a belt to relay the vibrations, which limits the expressiveness of the system. It also adds more to a part of the soldier’s uniform that already holds several other items. These systems also tend to be automatically linked to other equipment such as a GPS and therefore don’t support the type of person-to-person interaction that the CHIAD system was designed to support.

“They see similar advantages to the sense of touch,” Ferris says. “What we can add is having the communication aspect, and also ours is not limited to one location on the body. CHIAD can be reconfigured fairly quickly to present vibrations anywhere on the torso, and other garments can be incorporated to present signals to other locations if the application requires it.”