From 3D Printing to Spy Cats

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Welcome to the latest column of Notes from the Community. We start by thanking Jason Hong for his past authorship of this column and introducing Justin Manweiler as the new department coeditor.

Members of our Reddit community submitted many fascinating items this quarter. This issue's topics include the various ways we try to translate between virtual and physical reality, technologies that increase our enjoyment of playing and watching sports, new techniques for spying (with both good and bad results), and, of course, wearables—even wearables for feline espionage!

CREATING NEW REALITIES

Our readers continue to enjoy discussing new technologies for transforming physical reality into digital reality, and back again. Instead of ordering out for pizza, we'll soon be able to print a restaurant and also create its menu of tasty digital dishes.

3D Printing

A building contractor named Andrey Rudenko created a printer that translates CAD designs into concrete reality.[1] Using technology and software from the RepRap 3D printing project (http://reprap.org/), Rudenko's device puts out layers of sand mixed with cement with a high enough viscosity that walls can even include decorative elements (see Figure 1). The Minnesotan has demonstrated his printer by creating a single-story castle playhouse in his

> **Andrey Rudenko has demonstrated his printer by creating a single story castle playhouse in his backyard.**

backyard, which took three months to complete. Next up will be a full-sized, two-story house—which presumably won't be printed in his own backyard.

Virtual Lego Reality

The Lego Company is giving kids a way to bring together physical Legos and a virtual world. With Lego Fusion, players start out using the famous plastic bricks to build physical objects on a special platform equipped with a scannable barcode.[2] The kids then use a smartphone to run the Fusion app and snap a picture of their accomplishment. Their physical creations magically appear in a virtual world that players can share with their friends. As new needs are discovered virtually, kids can create and add new physical elements. We assume this approach requires less space and fewer emergency room visits than a concrete backyard castle, although it also provides fewer opportunities for exercise and spray-painting on walls.

Transforming the Virtual to the Physical

Moving in the other direction, the inFORM Dynamic Shape Display renders 3D virtual content in physical form. Each (rather large, coarse-grained) "pixel" on the physical grid can be raised or lowered to reflect the varying depth of the virtual surface. By changing the height of these pixels in real time, inFORM even allows interaction with objects in the real world through virtual means (see Figure 2). Watch a video of the display in action at http://tangible. media.mit.edu/project/inform.

Digital Lollipops

We've made good progress translating video, audio, and now 3D shapes between the virtual and physical, but what about taste? Past efforts to communicate taste digitally usually involved remotely controlled release of combinations of chemicals. That approach requires transporting and

storing the chemicals, and many people aren't comfortable with ingesting the results.

Instead, researchers at the National University of Singapore use a combination of noninvasive electrical and thermal stimulation on the tongue to produce taste sensations such as salty, sour, or bitter.[3] Goals of the work include entertainment applications, including "taste TV," where audiences can experience flavors along with the program's characters, and medical applications, including digital lollipops that allow diabetics and others with restricted diets to enjoy the sensation of foods they must avoid.

EXTREME SPORTS (FOR SPECTATORS)

Sports have long motivated the invention of new technologies, and this quarter we find basketball and baseball driving efforts in extreme displays and camera work.

An LED Basketball Court

Nike and AKQA have collaborated to create an interactive LED basketball court floor.[4] The floor provides astonishing special effects for the audience, but it can also provide training help for the players, as Kobe Bryant demonstrated on his recent tour of China, where the court was unveiled. View the fancy footwork at www.youtube.com/watch?v=u2YhDQtncK8.

