Physicality

Tom Igoe
ITP
Tisch School of the Arts
NYU

Wednesday, June 23, 2010

I teach at the Interactive Telecommunications Program in the Tisch School of the Arts at New York University. I wear three hats. I head the physical computing area, and I'm in charge of developing curriculum related to technology and environmental sustainability. I also focus on where networks meet the physical world.

This is the view from my office

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I like to start with a view of the space because your environment determines a lot about how you work, and what your assumptions are.

230 grad students, 9 FT faculty, 50 or so part time, one floor.

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We change the ITP space a lot. We keep it as open as possible, as flexible as possible. It's crowded enough that no one gets to work in isolation. We like to live with the stuff we build.

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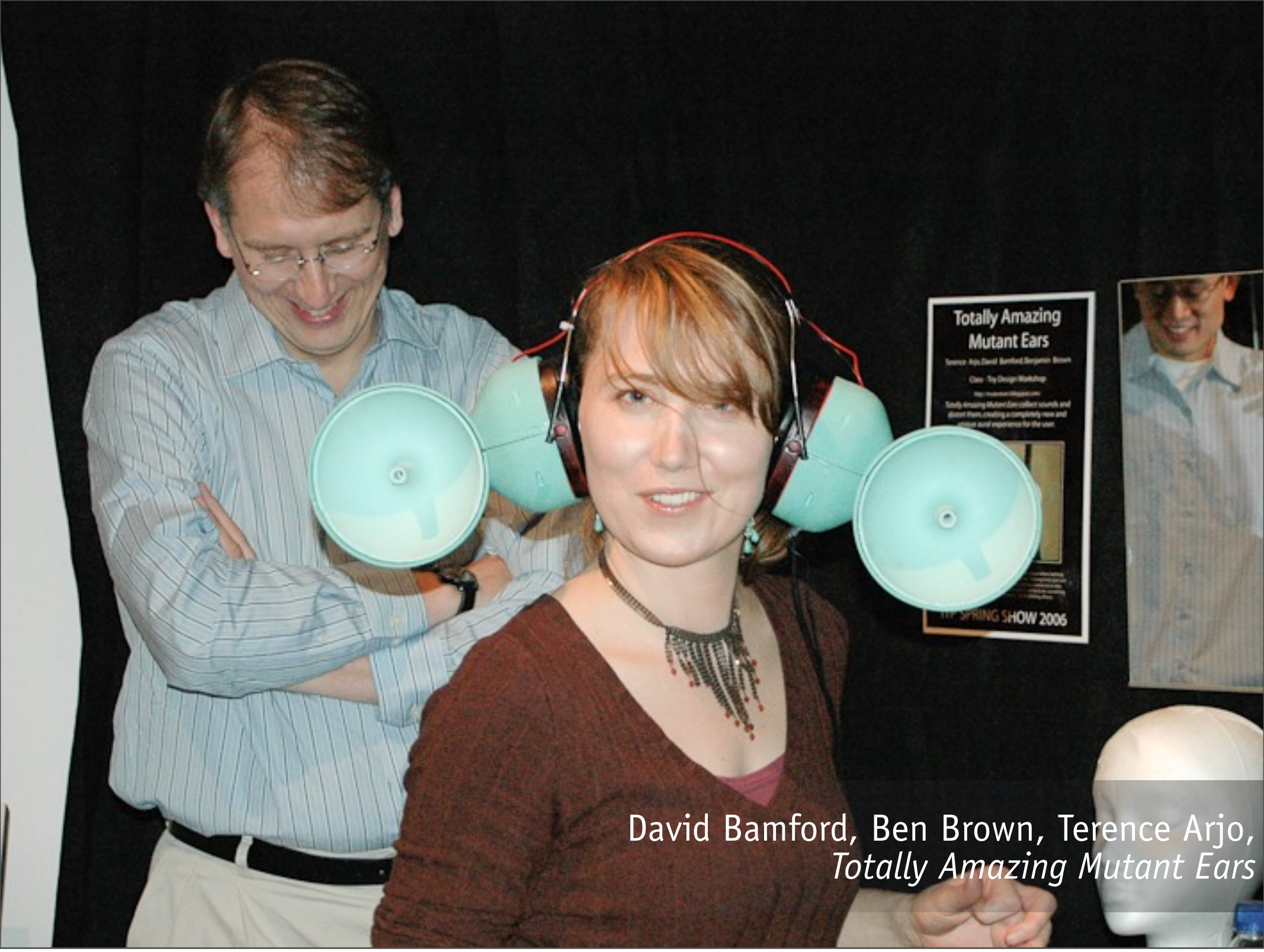
ITP's been around 30 years. It started because Red Burns, our founder, saw a need to empower non-technologists by giving them direct experience with using and developing new technologies. They wouldn't just be working with technologists, they would doing the development themselves. That's central to how we work at ITP.

Ed Guttman and Ayad Alkhadi,
flight simulator

Wednesday, June 23, 2010

It means we see a lot of amateurization. You see similar trends in journalism, citizen science, DIY, and other areas, as new tools give non-experts the ability to work at a more sophisticated level.

Amateurization offers a new POV, and is inclusive of the participant, but can compromise quality control. It's okay to lose some quality in some areas while you're learning others though.



David Bamford, Ben Brown, Terence Arjo,
Totally Amazing Mutant Ears

Wednesday, June 23, 2010

Amateurization takes advantage of the knowledge the participant has about her domain. It's co-design in the extreme. Sometimes “amateurs” produce quite sophisticated things, as this team did. None of them had skills we might associate directly with the product designed, but all of them had skills they brought to the table.

Link: http://www.therealbenbrown.com/projects/

How We See the Computer

I usually describe Physical computing as a way of teaching interaction design that foregrounds physical action and how to sense it.

How We See the Computer

How The Computer sees us

but for general audiences, I say:

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And they get it. Or at least, enough that we can start the conversation. That’s important: physical computing is a concept that’s in the popular imagination now, so we can practice it without having to explain it.

Ithai Benjamin,
Shmobblometer

Wednesday, June 23, 2010

It's not uncommon to ask of a physical computing project: What is that?

There are several ways to categorize physical computing projects. Given that I have a student base that comes from a variety of disciplines, I find it useful to break things down by the creators' intent for the thing's use: Expressive , Instructional, or instrumental.

http://www.ithaibenjamin.com/shmobblometer.html

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Expressive works are often the least directly interactive, because they're usually about expressing an artistic point of view. They're useful for learning about control of physical systems, and control of aesthetics, like any expressive work, though.

http://vimeo.com/7966149

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Instructional works aim to demonstrate or illustrate a phenomenon. I think this is one area where phys comp techniques shine. You learn many things best by experiencing it directly.

