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Contact: John Toon (404-894-6986)
E-mail: (john.toon@edi.gatech.edu)
or Jane Sanders (404-894-2214)

THE NEED FOR SPEED: GEORGIA TECH CREATES ERGONOMICALLY SUPERIOR INTERFACE FOR INTERNATIONAL MANUFACTURER

Today's competitive manufacturing environment requires the highest levels of efficiency. And though sophisticated automation can give manufacturers an edge, that equipment is only as effective as the humans operating it.

Jeffrey M. Gerth, a senior research scientist at the Georgia Tech Research Institute (GTRI), has been working with DEK, an international machine manufacturer headquartered in Weymouth, England. Gerth's mission: to improve the user interface on screen printers that DEK produces for the circuit-board and electronics-assembly industries worldwide.

User interfaces – the commands or menus that allow people to communicate with a computer or electronic device – are critical to nimble manufacturing. “The job of operators is to monitor machines so they're in constant operation,” says Gerth, who specializes in human factors at GTRI's Electronic Systems Laboratory. “If production stops or isn't going as fast as intended, then a manufacturer is losing money.”

DEK approached Gerth in 2001 after seeing a project from Georgia Tech's Manufacturing Research Center demonstrated at a trade show. The project included an Internet portal and user interface that Gerth had designed for surface-mount technology (SMT) manufacturing – one of DEK's domains.



Researchers Jeff Gerth and Michelle Berryman pose with the interface system they helped develop for DEK, an international machine manufacturer.

Now in its final stages, Gerth's redesigned interface saves time and streamlines production. Some of its advantages include:

- *Easier to use.* Whereas DEK's former interface was text-based, the new interface uses graphics to reduce dependency on language, which is important for an international player like DEK. What's more, the new interface accommodates a number of functional adjustments made to screen printers over the years – customer requests that didn't take machine operators into account until now.
- *Decreases training time.* Training materials are embedded in the interface, saving operators from having to reach for a manual whenever they have a question.

- *Reduces errors.* The new interface is geared to support best practices and circumvent problems. For example, a new alert system tells operators when replenishments, such as cleaning solvents, are dropping too low. The interface not only reports errors, but also provides troubleshooting tips to help operators take appropriate action instead of calling on a process engineer.

In fact, the new interface is so user friendly, DEK has dubbed it the “Instinctiv™.” A beta version of Instinctiv debuted this spring at the APEX manufacturing show in Anaheim, Calif., and is now being tested in two of DEK’s critical markets.

“The project has been a great success,” says Dick Johnson, DEK’s software manager. “DEK Instinctiv is a new and easier way of interacting with DEK printers. It’s an interface designed for machine operators -- not just engineers.”

Creating a user-friendly interface is no easy undertaking. “For one thing, users don’t always know what they need,” Gerth says.

Before Gerth even began the actual redesign, he toured factories using DEK machines in the Czech Republic, Mexico, the United Kingdom and the United States to observe machine operators and ask them to critique the existing interface -- what features they liked, disliked and used most often. He also interviewed technicians and line managers who were responsible for maintaining the machines.

One of Gerth’s goals was to expand the role of machine operators, making them more capable of maintaining screen printers during production and less dependent on process engineers.

This led to a “task-based” approach, which was key to the troubleshooting component. Instead of overwhelming operators with too much information at once, only information needed for the task at hand is presented to them. Graphics are also used as often as possible to help operators identify problems and suggest specific solutions.

Troubleshooting is especially difficult because of its non-linear nature. “You don’t necessarily have a single root cause for a given

problem, but rather, a number of possible causes could exist,” Gerth says. “We attempted to establish all possible root causes for the most frequently encountered problems and then gave ‘hints’ to their most probable causes.”

Creating easily understood icons was another challenge. Besides legibility issues, culture plays a role in machine operators’ comprehension. For example, a checkmark typically conveys that a task has been completed; however, in some cultures, a checkmark means something remains to be done.

Aiding Gerth in the interface project is Michelle Berryman, a recent graduate from the Georgia Tech College of Architecture’s Industrial Design Program.

The collaboration between engineering psychology and industrial design has been a unique and important one, Gerth says: “Industrial designers are particularly good at 3-D modeling and graphic design. The mockup concepts we can jointly create allow the end-user evaluation to be done on a more complete and realistic prototype.”

Gerth is currently working with Lorraine Justice, director of the Industrial Design Program, to create a laboratory for collaborative teaching and research for engineering psychology and industrial design. “Our world is becoming much more laden with complex electronic devices – and they all have user interfaces,” Gerth says. “We need interfaces that are easier to understand. Design will continue to be our biggest advantage.”

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Technical Contact: Jeffrey M. Gerth, GTRI/ELSYS (404-894-7309); E-mail: (jeff.gerth@gtri.gatech.edu).

Writer: T.J. Becker

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