# Haptic glove to touch on virtual fabrics

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"Virtual fabric" that feels just like the real thing is being developed by a group of European researchers. Detailed models of the way fabrics behave are combined with new touch stimulating hardware to realistically simulate a texture's physical properties.

Detailed measurements of a fabric's stress, strain and deformation properties are fed into a computer, recreating it virtually. Two new physical interfaces then allow users to interact with these virtual fabrics – an exoskeleton glove with a powered mechanical control system attached to the back and an array of moving pins under each finger. The "haptic" glove exerts a force on the wearer's fingers to provide the sensation of manipulating the fabric, while the "touching" pins convey a tactile sense of the material's texture.

"We are now ready to combine those two into one device," says Nadia Magnenat-Thalmann, of the University of Geneva in Switzerland, who is leading the project. A prototype should be ready by the end of 2007, she says.

The project, dubbed HAPTEX (HAPtic sensing of virtual TEXtiles), boasts collaborators in Switzerland, the UK, Finland, Germany and Italy. "Nobody has ever linked a 'haptic' device with a 'touching' device," Magnenat-Thalmann told **New Scientist**. "It should lead to a much more realistic experience."

The virtual model of each textile works on two levels – a "global" model of its properties, and a more detailed model of the area being touched. Together these drive the haptic and touching devices.

### Fast refresh

The second level is more difficult to simulate, says Magnenat-Thalmann. The human visual system will be fooled by images that change 20 times per second, but a realistic touch interface must ideally be able to change 500 times per second or more.

Previous efforts to communicate texture through a haptic interface have involved a user moving a stylus over a virtual surface. The tactile arrays being developed through the HAPTEX project should be much more realistic, says Magnenat-Thalmann.

They take the form of arrays of 24 pins crammed into a 1-centimetre-square space. "We're not trying to replicate the topology of the surface, but to provide the right stimuli to the touch receptors in the fingertips, which are about 0.5 millimetres to 1 mm apart," explains Ian Summers at Exeter University, UK.

Summers has developed a system that relays texture information to the 24 pins, which are moved up and down by piezoelectric actuators. The interface can currently change 40 times per second – or once every 24 milliseconds.

### Ambitious testing

"Preliminary tests have been promising," says Summers, "it feels a lot like running your finger over a textile, you can even tell the difference between different fabrics." Once the tactile displays have been integrated with the haptic interface, volunteers will be asked to assess and compare a set of textiles in reality and using the device.

Pitting real fabrics against virtual ones is ambitious, says Mark Paterson also at Exeter but not involved in the HAPTEX project. "I've never heard of direct comparison with the real world being used – that's quite bold."

Paterson says using pin arrays for HAPTEX is interesting because these are mostly only used for Braille, or to display icon-like patterns (see *Tactile passwords could stop ATM 'shoulder surfing'*). "Going back to that technology in a new configuration sounds promising," he says.

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