http://www.jillhaefele.com/nature

Instrumental

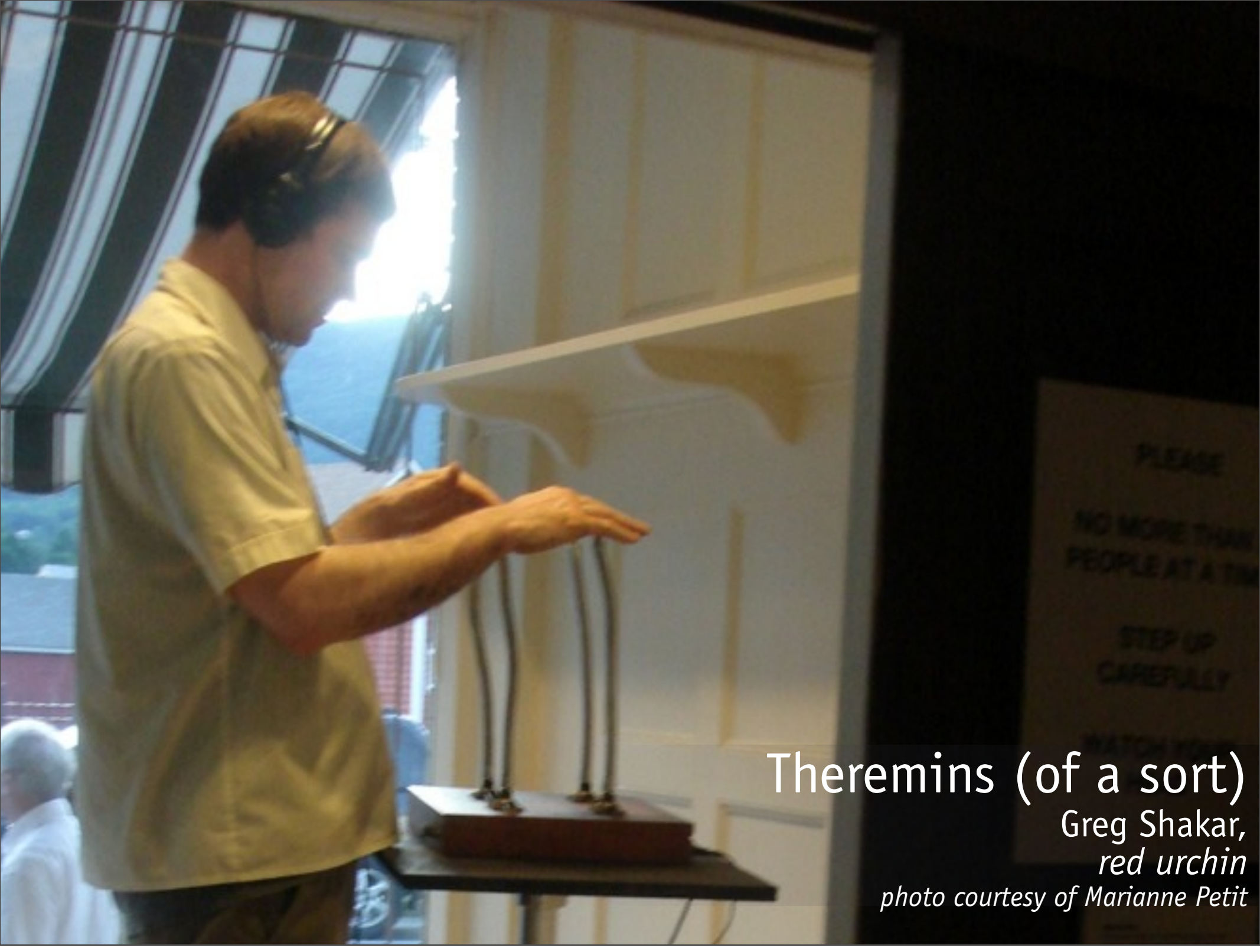
John Schimmel, Marilyn Ingram, Wlodek Koss, Tristan Perich,
Ramps
photo courtesy of John Schimmel

Wednesday, June 23, 2010

Instrumental projects can be purely utlitarian, or they can be purely whimsical, but they exist to enable some other behavior. You generally don't look at the instrument, you look at, or listen to, what it produces.

Greatest hits next.

There are certain projects that get repeated all the time. Some of these are due to what the tools afford, some are due to what the teachers have done, and some I can't explain.



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Making musical instruments is a great way to learn about physical interaction because you can't think when you make music, you have to think about the music. The theremin is usually the first instrument people build because it's the simplest to make: photocell on a microcontroller, the results into a sythesizer, and you're done. But the gestures don't mean much.

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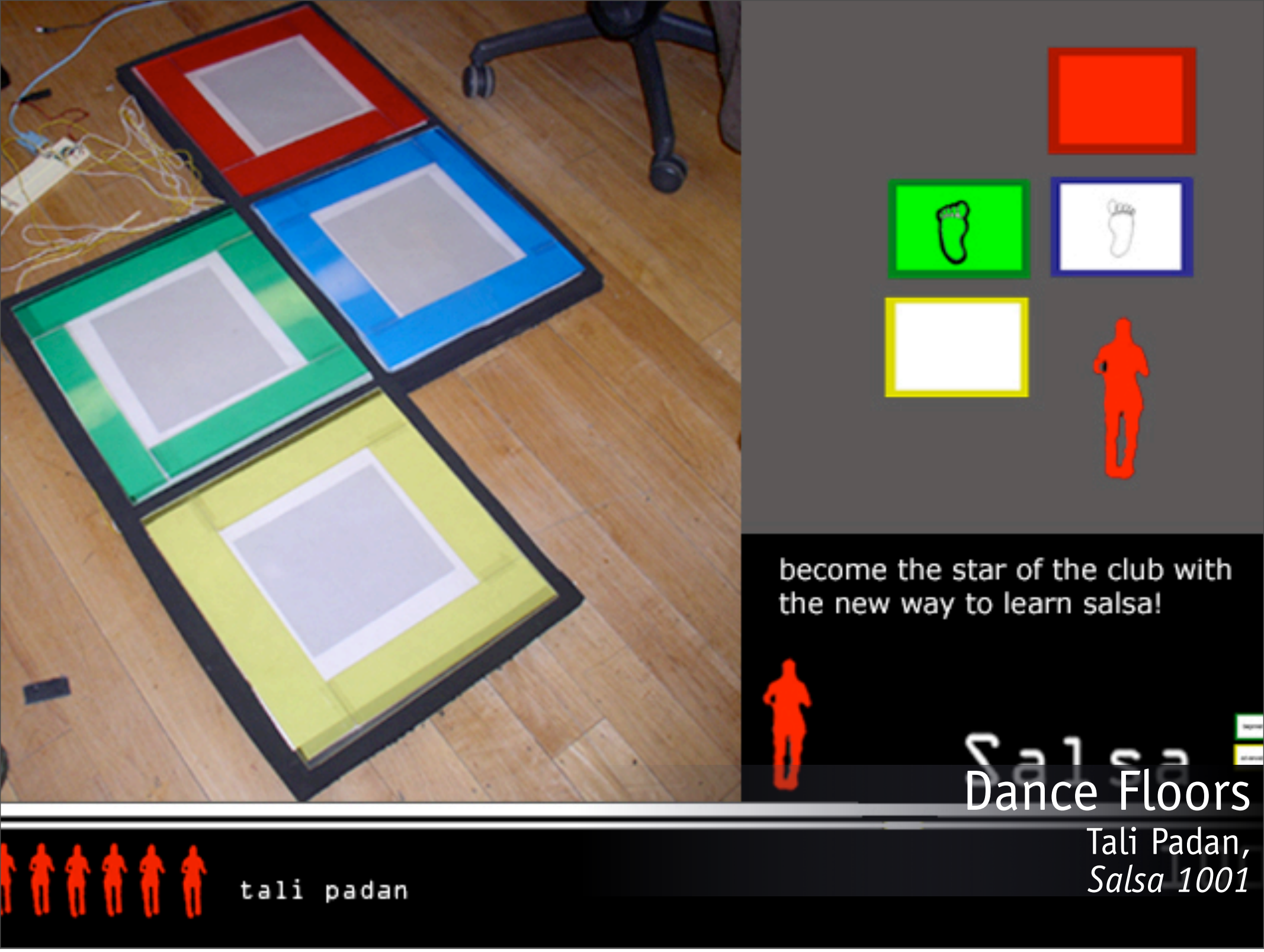
The drum glove is also popular, because it's almost as easy and you get to hit things and make a beat. And of course, a beat leads to....



