Project focuses on physical stresses caused by multi-touch electronic devices

June 8 2010

Kanav Kahol, an assistant professor in ASU's Biomedical Informatics Department, is leading team of researchers in a project to measure the amount of strain on the hands and wrist of individuals who use multi-touch electronic devices, like Apple's iPad. They will use cyber gloves to measure the kinematic features produced while interacting with multi-touch systems. Credit: ASU photo by Scott Stuk

The evolution of computer systems has freed us from keyboards and now is focusing on multi-touch systems, those finger flicking, intuitive and easy to learn computer manipulations that speed the use of any electronic device from cell phones to iPads. But little is known about the long-term stresses on our bodies through the use of these systems.

Now, a team of researchers led by Kanav Kahol of Arizona State University is engaged in a project to determine the effects of long-term musculoskeletal stresses multi-touch devices place on us. The team, which includes computer interaction researchers, kinesiologists and ergonomic experts from ASU and Harvard University, also are developing a tool kit that could be used by designers when they refine new multi-touch systems.

"When we use our iPhone or iPad, we don't naturally think that it might lead to a musculoskeletal disorder," said Kahol, an assistant professor in ASU's Department of Biomedical Informatics. "But the fact is it could, and we don't even know it. We are all part of a large experiment. Multi-touch systems might be great for usability of a device, but we just don't know what it does to our musculoskeletal system."

As we move towards a world where human-computer interaction is based on various body movements that are not well documented or studied we face serious and grave risk of creating technology and systems that may lead to musculoskeletal disorders (MSD), Kahol said.

Many of today's multi-touch systems have no consideration of eliminating gestures that are known to lead to MSDs, or eliminating gestures that are symptomatic of a patient population, Kahol said. This project - supported by a $1.2 million grant from the National Science Foundation - aims to develop best practices and standards for interactions that are safe and cause minimal user stress while allowing users to fully benefit from the new levels of immersion that multi-touch interaction facilitates.

In addition to Kahol, co-principal investigators on the project are Jack Dennerlein of the Harvard School of Public Health, Boston, and Devin Jindrich, an ASU kinesiologist.

Kahol said the project initially will focus on evaluating the impact multi-touch devices have on the human musculoskeletal system. Users will be fitted with electromyography (EMG) equipment to measure muscle forces, and cyber gloves to measure kinematic features that are produced while they interact with multi-touch systems. The researchers will then evaluate the impact of those stresses.

The second part of the project will develop biomechanical models where the user will be able to "enter the motion of a gesture, and the system will produce the forces being exerted through that motion, like a specific movement of the hand," Kahol explained. "We would then take this data back to the Microsofts, the Apples and other manufacturers so they could use it when they are designing new devices."

The system, Kahol said, will be built with off the shelf components and it will give designers a new tool to use when developing new multi-touch systems.

"The designers, the computer scientists, the programmers, they know little about biomechanical systems, they just want a system that they can employ in a usable manner and tells them if a gesture causes stress or not," Kahol said. "So our major challenge is going to be developing the software, the tool kit and the underlying models that will drive the tool kits."

Kahol said that the last time designers developed a fundamental interaction system with computers they modified the standard keyboard. While it was useful, it was not without its share of drawbacks.

"When we developed the keyboard, we didn't think through how working with it would affect the hands, arms, etc.," Kahol said. "As a result, it created a multimillion dollar industry in treating carpal tunnel syndrome. That is what we want to prevent with multi-touch systems.

"We are going for the preventative, rather than the curative," he added.

Provided by Arizona State University