Action from any Angle

The YES Network is using Replay Technologies' FreeD video-production tool at Yankee Stadium. The current system, housed in the TV compound, uses a server connected to a couple of four-megapixel cameras located around the first-base side of the stadium. They combine these feeds to create 3D data that lets the operator move a virtual camera through a 3D space to examine a play from different angles. Sports Video Group reports that as of 3 June 2013, the system was mostly capturing plays at home plate, where you

Figure 1. The ultimate playhouse—a castle playhouse created via 3D printing. (Source: Andrey Rudenko; used with permission.)
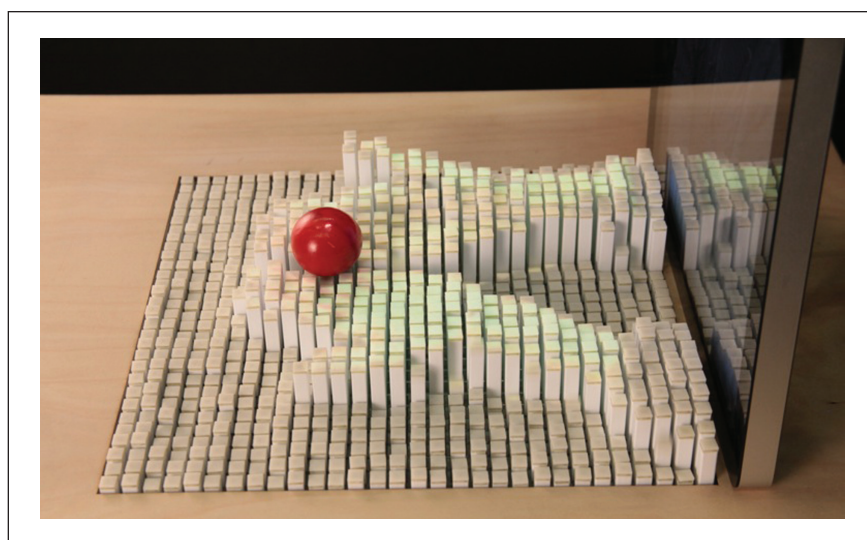

Figure 2. Physical interaction with the inFORM display. (Source: inFORM, http://tangible.media.mit.edu/project/inform; used with permission.)

can swoop around the batter and see exactly how he moves and makes contact with the ball.[5] Watch the bat hit the ball at www.youtube.com/watch?v=iz9l7IlLtrQ&list=UU5fniymL41G6OiRRaQM9izg.

UBIQUITOUS SPYING

Where there are sensors, there can be spying, and this quarter, readers contributed links to some particularly controversial examples.

Tracking Down your Phone's Thief

There are several stories about victims of smartphone theft tracking down thieves through "find my phone" applications. While potentially dangerous, there's something satisfying about using the device itself to provide enough information to find its thief. The Reddit community was particularly fond of the story of Sarah Maguire, who retrieved her phone and her friend's phone from a man who had stolen them both the

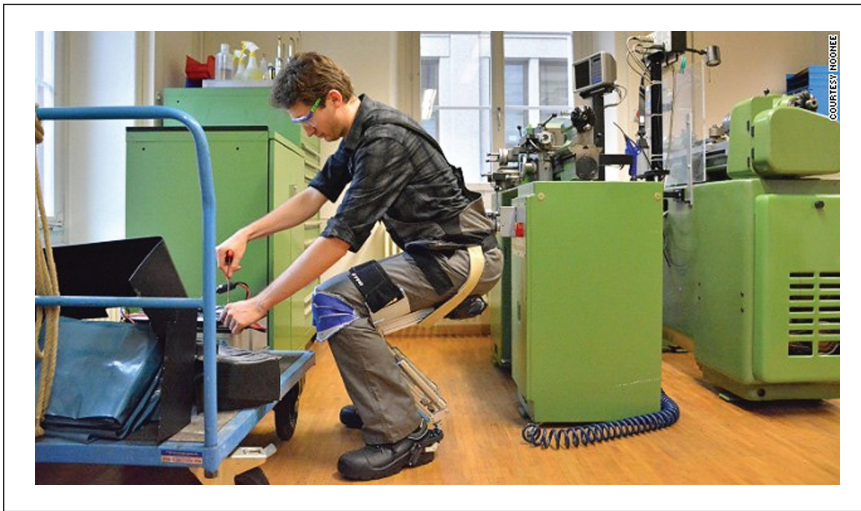**Figure 3. Rear-end wearables—a wearable chair that straps to your derriere. (Source: Noonee, www.noonee.ch; used with permission.)**