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Floor pads! Dance Dance revolution! Why? floor pads are easy to build and dancing is fun. and they're wicked simple to make. I love these. The irony is that many geeks don't dance.

http://www.talipadan.com/salsa.htm

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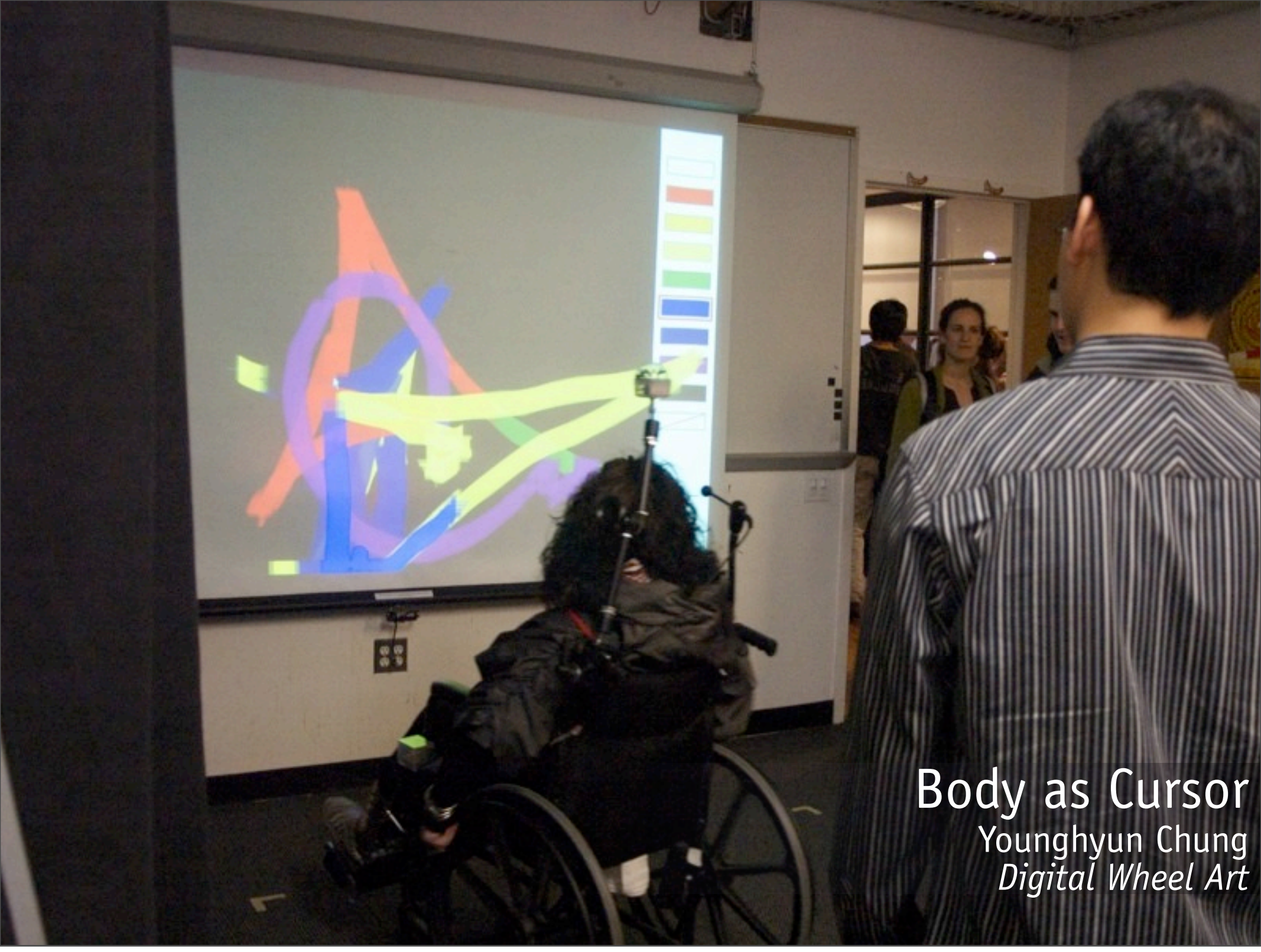
Remember the painting in the Scooby-doo episodes where the eyes followed you? Same thing here. They're displays that react to your presence. Most of the time, people who wanna build this confuse presence with attention. Sensing presence physically is easy, but how do you sense attention? What I like about this one is that it uses face detection, so at least the system knows if you're facing the work.



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Body-as-cursor. Projects where you sense a person's movement in a room and map it to movement on screen. What you get is this: (walk around with arms at sides). I like Younghyun's project because it is designed for someone for whom this is appropriate.

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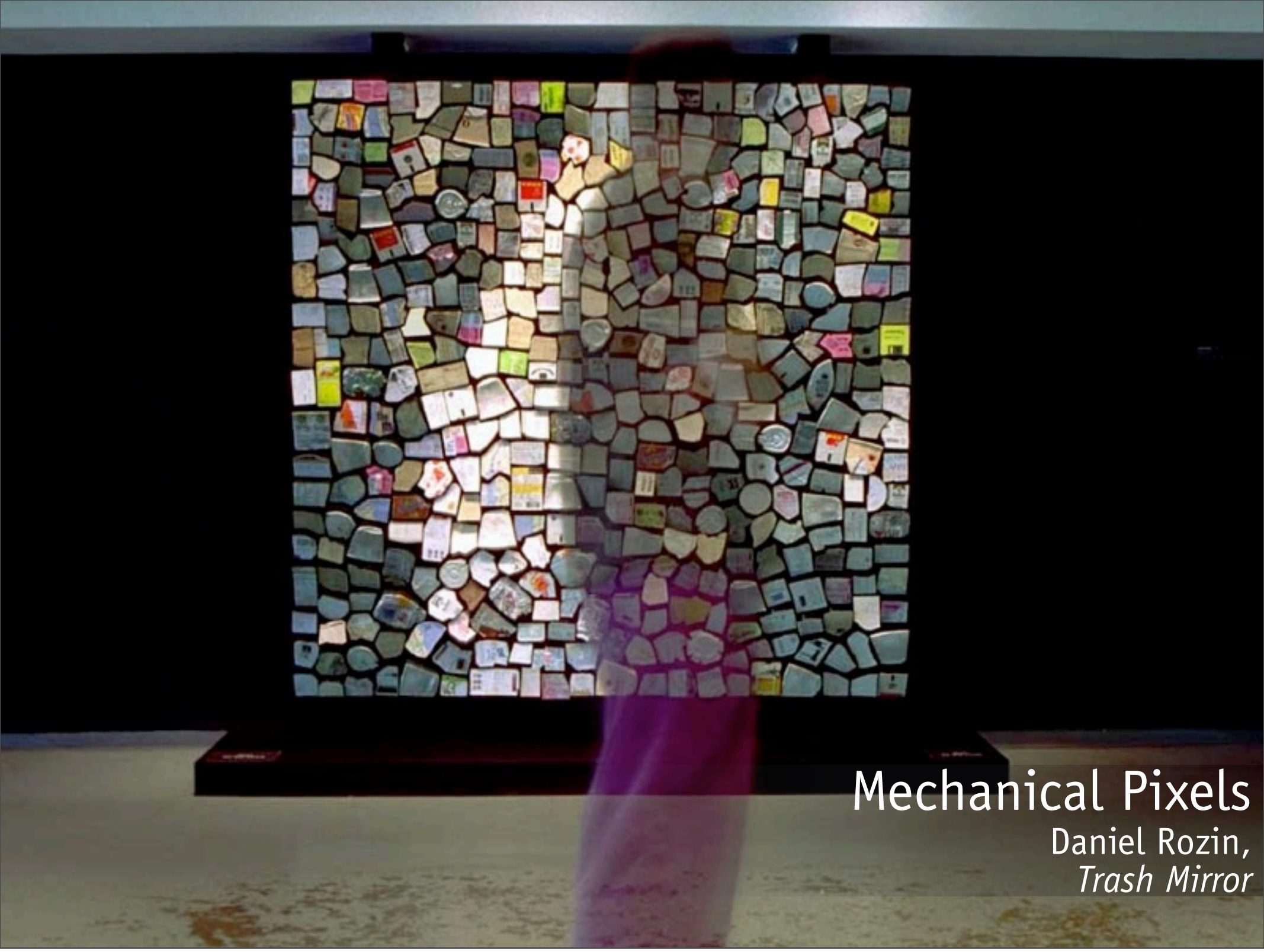
Video mirrors are the screen-savers of physical interaction. I call them hand-wavers because people do this: (wave hand). Not much in the way of expression there, but they sure are pretty, you can look at ‘em all day.



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Mechanical pixels are a follow-on from video mirrors, because once you've made a mirror, you wanna make things move. Here, the pieces of trash on the wall move to reflect your image.

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This one comes up all the time: “I want to make a field of grass (or stalks, or strings) that changes when you run your hand over it.” Why? Responsive texture, it’s magical. Turns out it’s also pretty hard to do.

