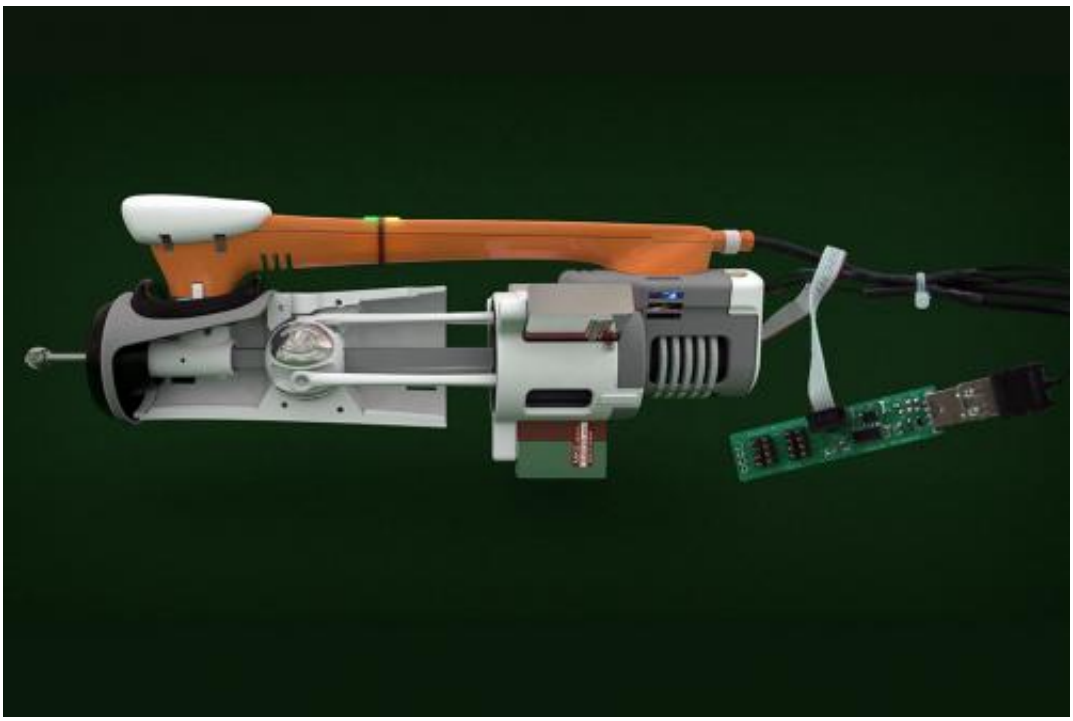
'Wise chisels': Art, craftsmanship, and power tools (w/ Video)

November 22 2013, by David L. Chandler



A carving tool designed by MIT Media Lab postdoc Amit Zoran, called FreeD, allows the user to control the carving process while aided by a computer guidance system that is preprogrammed with the desired three-dimensional shape. Credit: MIT

It's often easy to tell at a glance the difference between a mass-produced object and one that has been handcrafted: The handmade item is likely to have distinctive imperfections and clear signs of an individual's technique and style.

Now, some researchers at MIT are finding ways to blur those distinctions, making it possible, for example, to sculpt items with those distinctive signs of handicraft, while controlling the outcome so that the object doesn't stray too far from the desired form. They described their work at the recent Association for Computing Machinery Symposium on User Interface Software and Technology.

Amit Zoran, a postdoc at the MIT Media Lab who did much of this work as part of his doctoral thesis research, is the lead author of the reports. He says that, in an age of increasing standardization and mass-production, he has been "searching for this human quality, for ways to translate the long heritage of craft and creativity" into the digital age.

For example, in work with graduate student Roy Shilkrot, Zoran has designed a handheld carving tool that can be programmed with a desired three-dimensional shape. When the user begins to carve a block of material, anytime his motions would extend into the region of the desired final form, the device provides physical feedback that slows the motion.

If the carving alters the shape so much that it would compromise the structural integrity of the object, the computerized system can adjust the shape accordingly, in real time. For example, if in sculpting a giraffe the user carved too far into the neck, the computer can adjust the shape, introducing a bend in the neck that maintains its strength.

The basic principles Zoran and his colleagues are pursuing could also extend into physical safety. For example, by recognizing when they might be about to inflict damage, these "smart tools" could sense that a sharp blade is getting too close to a user's fingers, for example, and automatically deflect its path to avoid injury.

"We're developing tools that don't have a direct physical, craft heritage,

but are entirely new," Zoran says of a project conducted with graduate student Pragun Goyal. "Creativity is all about error. … We're looking for creativity, for something that surprises us."

To demonstrate the inherent flexibility and creativity of these computer-assisted tools, Zoran had several different people make carvings based on the same programmed shape—in this case, a cat. As expected, each piece had a unique appearance, with distinctive textures, forms, and styles.

Goyal and his advisor, Joseph Paradiso, an associate professor of media arts and sciences, have also developed a handheld inkjet printer head. The device can be programmed to print a specific image, but instead of moving across a fixed track as in a conventional printer, it can be guided by hand across any surface. This would allow, for example, a highly detailed image to be printed onto a complex 3-D shape—something no conventional printer can do.

This combination of digital capabilities and human control could permit a new kind of tool for measurement or testing, explains Goyal. For example, a handheld probe could be used to test an electronic circuit board—but unlike ordinary probes, it could be preprogrammed with details of the circuit. So instead of having to manually set parameters, such as the expected voltage range at a given point, the device would know what range to set, and do so instantly. It would also record the reading and automatically associate each result with the exact location where it was taken.

Zoran, Goyal, and Shilkrot carried out this research with Paradiso and Pattie Maes as part of the Media Lab's groups on Responsive Environment and Fluid Interfaces.