Figure 4. Coco the cat has been fitted with a wearable spy collar. (Source: Gene Bransfield; used with permission.)

previous evening.[6] Law enforcement officials remind us that such adventures might not end well, and perhaps the phone isn't worth the possible repercussions of recovering it. This potential for violent confrontations is covered by a darker story from the New York Times that describes how GPS trackers in pharmaceuticals led police to the

thief, who was then shot by police when he pointed a gun at them.[7]

Spying Runs in the Family
Many parents believe there are good reasons to spy on their teenagers, especially when they get behind the wheel of a car. These parents fear that smartphone apps that sense driving and turn

off the driver's texting capabilities are not powerful enough. Esurance has come up with a more comprehensive solution, as reported by The Atlantic Citylab.[8]

The DriveSafe device fits into the diagnotstic port of gas-fueled cars made in the last two decades. It lets parents customize what teens can and can't do with their phones while driving. For instance, some parents might turn off texting and tweeting but still allow navigation apps to work. They might turn off the ability to place and receive calls entirely (other than 911 calls, which can't be disallowed), or they might allow only incoming calls from family members. The device also spies on the driver's behavior and reports it to parents. After a drive, parents can receive a message describing all the possibly unsafe behaviors the driver exhibited related to velocity, acceleration, braking, destinations, and so forth. DriveSafe will be free for all Esurance customers. Teenage joyriding might officially be a thing of the past.

AND, OF COURSE, WEARABLES
Conveniently timed for this special issue, readers contributed many links about various aspects of wearable computing, including some intended for rarely featured applications and body parts.

Interviews and Overviews
Reddit users posted many wearable-related items that aren't just descriptions of new gadgets. They posted a summary of experience by Kai Kunze, who reports on his grandparents' use of Google Glass.[9] (Kunze also coauthored an article in this issue with Paul Lukowicz, "Sensor Placement Variations in Wearable Activity Recognition."). In addition, there was a pointer to *Verge*'s interview with wearables pioneer Sandy Pentland,[10] as well as a link to an overview of many different kinds of wearables by

IEEE Spectrum.[11] Finally, there was a request for pervasive datasets to use in research—user "rrawasi" posted a request for datasets that include not just location information but also subjective input about users' moods (see www.reddit.com/r/pervasive-computing/comments/2c4bbh/looking_for_a_pervasive_dataset). It's good to see our subreddit getting this diversity of use.

Gadets!

This is not to say that readers neglected to report on new gadgetry. An *Engadget* article describes Docomo's attempt to create a more independent wearable by moving your phone's SIM card into a wrist device.[12] The article shows a picture of Acer's Leap band for motivation, as the Docomo prototype is currently the size of a Wi-Fi hotspot—which would make for an awkwardly large wrist wearable.

Also, Nod is developing a gesture-sensing ring to allow you to control everything around you that you could conceivably control with gestures, such as typing on virtual keyboards through swiping gestures, turning up virtual thermostats, using a thumb-reachable button on the ring to control your music, and playing games. In the video (see www.hellonod.com), gestures that require precision or low latency (such as keyboard entry and game playing) seem a little iffy. Maybe further development will improve matters.

And because not all wearables need to be tiny computers that strap to wrists, ears, fingers, faces, and feet, the subreddit also includes a link to *Engadget*'s story on noonee's wearable chair for factory workers, which provides power-efficient mechatronic posture support strapped onto one's legs and derriere (see Figure 3).[13]

Wearables for Spy Cats

Combing several of the topics discussed here, along with the Internet's fondness for cats, we have a link to *Wired*'s article on "How to Use Your Cat to Hack Your Neighbor's Wi-Fi."[14] The inventor, Gene Bransfield, fitted out his grandma-in-law's cat Coco with a WarKitteh collar that includes specialized firmware on a Spark Core chip, a Wi-Fi card, a tiny GPS module, and a battery (see Figure 4). As the kitty roamed the neighborhood, the system-on-a-collar detected many Wi-Fi hotspots and revealed that a third of them were either open or using broken WEP encryption. ◆

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