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Hand-as-cursor allows you to gesticulate, and god knows we do it. A little video tracking to track the arms, and all of a sudden you're sensing gesture. I blame Tom Cruise and "Minority Report" for the increased number of these projects.

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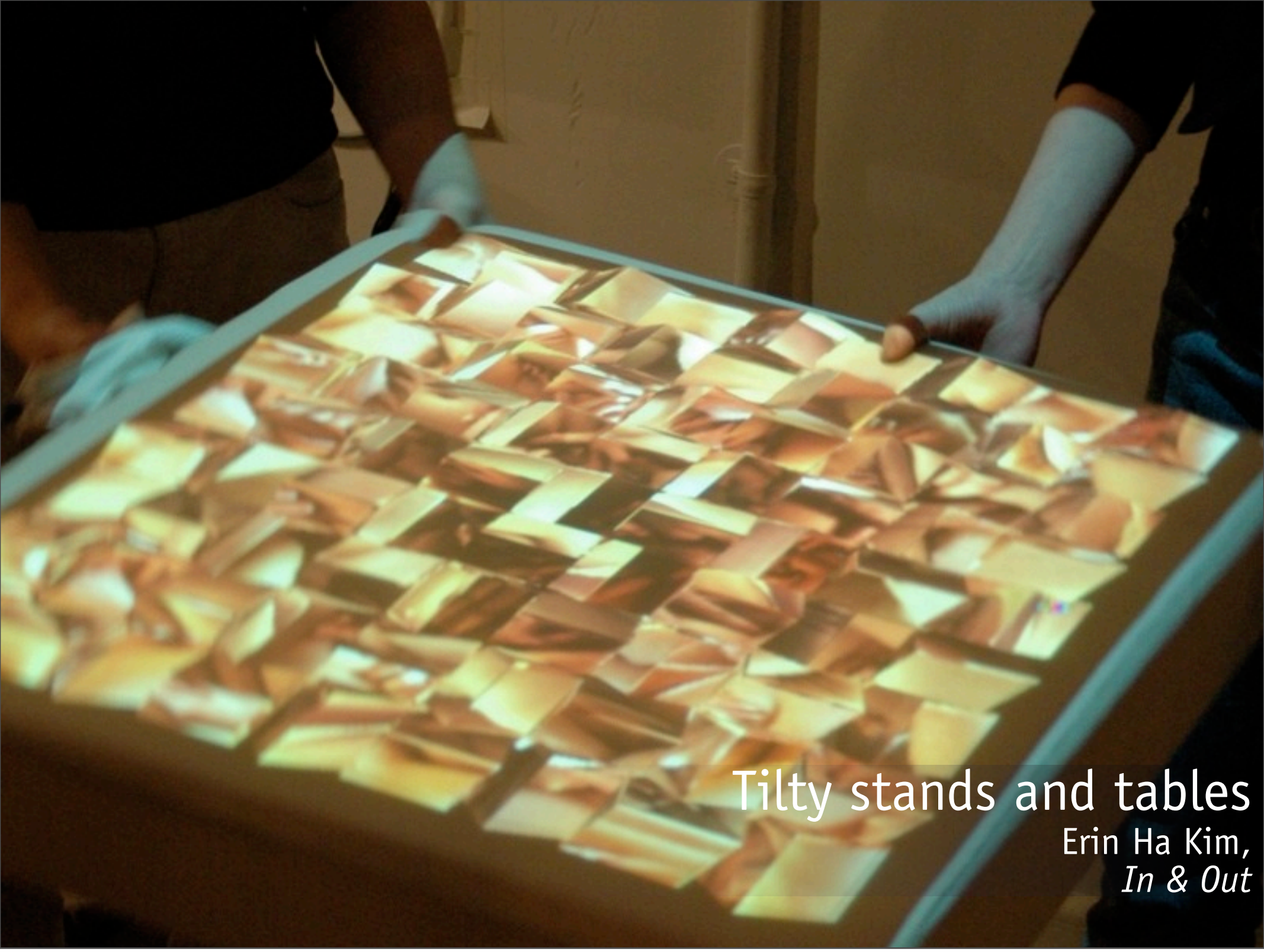
Gesture's great, but it's even better when you can touch something, and touch is better with two hands, right? Multitouch is flavor-of-the-month in museum exhibits right now, but try operating an iPhone in your pocket.



Tilty stands and tables

Erin Ha Kim,
In & Out

Wednesday, June 23, 2010

Well if you can't touch it, tilt it! I think tilty stands are a response to our desire to break furniture.

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Gesture's even easier to sense when you're holding a prop, and this is where tilty controllers come in. Of course, no one needs to build these anymore thanks to the Wii.

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It’s amazing how much fun it is to yell at things, and how easy it is to take a sound level reading and to convert it into physical action.

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Many people get spiritual when they start working with biofeedback sensors. Meditation helpers and systems to help you get calm (not Weiser's Calm Technology) are popular physical computing projects.

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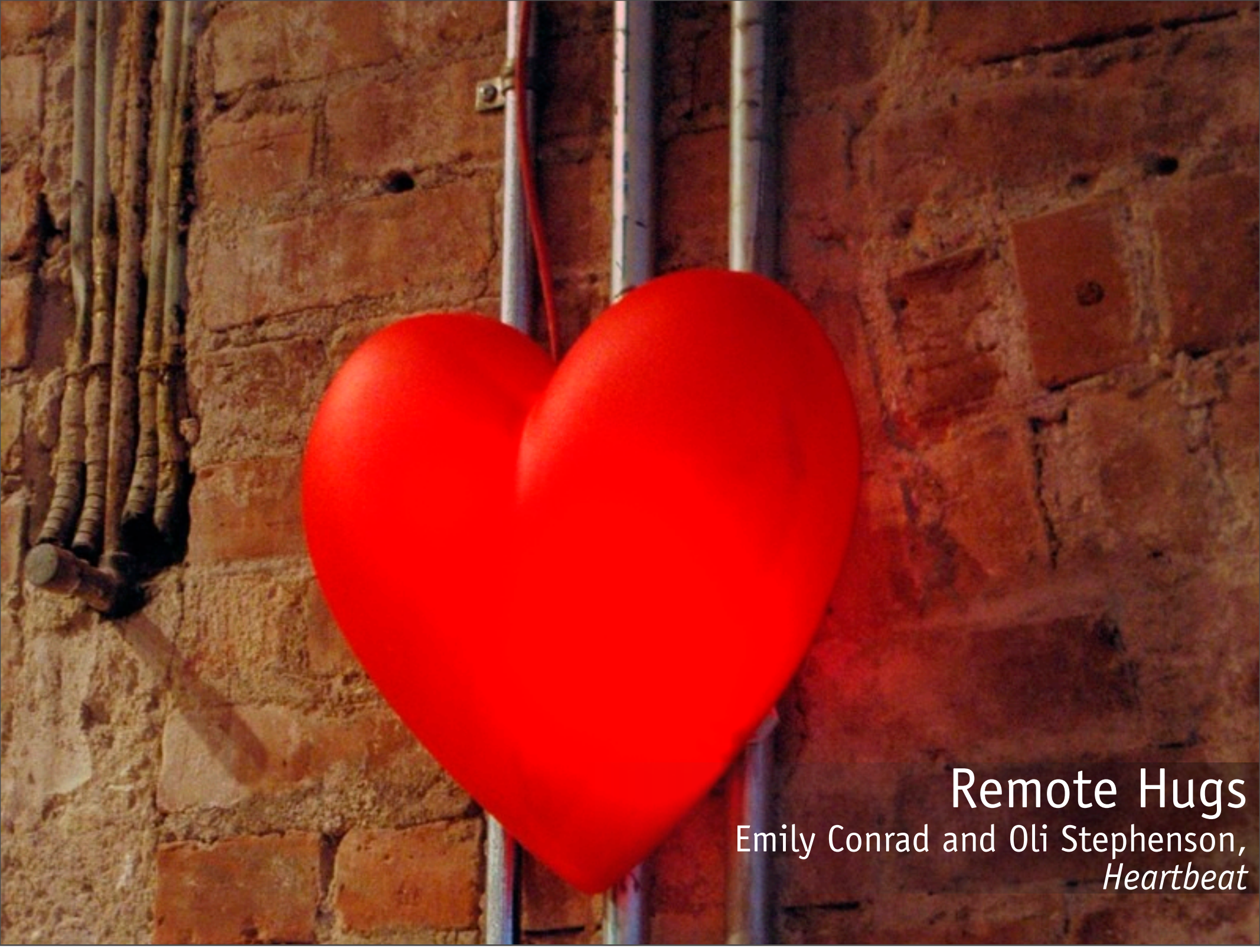
There's a whole wide range of wearables, of course, and it probably deserves its own greatest hits list. This one senses the level of volatile organic compounds in the air and changes the garment to reflect that.

Dolls and Pets

Noriaki Okada and Soyoung Park,
Interactive Dolls

Wednesday, June 23, 2010

Everybody loves to play with dolls! These ones are animated onscreen when you make hold hands or rub bellies or hug, it's very cute.



Remote Hugs

Emily Conrad and Oli Stephenson,
Heartbeat

Wednesday, June 23, 2010

Paired objects that send your feelings across the network come up all the time. In this case, the heart beats faster as your lover gets closer to home. I guess we all want to share the love.

LED Fetishism

Vikram Tank and Ithai Benjamin,
Set in Stone

Wednesday, June 23, 2010

Come on, we're all guilty of doing the gratuitous LED project. When -- not if -- you do it, make it interesting. Embed them in concrete or something like that.

Wednesday, June 23, 2010

Now, contrast this (http://tomgerhardt.com/mudtub/) with what follows:

http://digitalwellbeinglabs.com/dwb/?p=269

Wednesday, June 23, 2010

Generality is a core ideal in computing. Programmers are often taught to solve the general case, make it scalable. And that has seeped into the physical design of things as we move away from the desktop. This is not always a good thing.

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Tom Gerhardt is an industrial designer and ITP alum who's done some great work making sure that the behaviors of the things he makes are as sensual as the materials they're made from.

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Firelight is a lamp that started because he wanted to make a wall sconce that had the natural flicker of a candle. He'd never seen anyone re-create it from an algorithm, so he captured a live flame for his sconce.

fireLight

Wednesday, June 23, 2010

Video: http://tomgerhardt.com/fireLight/

Jooyoun Paek
Pillowig
photo courtesy of Jooyoun Paek

Wednesday, June 23, 2010

This is Jooyoun Paek. She has an eye for observation of behavior.

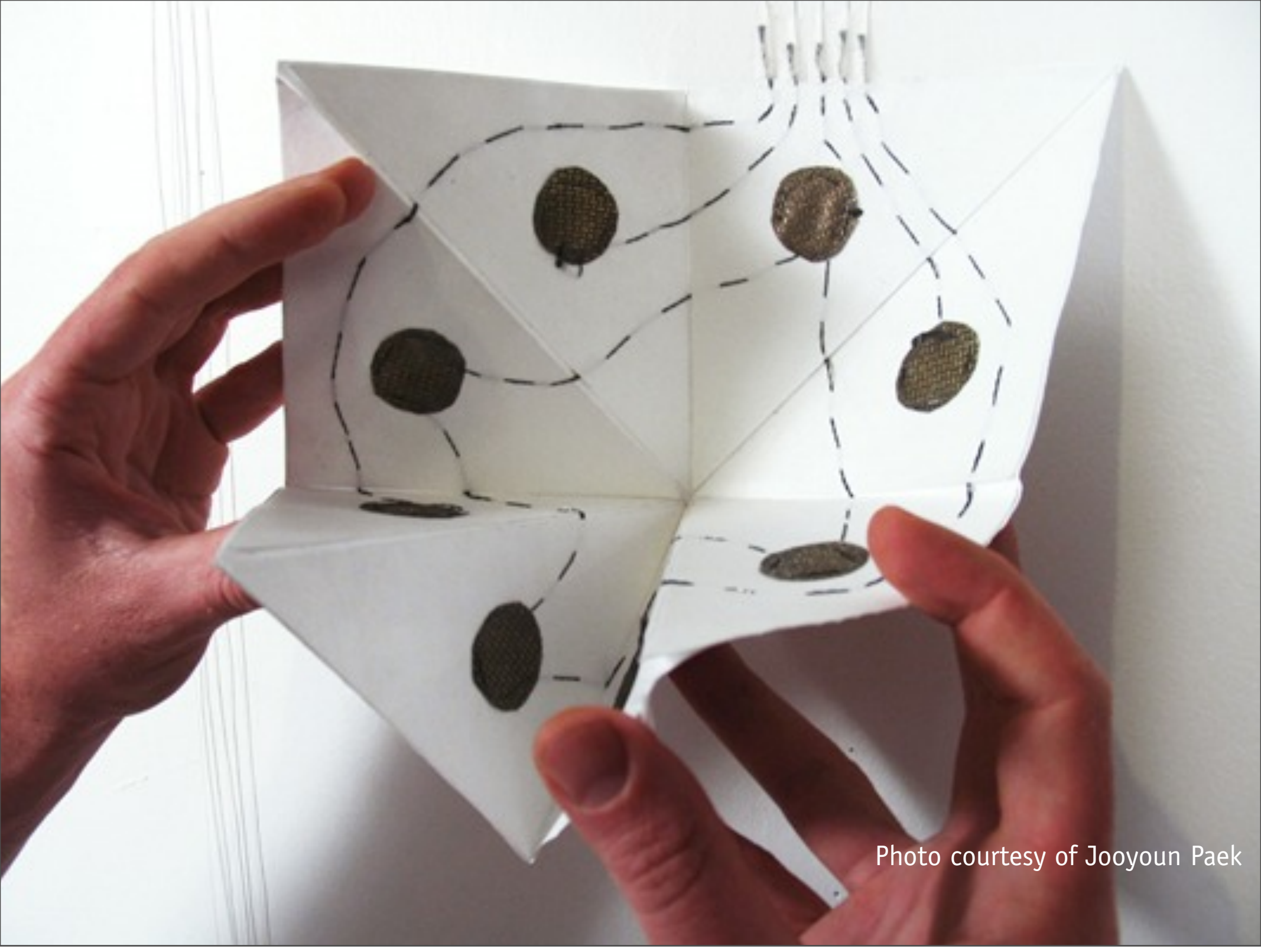
Photo courtesy of Jooyoun Paek

Wednesday, June 23, 2010

Her polite umbrella takes a gesture that we all do when walking down a rainy street, and builds it into the umbrella itself. By making this everyday gesture part of the thing you gesture with, she makes it the umbrella's behavior and not yours.

This isn't computational, but it's a great study of interaction. It really drives home for me the physical part of physical computing.

Video: http://jooyounpaek.com/politeumbrella.html



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Fold Loud is her experiment with the sounds of paper. She takes two things you're familiar with: origami, and a music player, and combines them to get a really pleasant surprising behavior out of them.

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Video: http://jooyounpaek.com/foldloud.html

Matt Cottam

Photo by Timo Arnall

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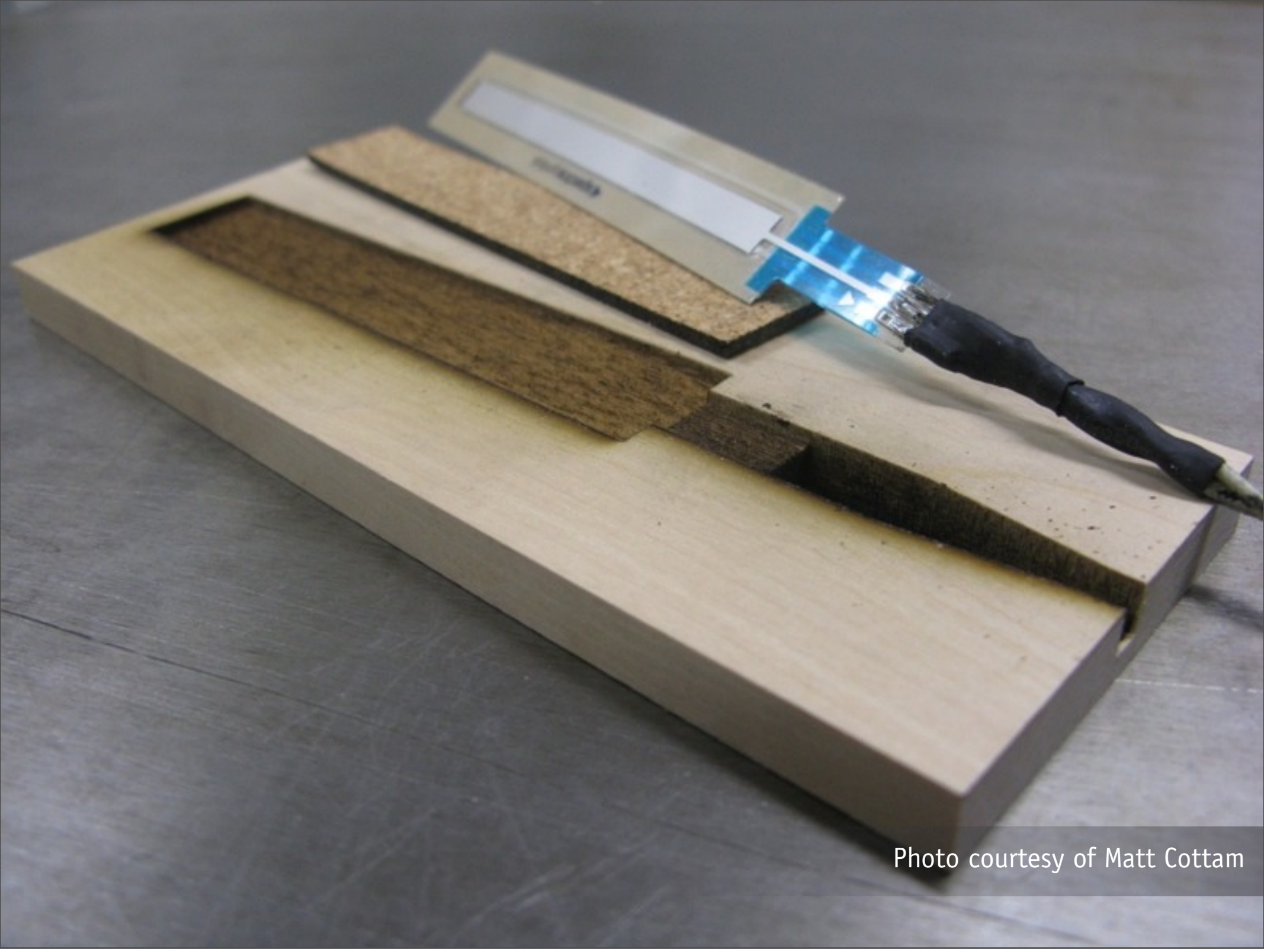
Matt Cottam, a design instructor at the Copenhagen Institute of Interaction Design, is interested in heirloom electronics. He's obsessed with the patina that wood develops through use and care, and how those objects develop personality and meaning to us.



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He wanted to know if electronic controls, which see a lot of use, could develop that same patina. So he made wooden sensors.

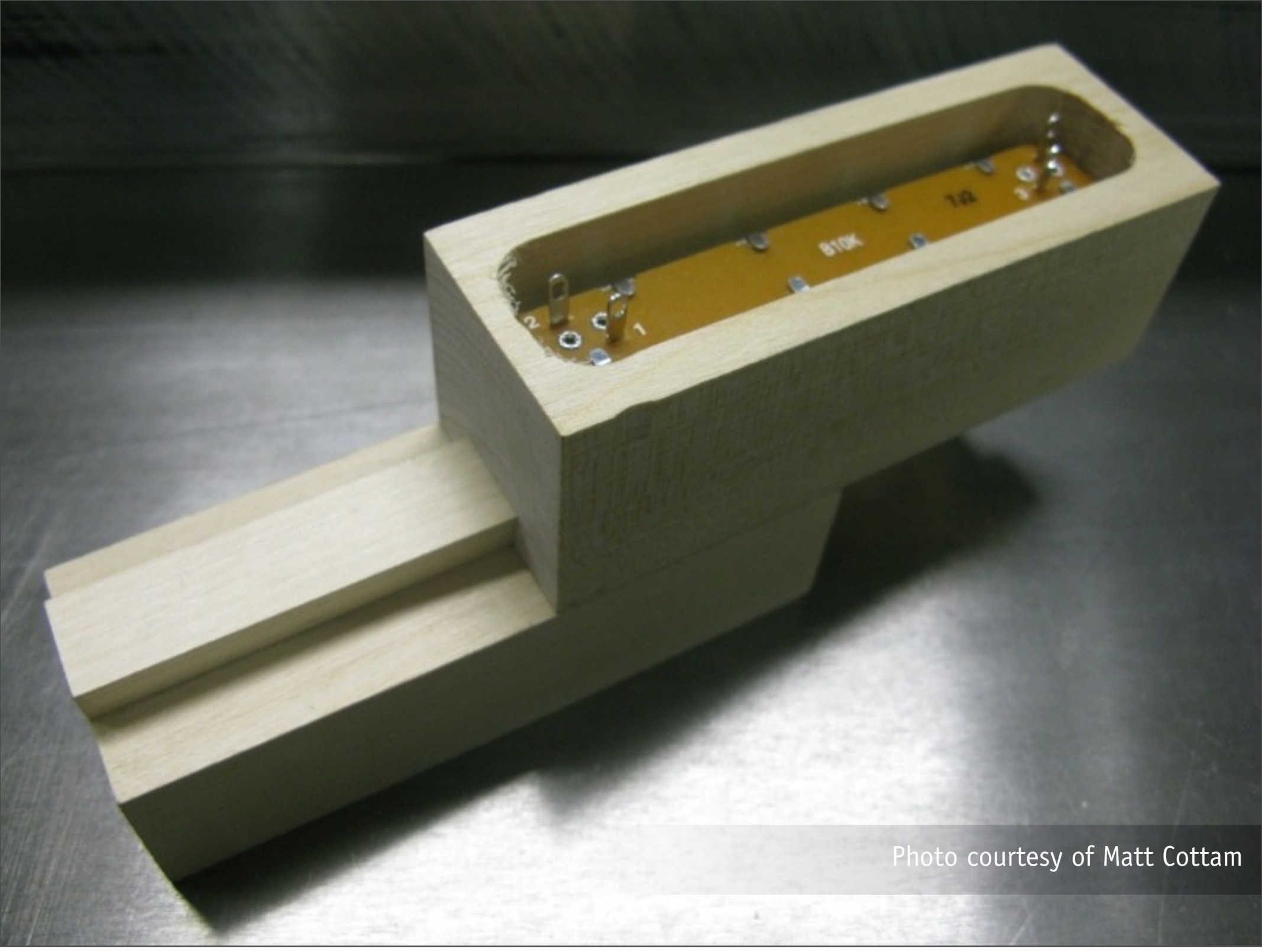

Photo courtesy of Matt Cottam

Wednesday, June 23, 2010

here's a slide potentiometer that needs the same care as a good drawer pull.

Matt's work brings me to the second ideal that I think is important, conviviality.

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He made a set of paired wooden blocks that would know when they’re apart from each other, and come to life when they’re joined.

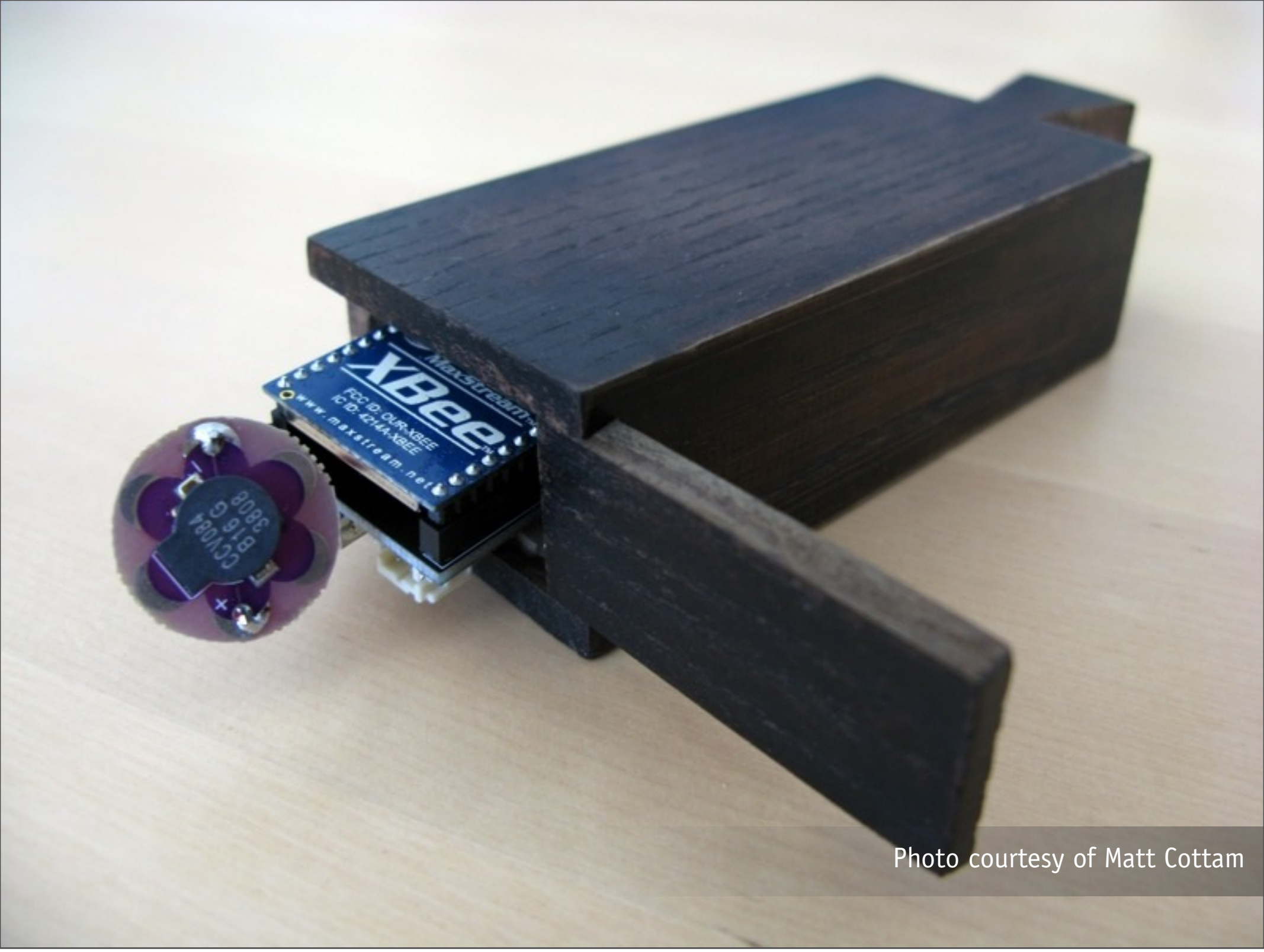

Photo courtesy of Matt Cottam

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There’s a radio in each one that detects the other, and a simple vibrating motor.

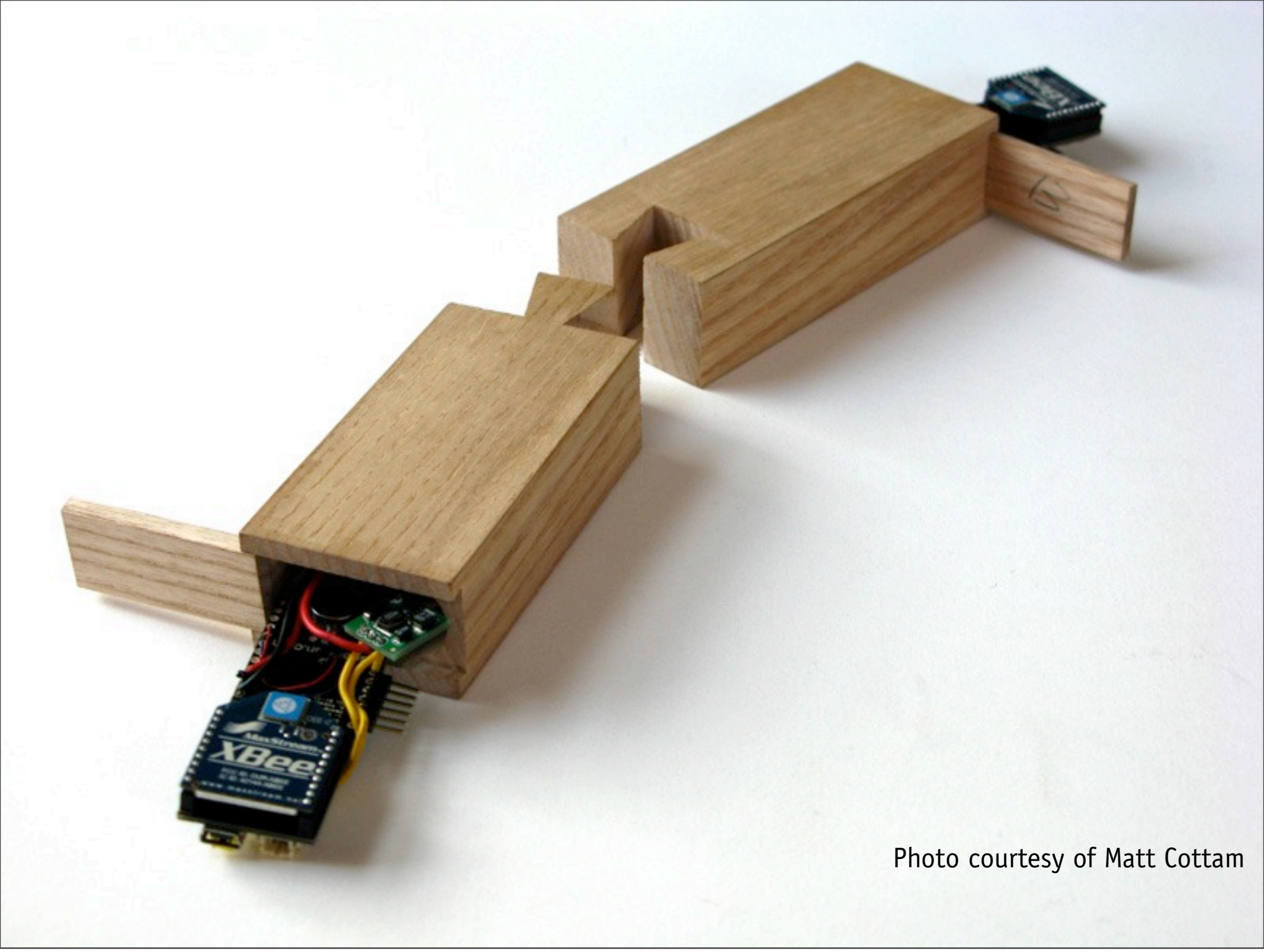

Photo courtesy of Matt Cottam

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As they get closer to each other, they start to vibrate.

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He and his wife, often separated by work, each took one and used them while they were apart.

Photo courtesy of Matt Cottam

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While I love the fact that Matt's devices develop more material personality through use, I think they don't yet develop more behavioral personality over time.

Elevator User Tracking

Michael Kertesz, Mouna Andraos, Jun Oh
video by Michael, Mouna, and Jun

Wednesday, June 23, 2010

A couple notes on basic topics covered. Observation is key, first. We do an observation exercise and a fantasy project. This is one of my favorite examples of observation and intervention, by Michael, Mouna, and Jun.

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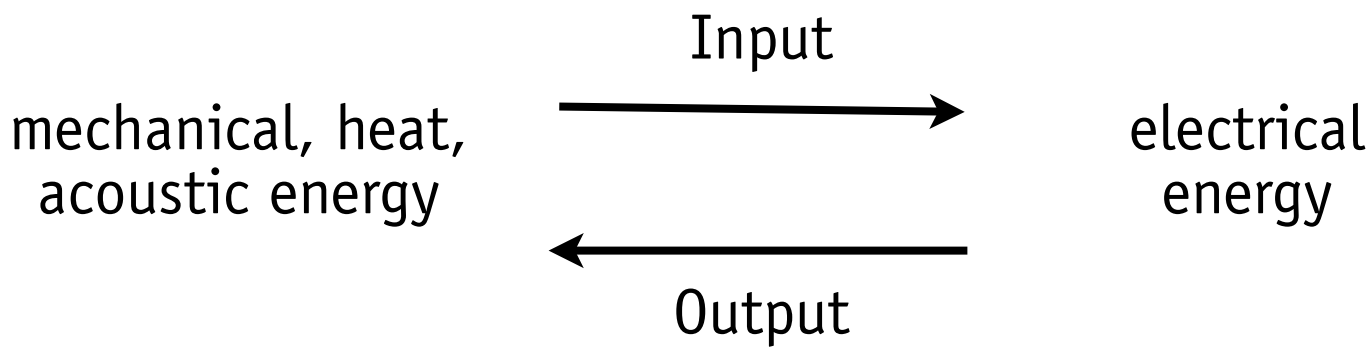
Transduction: the conversion of one form of energy into another.



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Both the electronics and the interaction of physical computing can be thought of in terms of transduction, that is, converting one form of energy into another. You never get to deal with the user at the level of meaning or intention until you think about the energy that her physical action will generate (and that you will sense), and the energy your actuators will have to output to cue her to respond.

Sensors convert changes in various forms of energy into changes in electrical energy

Digital (Discrete) sensors: can sense a limited number of discrete states (mostly only two, on or off)

The cat is on the mat

The cat is not on the mat

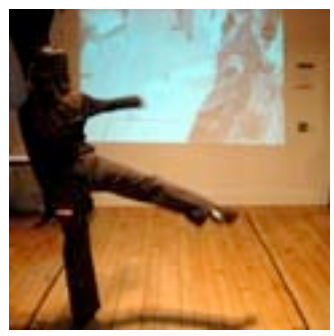
(Analog) sensors: can sense a continuous range of states

How fat is the cat on the mat?

Physical Interaction

Explicit interaction
Action is primarily intended to send the computer a message

Implicit interaction
Action has some other primary purpose, and sending the computer a message is a secondary effect



When you’re planning physical interaction, it’s useful to think in terms of implicit vs explicit actions:

Physical Interaction

Explicit interaction

Action is primarily intended to send the computer a message

Physical affordances should be clear and obvious

Implicit interaction

Action has some other primary purpose, and sending the computer a message is a secondary effect

Physical affordances may not be obvious

Physical Interaction

Explicit interaction

Action is primarily intended to send the computer a message

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Sensing is often in a very contained area

Implicit interaction

Action has some other primary purpose, and sending the computer a message is a secondary effect

Physical affordances may not be obvious

Sensing may be across a wide area (too wide an area may result in false triggering)

Physical Interaction

Explicit interaction

Action is primarily intended to send the computer a message

Physical affordances should be clear and obvious

Sensing is often in a very contained area

* Examples:
  - o Buttons
  - o Knobs
  - o sliders
  - o keys
  - o card swipers

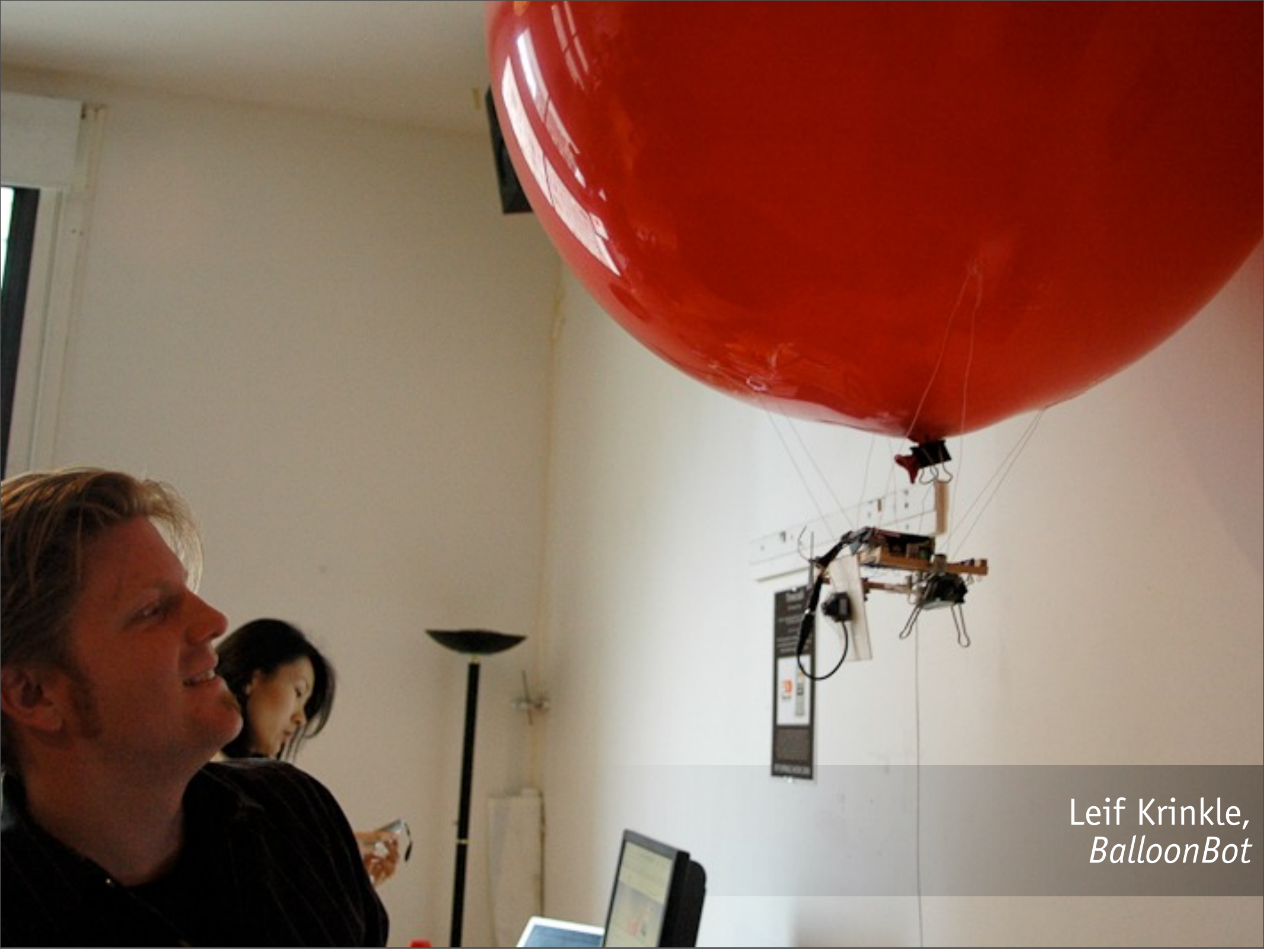
Implicit interaction

Action has some other primary purpose, and sending the computer a message is a secondary effect

Physical affordances may not be obvious

Sensing may be across a wide area (too wide an area may result in false triggering)

* Examples:
  - o Door entry sensors
  - o floor triggers
  - o faucet sensors
  - o motion detectors



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Finally, consider the value of laughter. Many physical computing projects make you laugh, and hopefully some of that comes the ideals of how it's taught. When people can laugh at what they are learning, they have a sense that they are on a level with it -- that they can master it. We're often afraid of things that seem too Important or canonical. So I try to introduce humor into the process, so people feel comfortable with it.

I think being able to produce joy with your work is a mark of real talent and generosity. Those projects in this presentation that are funny are some of the ones I value the most.

Wednesday, June 23, 2010

Now: