VOLUME XVIII.2 | MARCH + APRIL 2011

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What I Learned on Change Islands: Reflections on IT and Pace of Life

Cover Story by Phoebe Sengers

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DEMO HOUR

8 Energy AWARE Clock
Loove Broms

Shutters
Marcelo Coelho, Pattie Maes

Electronic Popables
Jie Qi, Leah Buechley

Shape-Changing, Weight-Shifting, and Living Mobiles
Fabian Hemmert, Susann Hamann, Matthias Löwe, Anne Wohlauf, Josefine Zeipelt, and Gesche Joost

BLOGPOST

10 On Methods
Steve Harrison, Deborah Tatar

DEPARTMENTS

7 Feedback
88 Community Calendar

COLUMNS

TRUE TALES
12 What to Expect When You're Not Expecting It
Steve Portigal, Julie Norvaisas

BODONI, BAND-SAWS AND BEER
80 Endless Nights—Learning from Design Studio Critique
Jon Kolko

DAY IN THE LAB

82 Mobile Life Centre: Mobile Applications for Fun and Pleasure

FORUMS

SOCIAL MEDIATOR
15 Bridging the Gaps between HCI and Social Media
Joe McCarthy

LET'S GET PHYSICAL
19 The Role of Physicality in Tangible and Embodied Interactions
Eva Hornecker

COMMUNITY + CULTURE
24 Productive Tensions: Approaching Community Technology Design
Tad Hirsch

UNDER DEVELOPMENT
72 While the Meter is Running: Computing in a Capped World
Marshini Chetty, Richard Banks, A.J. Bernheim Brush, Jonathan Donner, and Rebecca E. Grinter

UNIVERSAL INTERACTIONS
76 Universal Interactions: Challenges and Opportunities
Juan Pablo Hourcade, Natasha E. Bullock-Rest

FEATURES

28 Comparative Informatics
Bonnie Nardi, Ravi Vatrapu, and Torkil Clemmensen

34 Digital Interdependence and How to Design for It
Ann Light

49 Where is the Thinking in Systems Thinking?
Jodi Forlizzi

52 Designing for Everyday Interactions in HCI4D
Susan P. Wyche

57 Sketching with Stop Motion Animation
Daniel Fallman, Camille Moussette

62 Open Sesame!
Martin McCaig

66 Reflexive Design Thinking: Putting More Human in Human-Centered Practices
Barton Friedland, Yutaka Yamauch

COVER STORY

40 What I Learned on Change Islands: Reflections on IT and Pace of Life

Computing technology has improved our lives for the better, or so we are lead to believe. But can we move beyond productivity and efficiency? It may be time to rethink the modern, urban values embodied in IT and open a new space for design.

Phoebe Sengers

▶ PAGE 19

▶ PAGE 28

▶ PAGE 40

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interactions

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Various subscription rates are available; please see the *interactions* Website at http://interactions.acm.org/subscribe.php for more information.

Single copies are $13.00 to members, $20.00 to nonmembers. Please send orders prepaid plus $4.00 for shipping and handling to ACM, General Post Office, P.O. Box 30777, New York, NY 10087-0777 or call +1-212-626-0500. For credit card orders, call +1-800-342-6626. Order personnel available 8:30-4:30 EST. After hours, please leave message and order personnel will return your call.

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interactions (ISSN 1072-5220) is published six times a year in January, March, May, July, September, and November, by the Association for Computing Machinery, Inc., 2 Penn Plaza, Suite 701, New York, NY 10121-0701. Periodicals postage paid at New York, NY 10001 and at additional mailing offices. POSTMASTER: Please send address changes to interactions, ACM, 2 Penn Plaza, Suite 701, New York, NY 10121-0701.

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The EiCs generally respond to inquiries, including responses to unsolicited manuscripts, in 2-3 weeks.

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Interactions: Our Past, Present, and Future

In this issue's cover story, "What I Learned on Change Islands: Reflections on IT and Pace of Life," Phoebe Sengers reflects on our relationship with technology based on a study she conducted on Change Islands in Newfoundland, a large island on the furthest eastern end of Canada. In 1949 Newfoundland relinquished its self-governing dominion to join Canada as the last province. Despite this, attitudes of fierce independence have not abated so quickly— Newfoundlanders relish the fact that they are not *mainlanders* like the rest of Canadians. Change Islands are a series of islands off an island and so are twice removed from the geographic and metaphoric mainland. What better place to reflect back on a life that was in order to speculate on a future that might be. *interactions* has many possibilities, one of them is to be a "Change Islands" for our community. That is to create a venue, a place from which to reflect on what we have done and from here where we might go.

This being our second issue as editors-in-chief, we can now say that we have a past. We received lots of positive feedback on the last issue (more about that later), especially on the feature articles. The feature articles in the present issue should elicit equal feedback, if not more. Adding to our new introductions, this issue includes three new forums: "Social Mediator" is edited by Joe McCarthy and explores social media; "Let's Get Physical," which is edited by Eva Hornecker, discusses tangible and embodied computing; "Culture +Community" edited by Tad Hirsch discusses the intersection of what makes us who we are as a collective, and "Universal Interactions" edited by Juan Pablo Hourcade is a redux of "Lifelong Interactions," which was a forum on lifelong learning formerly edited by Allison Druin (thank you, Allison!).

We also have two new columns by three new columnists: Steve Portigal and Julie Norvaisis, who work together at Portigal Consulting, are coauthors of "True Tales"; and Jon Kolko, now with Thinktiv, will make a reprise with *interactions* in his column "Bodoni, Bandsaws and Beer."

In the future, we want to hear from you. We want to dedicate space in each issue with highlights from your emails and comments to authors, forum editors, columnists, and us. We of course need your input to do this! The issue is laden with email addresses of each author including our own at the end of this article. Please use them. Our plans for online and social media are brewing in the backroom and we plan to unleash them soon. This will be yet another opportunity to participate and give feedback. Why is this so important? Our futures are many and the ones we give shape to and articulate need to be determined by you—the islanders and mainlanders of *interactions*.

— Ron Wakkary and Erik Stolterman
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DOI: 10.1145/1925820.1925821
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Feedback to the Editors

Hi Ron and Erik,
I want to congratulate you on your first issue of *interactions*. It's very entertaining and informative. I have not finished it yet, but I already see more articles about future trends of interaction design. I think this is great.

I would highly appreciate it if each article had a small summary at the beginning (like a newspaper) or at the end (like a research paper), so that the reader could easily determine whether it's worth reading an article. A lot of the authors in the current issue have included a summary somewhere in the text, but not all of them, and not in a structured way.

I think it would be great if you could outline your vision and goals for *interactions* in the next issue. In the spirit of interaction design: What is the goal of the magazine? What is the target audience (e.g. researchers or professionals, maybe a persona)?

Thank you for taking the time to read through my feedback. I'm already looking forward to the next issue of *interactions*!

Andreas Bossard
http://swissusability.tumblr.com

Feedback to Blogpsot

Nice article. I applaud the experiment and look forward to seeing what happens.

By coincidence, I have a Viewpoint coming out in the March issue of *Communications* titled "Technology, Conferences, and Community." I was able to revise the intro to take into account material published after I submitted the piece in 2009.

I really do think yours is a great experiment, carefully thought through and articulated.

Jonathan Grudin
jgrudin@microsoft.com

Feedback to Liz Danzico

I just received my issue of *interactions* and I really enjoyed your piece on "The Art of Editing." I've been so frustrated in the past few years with the proliferation of content and the feeling that great editing is a rare thing.

Carla Diana
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In your *interactions* piece, you talked about the ways you assess information online: the significance of the lag time between a TED talk and its posting, for example. These are very subtle clues compared to anything that happens face-to-face.

Finally, talking about editing, you cited Ira Glass's work on "This American Life." For me, he is the master of media alchemy. I can remember being stunned by some of the stories I've heard on that show.

John Goodman
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DOI: 10.1145/1925820.1925840
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Energy AWARE Clock

Energy AWARE Clock is designed to make energy awareness a part of everyday life. The 24-hour clock visualizes the daily energy rhythms of a typical household and is intended to function like an ordinary kitchen clock, both in form, place, and use. The clock displays electrical utilization of the household in real time. Yesterday's graphs fade away slowly and today's consumption is drawn on top of previous days, making it possible to compare your current electricity consumption with yesterday's and the day before yesterday.

Project website: *http://www.tii.se/projects/aware/*
Publications: *Broms, L., Katzeff, C., Bång, M., Nyblom, Å., Ilstedt Hjelm, S., and Ehrnberger, K. Coffee maker patterns and the design of energy feedback artefacts.* Proc. of the Eighth ACM Conference on Designing Interactive Systems *(Århus, Denmark, Aug. 16-20) ACM, New York, 2010, 93-102.*

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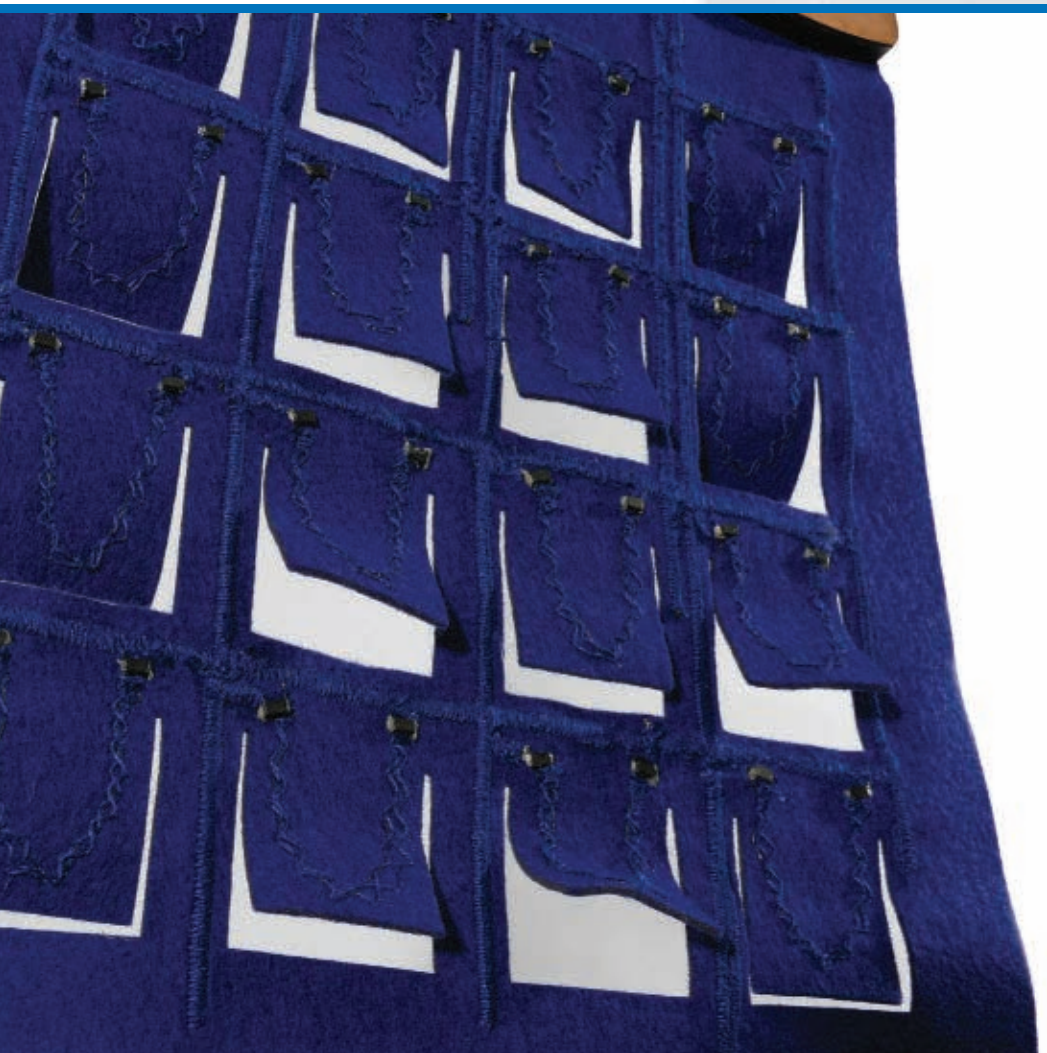

Shutters

Shutters is a kinetic e-textile membrane for environmental control and communication. It is a curtain of actuated louvers that can be individually programmed for precise control of ventilation, daylight incidence, and information display. The shutters' soft mechanics is based on the electronic actuation of shape-memory alloy, which can be controlled to angle the louvers and dynamically adjust its aperture, regulating shade and ventilation, as well as displaying images and animations.

Project website: *http://web.media.mit.edu/~marcelo/shutters/index.html/*
Publications: *Coelho, M. and Maes, P. Shutters: A permeable surface for environmental control and communication.* Proc. of the Third International Conference on Tangible and Embedded Interaction. *(Cambridge, UK, Feb. 16-18) ACM New York, 2009, 13-18.*

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Electronic Popables

Electronic Popables is an interactive pop-up book that sparkles, sings, and moves. The book integrates conventional pop-up mechanisms with thin, flexible, paper-based electronics. It is made from a blend of traditional paper craft and standard circuit components with conductive paints and e-textiles. The result is a book that looks and functions much like an ordinary pop-up with the added element of dynamic interactivity. Through this project we explore paper-based computing and the unique opportunities that arise from combining material experimentation, artistic design, and engineering.

Project website: *http://hlt.media.mit.edu/?p=5/*
Publication: *Qi. J, and Buechley L., Electronic popables: Exploring paper-based computing through an interactive pop-up book.* Proc. of the Fourth Tangible and Embedded and Embodied Interaction. *(Cambridge, MA, Jan. 25-27). ACM, New York, 2010.*

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Shape-Changing, Weight-Shifting, and Living Mobiles

This project explores ways of making digital content graspable through various prototypes: weight-shifting and shape-changing mobile phones, and a mobile device that articulates life-like signals. The mobile phone-shaped box prototypes have an actuated back plate, which allows for directional cues (e.g. as a haptic compass), content display augmentation (e.g. representing one's reading progress through an e-book), and empathy-based displays (e.g. a calm, relaxed pulse as the normal state, as opposed to an excited pulse in case of a missed call).

Project website: *http://on.ted.com/8nkF/*
Publications: *Hemmert, F., Hamann, S., Löwe, M., Zeipelt, J. and Joost, G., Shape-changing mobiles: Tapering in two-dimensional deformational displays in mobile phones.* Proc. of the 28th of the International Conference Extended Abstracts on Human Factors in Computing Systems. *(Atlanta, GA, Apr. 10-15). ACM, New York, 2010.*
Hemmert, F., Hamann, S., Löwe, M., Zeipelt, J. and Joost, G., Weight-shifting mobiles: Two-dimensional gravitational displays in mobile phones. Proc. of the 28th of the International Conference Extended Abstracts on Human Factors in Computing Systems. *(Atlanta, GA, Apr. 10-15). ACM, New York, 2010.*

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DOI: 10.1145/1925820.1925822 © 2011 ACM 1072-5220/11/0300 $10.00

BLOGPOST

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On Methods

Some design methods are used but not taught. Others are taught but not used. That is the problem.

Arguably, the most useful methods we can teach our students are the most neglected in our classes. When we look at people in design practice, we see variations of affinity diagrams. We observe clumps of Post-its on walls. We see information architects asking users to sort cards into clusters of preexisting or novel categories. The K-J method formalizes these techniques as a group process. Yet these methods are commonly relegated to a single perfunctory in-class exercise, and they are not widely represented in the research literature.

Likewise, personas are treated as an almost embarrassing afterthought. Yet they are widely used in industry. Other methods are too simple to even receive discussion. For example, the Zwicky, or morphological box—a method that is almost as simple and flexible as paper itself—may never be mentioned at all. Or, if it is, it may show up only as a technique for "defining the design space," not a resource to be used over and over in different ways.

Complex techniques, such as usability engineering, agile design, scenario-based design, and claims analysis, receive more attention. There is nothing wrong with these techniques. But their use in practice is much more limited than that of many neglected or untaught methods.

We have a few theories about why HCI design instruction is unbalanced.

Simon says. Abstraction is overrated. We single out Herb Simon for some of this: In addition to his many accomplishments, unfortunately, Herb Simon's *The Science of the Artificial* did create at least one disservice. By taking the notion of design to dizzying heights of abstraction, he made it difficult for interaction designers to see particulars in disciplines that traditionally took design activity as central [1].

In some fields—economics, psychology, computer science, and, indeed, engineering—an idea is often considered better and more powerful if it is more general; a system that encompasses an entire process is often considered better than a system that implements only one piece of the process. Consequently, simple, reliable design methods become less valued than more general, all-encompassing ones and disappear from consciousness. This may be useful in many of our allied disciplines, but not so in interaction design.

Dream big visions; dream big methods. Novel methods are overrated (or at least more highly rated than old methods). Methods are taught as if they were the research or design itself. "Hey, we're designers too! We have big visions and design big systems! We want to share them with our students!"

Special methods for a special discipline. Many interaction design instructors believe interaction design intrinsically requires methods unique and specific to HCI. They avoid the methods of its root disciplines—computer science, cognitive psychology, industrial design, graphic design, and informatics, to name a few. Perhaps the fear is that borrowing methods might premiate one foundational discipline over another, or that design students will lose their tenuous grasp of the ineluctable nature of interaction.

Let's use their methods—they must know something we don't. Just as there are those interaction design instructors who believe that interaction design requires unique methods, there are those who try to use design methods of engineering—particularly software engineering. Of course, implementation often takes interaction design into the realm of software, but that is not a reason to mold interaction design processes into

the shape of software engineering. Furthermore, the issues of interaction design are just as likely to involve issues of other disciplines as well as software business—why not use the methods of marketing or electrical engineering?

Perhaps those are not bad ideas. In fact, the techniques that are used in practice come from many sources. But they engage designers easily, speak easily to people inside and outside the design process, and can be plugged in when needed and dropped when not. They are very simple. Most important, they are appropriable.

Appropriate Appropriation

And this is where the true pedagogical problem arises. The methods may be simple, but learning to appropriate is not. "Good designers copy; great designers steal" [2]. To appropriate appropriately, the designer must know what the design situation is. Workaday designers design for the same situation over and over again, often without reflection on the repetition of process or the appropriateness of the methods. But good and great designers often switch design situations. To train good and great designers, we must make students aware of their design situation and give them permission to make and remake methods as needed.

Designing Situations or the Method of Methods

Academics often describe the design situation in terms of a brief or problem statement. But on the job, employment, client relations, and concerns of practicality are just as much in play.

A few years ago, we wrote a paper with Mary Beth Back called "It's Just a Method!" about trying to teach HCI students the Method of Methods. The idea is that students learn *many* methods and then have to appropriate them in the course of design. The paper has been cited pretty widely but suffers from simplicity. The Method of Methods can be reported as research only once. But that does not make it less important as pedagogical practice.

One aspect is teaching a number of variations of one method and then having students explain how they are basically the same thing and how they were fashioned to be appropriate in a particular project. For example, the morphological box can be used to describe the design space, become a concept-selection matrix, a combinatoric tool to bring together disparate ideas, and even a way of identifying problem structures. Some students do not see the connections immediately. We have them poke around the website of the Swedish Morphological Society (http://www.swemorph.com/) to get a feel for how this can be a rich, varied, and appropriable method.

Another aspect is encouraging students to appropriate from scratch. This is not hard: As John Zimmerman of Carnegie Mellon is fond of saying, "Design methods are like toothbrushes. Everyone uses them, but no one likes to use someone else's." Method redesign becomes an active part of design learning. This means using methods over and over and asking at opportune moments what methods the students might use or repurpose for the situation at hand. The "owned" or appropriated method becomes the favorite pen with which the design is written.

Brainstorming Is Not Enough

Brainstorming is both widely used and taught. Brainstorming is important. On one hand, it is often taught as early as fifth grade and occurs across the K–12 curriculum. On the other, there are design-education programs built around brainstorming. For example, Stanford's design program has long emphasized brainstorming as a key method in ideation and problem solving. Not surprisingly, brainstorming is ubiquitous in design practices.

But brainstorming has a number of drawbacks. First, it can look like a solution to every design situation, obviating the need to consider the process of design for the situation. Second, it can dichotomize the social part of design into (1) a fun—and sometimes competitive—brainstorm coupled with (2) a set of implementation roles often conducted without much use for method. Worse, brainstorming is often a perfunctory nod to the gods of good design. Teaching brainstorming plain and simple is not enough.

Our point is that designers are charged with designing their process of design. Getting specificity with regard to a design situation is one key reason to employ a designer. And this is what it means to teach design.

We expect to hear from exponents of particular methodologies—both academics and practitioners—about the value of their method over other methods. Enthusiasm is good, especially in research. But we also hope that a few interaction design faculty will appropriate the Method of Methods or at least focus on getting students to master their own process of designing.

END NOTES

[1] Of course, Nobel Laureate Simon (correctly) pointed out important commonalities across design activities and endeavors.

[2] Steve Jobs is fond of saying this about designers, but earlier variations are attributed to Pablo Picasso, Igor Stravinsky, and T.S. Eliot.

DOI: 10.1145/1925820.1925823
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What to Expect When You're Not Expecting It

As practitioners, when we meet with people to conduct contextual research, our focus is driven by our client's business objectives, nominally investigating how our client's products are falling short of people's needs, or how the organization's core capabilities could achieve those business objectives by meeting those needs. Because of this, our work leads us toward what's missing, which we identify as needs or opportunities that provide valuable direction and inspiration for our clients at all points of the development process. Along the way, however, we are inevitably astounded and affected by what exists outside of those explicit constraints. As professionals we believe this is why organizations should do research, and as individuals this is a key reason why we do research.

We indulged in a little reflection on some of the people we've met and how meeting them took us outside of the business questions at hand but had a real impact on the team and reframed the way we thought about the business questions. This opportunity to dwell on the exception provides a reminder of how these experiences deliver a potent dose of humanity to the business of providing products for people.

In the earliest days of one consulting engagement, we visited a young woman to talk about what seemed like a straightforward topic: digital photography and home printing. As we sat down together in her living room, surrounded by baby toys and child-rearing bric-a-brac, our participant (we'll call her Jenny) revealed she had very recently separated from her husband and was dealing with that change in her life as well as managing her new role as a single mom. While we came armed with dozens of carefully constructed questions to help us uncover greater insights about how people were managing their digital libraries and creating printed content, all Jenny could think about was the massive upheaval she was experiencing. You might as well have played "D-I-V-O-R-C-E" as the underscore to our entire conversation. When Jenny told us about her approach to taking pictures of her young child, she naturally spoke about how the responsibility for child rearing (such as documenting memories) had very recently shifted. Even sharing photos was something Jenny was being forced to reexamine through the lens of a change in the dynamic between her and her extended family.

The interview took a dramatic turn when the estranged husband, whose ears must certainly have been burning, burst into the house. He was tall, heavily muscled, and wearing a military uniform. And he was quivering with barely suppressed aggression. He demanded to know who we were and what we were doing; in our most calming tones, we explained the project and its goals. He glared at us for a moment, and eventually he and Jenny went to the other room to discuss in muted yet intense tones. During those few minutes, we both sat quietly on the couch, imagining what sort of situation might erupt and how we might respond. After he left and Jenny apologized, we continued our discussion of printing and digital images, but we were now insiders, having shared in the experience of Jenny's relationship situation. The interview was still essentially about Jenny's pressing life issues, but our having participated in that scenario

rendered the issues more implicit, and we were able to delve deeper into questions of product use.

During another project, focused on consumer technology, we encountered a man who caused us to rethink the role that digital devices might play in people's lives. One participant, whom we'll call Bruce, told us how he was hit by a car while riding his bicycle. While we were dutifully asking him about usage scenarios and desired features for his devices, he quietly told us about the isolation his recuperation brought on. For Bruce, a "mobile-computing task" like going into Starbucks with his laptop was a way to reconnect with his community. While we might have expected a tech-as-hero story about how he used his devices to keep in touch with people while housebound, we learned that these devices were now serving as props. Bruce passionately emphasized how as his physical mobility increased, his laptop and other technology served as excuses to get out of the house, opening the world up to him again and serving as companions as he reintroduced himself to the world. His story moved us deeply and allowed the team to recognize that what they were seeking to enable went far beyond performance specifications.

This interview follows a familiar pattern in these studies: We start with what we know and what we want to know, but we make sure to create space for people's fascinating and unexpected stories to emerge. At a distance, none of these stories is surprising, but what *continues* to surprise us is their ability to empower teams to see past the bills of materials and marketing requirements documents that

Photograph by Seth Sawyers

can smother workaday lives.

Another unexpected but essential outcome is a revisiting of whom we understand our customers to be. This aspect of research can be a vicious tautology since we choose—often through rigorous definition—which customers to study, sometimes literally pulling names from lists of individuals who have purchased our client's products. One surprise came in a lengthy project that explored how people were experiencing major transitions with a financial services firm. We worked with people in different regions of the country, at different points in this transition. But during a final round of ethnographies, we found something we hadn't planned for: people who were (to use the ugliest jargon) edge cases. A number of participants, without realizing it, had certain criteria that meant their transition was handled differently. One woman (let's call her Alana) had been providing us with regular updates over the course of the study, describing her frustrations and challenges. When we finally sat down to meet with Alana, the extremity of her situation became palpably clear. Her voice rang with emotion as she related the disconnect she had been experiencing. While we can't be specific about the transition or exactly how she was an edge case, suffice it to say that at one point in the interview, she began to cry. Given that Alana was essentially a misrecruit (someone who wasn't actually using the recently launched services), we uncovered a crucial opportunity for the organization to do a better job at designing for a whole class of "other" customers. We've often heard the refrain that a certain individual "isn't our customer." That rhetoric tends to be used to mask the uncomfortable truths revealed during fieldwork. Fortunately, our clients here recognized the new opportunity and returned to their own organization prepared to advocate for this group of people.

In another case, leaving the familiar behind yielded a powerful perspective for the design team. While in New York City to study people using high-end consumer technology, we were up against the clock to find the last few participants. Our client was open to creative recruiting, so we used Craigslist and found a woman we'll call Manuela. As we made our way toward the interview, we began to realize that this session was not going to be like the others. Having spent the previous few days talking to people in the enclaves of the Upper East Side and Brooklyn Heights, we felt challenged as we traveled deep into East New York, a gritty Brooklyn neighborhood known for its high crime rate. The challenges kept coming. Manuela is a hoarder, complete with the requisite cats. The smell in her sizable family home was overpowering. After descending two harrowing flights of stairs to the basement, past the floors where her grown children and elderly mother live, we sat on the floor to conduct the interview (this was the only option). We saw bugs. Yet Manuela's warm personality and intense storytelling style rendered the uncomfortable environment neutral. She explained that her father was in the hospital, dying of cancer. She told us of her work as a funeral director and her passion for playing the lottery and reading romance novels (which she emphasized by pointing to a corner of the room piled high with them). Neither Manuela nor her environment corresponded with what our client's team had in mind when they set out to learn more about their customers. Yet she was one of them: We observed, tucked amid the mountains of household debris, a new high-end HDTV, late-model game consoles, laptops, and other items in our client's categories. An underlying paradigm of the project—whom we were designing for—was enlighteningly disrupted. Rather than dismiss Manuela as an outlier (or worse), our client embraced her story as an object lesson in reality, reminding designers that their designs must fit more than the privileged, pristine environments they like to imagine.

These sort of surprises and reframes are necessarily part of the process; they are ultimately why we do this type of work and why it's valuable, but they are sometimes at odds with the focused activities and totems of research objectives or the careful structure of proposals, scope changes, and participant screening criteria. Every project and set of interviews reveals surprises, personal revelations, confessions, and sometimes even tears. It's key to wallow in and celebrate these moments, not as exceptions, but as important beacons that empower design teams and strategists to transcend their confined objectives.

DOI: 10.1145/1925820.1925824
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"Social Mediator" is a new *interactions* forum exploring the ways that HCI research and principles interact — or might interact — with practices in the social media world.

Joe McCarthy, Editor

Bridging the Gaps between HCI and Social Media

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We are increasingly surrounded by, immersed in, and captivated by social media. This is hardly surprising, given that we are social creatures who naturally gravitate toward channels that enable us to connect with others. But what does the explosive growth of social media mean to those who study and practice the principles of human-computer interaction, and what does HCI have to contribute to this rapidly burgeoning collection of human activity streams?

Social media, in the context of this forum, consists of any website or service that enables users to create, modify, view, rate, or share digital objects of interest. These platforms for participation are proliferating and transforming at a rate that far exceeds the capabilities of traditional scientific study, not to mention our legal system and societal norms.

Some of my friends in the HCI community have criticized social media entrepreneurs for ignoring—or even violating—well-known, fundamental HCI principles. Conversely, some of my friends in the social media startup world have criticized HCI research and practices as being irrelevant to the scale of their systems and/or the pace of their evolution.

This forum represents an attempt to bridge these gaps and promote greater awareness of, if not appreciation for, what HCI has to offer social media, and what social media has to offer HCI.

I readily acknowledge that some people are already bridging these gaps, applying HCI principles to the design of social media systems, and/or investigating social media to uncover new HCI insights. I hope to convince some of these people to contribute to future forum articles.

I also recognize that to some extent the distinction between HCI and social media is somewhat artificial, given that many social media systems incorporate some HCI principles, and many HCI researchers and practitioners are incorporating social media into their work. These existing intersections will surface in contributions to this forum, but the primary focus will be along the edges, highlighting areas that could be, but are not yet, part of a more widely shared repertoire.

And there are lots of edges (and nodes) in the social graph. The network effects within—and across—social media streams represent one of the most significant shifts within the field of HCI. Some of its core principles, such as those involving predictability and reversibility, become particularly elusive when any given interaction can instantly propagate throughout the network… or the network of networks.

These issues loom even larger with the growing number of network bridges: Flickr photos appearing in Facebook status updates, Slidehare presentations appearing in LinkedIn feeds, Twitter posts appearing in aggregators like @HateMyJobFeed or Foursquare check-ins appearing on PleaseRobMe.com. Some of these internetwork effects may be seen as beneficial to an individual user, others less so, but the primary issue is that it is becoming increasingly difficult to fully predict or undo the effects of any action in social media.

Indeed, some social media entrepreneurs and commentators suggest a whole new paradigm is at work. Longtime Internet commentator Clay Shirky contrasts the "filter, then publish" approach of traditional broadcast media with the more laissez-faire "publish, then filter" practices that predominate in social media. Facebook CEO Mark Zuckerberg suggests this paradigm may guide the design of social media tools as well, noting at the recent Web 2.0 Summit that "if you're building a product that people love, you can afford to make a lot of mistakes."

Even some stalwarts in the HCI community are acknowledging a

paradigm shift. Don Norman, in his most recent *interactions* column, "Looking Back, Looking Forward," reflects on the gulf he had earlier identified between human-centered design and practice: "Great designers do not use HCD. And as a corollary, great designers have both great successes and great failures" [1]. His comment applies to a broader range of areas beyond social media, but I do believe that social media entrepreneurs have embraced this approach with particular zeal.

Interestingly, in the context of social media and *interactions* magazine, Norman also laments a lack of participation in or reaction from readers to many of his provocative pronouncements, and attributes this to the magazine's "failure to be [fully] open and accessible." The new editors of *interactions* assure me that contributions to this forum will be fully open and accessible, and we are working together to develop a new online strategy for *interactions* as a whole. I hope you will take advantage of this openness by posting your reactions in comments here or the social media streams of your choice.

Reflecting the conversational nature of social media, the format of future articles in this forum will more closely resemble a group panel discussion than an individual invited talk. This forum will run in every other issue of *interactions*, focusing on a single topic and presenting multiple perspectives, which a small panel of experts from both the HCI community and the social media entrepreneurial world will articulate. We hope readers will also share their perspectives on these topics, and/or their perspectives on others' perspectives.

Given the explosive growth of social media, it is impossible to enumerate all of the possible topics we might explore in this forum, but I will name a few areas that I believe are especially ripe for investigation.

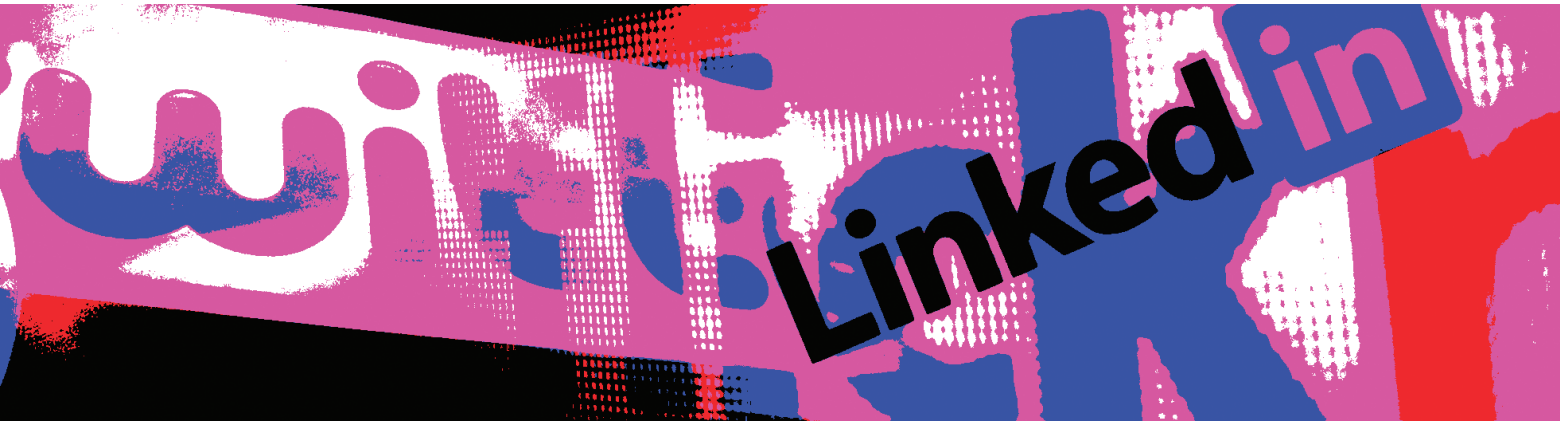
Game Mechanics and Social Game Design

Many games are inherently social, and they have played a role throughout history in every media stream humans have used. The telegraph was being used for chess as early as 1844, and the first television game show, "Spelling Bee," aired in 1938. Computers have been used for games since A. S. Douglas created a graphical version of tic-tac-toe named OXO (or "Noughts and Oughts") for a computer as part of his Ph.D. thesis in 1952.

The most recent statistics reported by Nielsen show that the proportion of time U.S. Internet users spend engaged in online gaming rose to an average of 10 percent. With the growing popularity of smart phones and game consoles that can connect to the Internet, this is probably an underestimate; in any event, the amount of time people spend on games is sure to rise.

While games are nothing new, our understanding of their essential mechanics is evolving as they take new digital forms. Several years ago, Amy Jo Kim, social architect at Shuffle Brain, identified the key ingredients that make games fun, compelling, and even addictive: collecting, points, feedback, exchanges, and customization. She went on to show how many social media sites such as YouTube or Twitter can be viewed as games [2]. However, as the Web becomes saturated with more and more sites sprinkling points, badges, and other game mechanisms around like pixie dust, Kim has more recently been promoting a longer-term, life cycle perspective on game design as experience design. The best social games create social-engagement loops that provide a series of stages through which players can progress on an intrinsically motivated journey of ever-increasing skills, challenges, and rewarding experiences [3].

In addition to offering new insights for design, social games provide an opportunity to think about other aspects of HCI in new ways. Many HCI metrics are designed to measure productivity, efficiency, or effectiveness with respect to accomplishing well-defined—and often work-related—tasks. While many social games include "tasks" such as plowing a field, icing a rival, or slaying a dragon, the success of a game has more to do with the fun and engagement experienced by the player. Developing new metrics, or methods of analysis, that can help us understand player experience versus user experience may be a promising trajectory of inquiry, perhaps leading to a new subfield, player-game interaction (PGI).



Object-Centered Sociality

One of the most fascinating concepts I've encountered in the social media space is object-centered sociality. Jyri Engestrom, a serial social media entrepreneur, invoked this concept in a blog post contrasting the levels of fun that users might experience on LinkedIn versus Flickr [4]. The main difference, he contended (back in 2005, when LinkedIn didn't even allow user photos), was that Flickr photos constituted social objects—entities that served as anchors for conversations—whereas LinkedIn was, at the time, mostly about people and links. While gossiping about people is a common social practice, the professional orientation of LinkedIn was not conducive to gossip… or to much socializing at all.

Social media has evolved to encompass many other types of social objects—videos, music, events, television shows, restaurants, wines, and even credit card transactions. LinkedIn has also evolved, and now supports several types of social objects, including slide presentations, events, tweets, and links (which, in turn, support a broad variety of other social-object types).

Object-centered sociality, as initially outlined by sociologist Karin Knorr-Cetina, has two basic manifestations [5]. One is the idea of socializing about objects, which is the aspect elaborated and popularized by Engestrom and others. The other, which has received far less attention in the social media space, is socializing with objects, i.e., establishing a social relationship with an object.

Knorr-Cetina uses the example of how biologist Barbara McClintock, who won the Nobel Prize for her discovery of genetic transposition, would totally immerse herself in her study of plant chromosomes, developing a "deep emotional investment" with the chromosomes and imagining how they might see the world. This concept of socializing with objects themselves can be seen in some place-based social media applications, such as Foursquare, where one can become mayor of a place without having any kind of physical or digital interactions with others who check in there.

According to the ACM Digital Library, only 16 publications reference "object-centered sociality"—although there are more than 600 references to a related concept, "media equation" (which is more about emotional investments in computing objects than social media objects)—so this is an area that will receive more attention, at least in this forum.

Hybrid Social Media

Foursquare, mentioned above, is one of the more popular social media applications that bridge the gap between online and offline. Users check in with their GPS-enabled phones when they are in or near a point of interest in the physical world, such as a coffee shop or pub. There are a number of other place-based social media applications—Gowalla, Whrrl, and Loopt—and many existing social media platforms are now supporting users' associations with places, e.g., Facebook, Twitter and Yelp.

Recent announcements and speculation regarding the increasing incorporation of near-field communications (NFC) support in mobile phones suggests there will be more mechanisms and modes for making connections between the physical and digital worlds [6]. However, these technological connections may come at the cost of interpersonal connections. Comedian Stephen Colbert recently observed that "nothing brings people together like ignoring each other to stare at their phones."

Hybrid social media holds the promise of connecting people more easily and/or effectively with the people, places, and things around them in physical spaces. Of course, building bridges from the online to the offline may also leave people more physically vulnerable to unfriendly advances.

Privacy-Benefit Trade-offs

Privacy has been a significant concern for many researchers and practitioners in the HCI community, and a mounting concern for some who are active in the social media space. In the past, many HCI studies have elicited responses to proposed software features and settings that involve privacy by prompting users with hypothetical scenarios. Given the scale and scope—especially when network effects are considered—of many social media applications—especially when their publicly available application programming interfaces

(APIs) are considered—it is increasingly challenging to comprehensively characterize what might be visible to whom, not to mention where, when, or for how long.

Facebook, the world's largest social media platform, has been under fire for its unanticipated and unwanted privacy implications as part of its ever-evolving terms of service, especially with respect to the availability of personal data [7]. Zuckerberg's aforementioned willingness to make mistakes notwithstanding, developing effective interfaces for helping users understand and navigate the bewildering privacy settings for social media services is an important area to which HCI may be able to provide useful guidelines.

Another dimension of Zuckerberg's comment is the explicit acknowledgment of the implicit cost-benefit analysis that many users make when facing changes to terms of use with popular social media services. While 30,000-plus people pledged to delete their Facebook accounts on May 31, 2010 ("Quit Facebook Day") in protest over the most recent privacy changes, they represent less than 0.01 percent of the Facebook user population. Unfortunately, we will never know how many actually deleted their accounts or how many of them later rejoined the site. We do know that the number of unique visitors to Facebook site increased during the following month [8].

All of this is not intended to suggest that privacy is not or should not be an important consideration in HCI and social media. However, it does suggest that we may want to expand our consideration of relevant factors, and to incorporate insights from other fields that have not traditionally played a key role in HCI, for example, behavioral economics.

Health 2.0

The best description I've seen of Health 2.0 was in a slide deck entitled "Patient 2.0" by Regina Holliday, in which she defined e-patients as "engaged, empowered, equipped, and expert" [9]. The Health 2.0 movement is broader than social media, as it involves many stakeholders, such as government and insurance industry bureaucracies, who have yet to embrace social media (to put it charitably).

But the potential for truly participatory medicine—with platforms promoting interactions among e-patients and healthcare providers—represents one of the most exciting application areas of social media. It's perhaps best exemplified by PatientsLikeMe.com, which allows people suffering from an array of diseases to share information about their symptoms, treatments, and outcomes with other similarly afflicted patients.

Moving Forward

These categories are not intended as comprehensive or even clearly demarcated. Some of the most interesting areas incorporate two or more of them, for example, social games that are based on physical locations and activities (e.g., through mobile augmented reality or game consoles like Wii or Xbox 360 + Kinect), or the ways in which the social objects in Health 2.0 often include life-threatening or life-saving aspects not typically present in other forms of object-centered sociality. And, of course, new categories are sure to emerge as social media continues to evolve.

As this forum unfolds, I hope you find the articles informative and provocative. You may not agree with everything that is written here, but I hope we will at least entice you to think about HCI and social media in new ways. Ideally, the articles themselves will prove to be engaging social objects, worthy of comment and critique, so that this forum will exemplify social media in both form and content.

I welcome your input about topics to explore and/or people to explore them, as well as feedback on the ways in which we might better approach these explorations.

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DOI: 10.1145/1925820.1925825
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The boundaries between "the digital" and our everyday physical world are dissolving as we develop more physical ways of interacting with computing. This forum presents some of the topics discussed in the colorful multidisciplinary field of tangible and embodied interaction.

Eva Hornecker, Editor

The Role of Physicality in Tangible and Embodied Interactions

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Olivia Newton John's popular single "Let's Get Physical" came out in the early 1980s, at about the same time that HCI researchers were bringing the physical world back into computing by inventing new interfaces that let you talk, move, touch, and gesture with them [1]. Within HCI, Hiroshi Ishii and his tangible media group were among the first to explore the merging of form and computation in the late 1990s. They were looking for ways to bring the richness of physical interaction into the sterile world of digital information. Technological advancements and a better understanding of the psychological and social aspects of HCI have led to a recent explosion of post-WIMP interaction styles, in which many novel input devices draw on user skills in interacting with the real world. Artists and interaction designers are embracing these possibilities, especially since the availability of rapid prototyping toolkits like Arduino. Physical computing has emerged as a culture of tinkering and making interactive things, which involves fast prototyping with electronics, reusing and scavenging existing technology. At the same time, "intelligent" devices have spread into all fields of life and work. This has required product designers to design complex, digitally controlled behavior, which has no inherent relationship to product form, and to explore intelligent, adaptive form [2]. In reverse, the notion of a tangible user interface [3] required HCI researchers to consider physical form factors, choice of materials, and so on.

Tangible and embodied interaction (TEI) is now an established field of research and design practice that focuses on the implications and new possibilities for interacting with computational objects within the physical world. It constitutes a deliberately broad view that encompasses a wide scope of systems relying on embodied interaction, body movement, tangible manipulation, and physical embodiment of data, being embedded in real space and digitally augmenting physical space. It covers approaches from HCI, computing, product design, the physical computing tinkering tradition, robotics, and the interactive arts. By providing a shared concern for designers, artists, social scientists, and technologists alike, TEI has become a meeting place of disciplines seeking inspiration and insight, trying to understand what the other might have to offer.

When I started my Ph.D., people would stop in when our lab door was open and ask in disbelief, sometimes mockery, why we were playing with wooden blocks. Our work seemed even more obscure when we explained that we were wearing data gloves to track how we moved blocks and other pieces around. From this tracking data we simultaneously generated an executable digital model, which could then be projected back into the physical space, showing us the outcomes of our design decisions in simulations. Much has changed, fortunately. Whereas in the late 1990s, specialized hardware and expertise were required to build a prototype with comparatively simple functionality and abominable usability, building tangible interfaces is now a standard project assignment in many industrial and interaction design courses. It has become significantly easier to build systems, and with the ACM-sponsored TEI conference, this kind of work has turned into an established field. Yet we still encounter this peculiar mix of envy (*you're allowed to play?*), skepticism (*is this really research?*) and fascination (*cool stuff!*). The irony is that as a research area, TEI is still young and smallish, yet augmented objects permeate our lives.

TEI investigates an augmented physicality that takes us away from the desktop and searches for other ways of interacting. As we start to embed computing in the everyday environment, this requires design-

Photograph by Evan Grant

ing the digital and physical together. It also requires us to design new types of interaction that enable the user to directly interface with the computer in ways that require fewer intermediaries and that fit better with our innate abilities. In a way, tangible and embodied interaction implements the vision of media-artist and technologist Myron Kruger, who advocated increased physical engagement and direct interaction. While Kruger's 1970s and 1980s installations mostly relied on the recognition of users' silhouettes from video, using these for shadow-play interactions, we now employ a broad spectrum of mechanisms.

Whereas Kruger had to pay for the use of computing resources by the hour, we can now buy an XBox Kinect for around $150. The new genres of computer games supported by Kinect or the Wii fundamentally change the social dynamics of play, reaching new user groups, creating new kinds of computer games (could you imagine doing yoga with a keyboard?), and implicitly change the ways we define and see computing. Numerous open questions relate to how these computerized artifacts (not just those that are games) affect us.

Can they improve learning? How do they change play behavior? Might they help disabled children learn new skills? If we embed computing in the environment, should it be visible or invisible? Can interaction with physical objects support tasks with abstract content and scale to complex problem-solving tasks, or does it prevent us from reflecting? How do we perceive responsive artifacts—will they appear to be alive, and is this good or bad? Is interaction through bodily movement more effective than keyboard

and mouse interaction, or do we just trade one kind of repetitive strain syndrome for another? Will the Wii-arm be the next medical condition? What might constitute aesthetics in movement interaction?

So far the field is characterized by exploration, building of design examples, and playful investigation of new technologies. As it matures, so has interest in theory grown. When we started our research in this field in the late 1990s, we began to wonder why the prospect of tangible interfaces enthralled us so much. What was so satisfying about being able to touch and physically manipulate computing by handling some wooden blocks on a table [4]? What had been missing before? Might these blocks be helping us to externalize our thoughts, as embodied and distributed cognition theorists suggest? How do physical affordances help? This in turn led us to more philosophical questions surrounding the notion of embodiment. What does it mean to have a body? And if we can't escape our body, can there ever be something like non-embodied interaction? Should we base all post-WIMP interfaces on the model of reality-based interaction [5]?

Objects, Bodies, and the World

"Tangible and embodied interaction" provides a broad umbrella description for a research field united through an interest in the role of physicality. There is the physicality of our own bodies, the materiality of objects, the physical world in general, and the physicality of space. We touch and feel objects. Our bodies are living, experiencing, and feeling bodies. Tangible objects and our bodies are embedded in a physical space that we experience and interact in and with.

These physicalities intersect in interaction. Tangible interaction merges physical form and computation, resulting in interactive and responsive form [2]. Through tangible manipulation of objects we experience these physicalities through our senses. The tactile sense is multimodal: Touching something fires a whole battery of sensors and nerves; we feel resistance, temperature, surface quality, softness, weight, and more. The word "tangibility" refers to the peculiar double-side characteristic of the sense of touch—that one cannot touch something without being touched oneself, being at once active and passive [6]. The tendency of Western philosophy to take vision as our primary or highest sense has led to the demotion of touch (as well as smell) as a lower sense, claiming it does not allow for abstraction and detachment [7]. But from an anthropological and phenomenological viewpoint, the sense of touch reminds us that we are embodied beings [6]. Touch forms the permeable border between outside and inside, enabling primary experience of the world, and reassures us of our existence [8]. But because touching something always means a close (and potentially dangerous) encounter, touch is responsive and dialogic and can be deeply emotional; the aesthetics of touch have immediate emotional responses. Material properties can influence the interaction experience—weight or heft increasing importance, or softness making something more likable—and can be read and interpreted along with visual characteristics, contributing to the meaning of objects. Besides active touch, our body has a wide range of kinaesthetic, tactile, and proprioceptive senses, which until recently have been relatively ignored in discussions of sensory perception but influence our well-being. Focusing on lived body experience, we may ask: What is the sensory experience of moving when interacting with this system?

We may think of space as abstract and non-physical, yet lived space is physical. We cannot escape spatiality; we are spatial beings. We live and meet each other in space. The tangible objects in an interface exist in this "real" space that we live in and become part of this space. Big objects may contribute to structuring the space, changing how it is interpreted. Movement and perception are tightly coupled. Since we interpret spatial qualities in relation to our own body, spatial relations attain psychological meaning. A room that we encounter for the first time and know nothing about may have a specific atmosphere and invite a particular kind of usage. Architects and interior designers are experts in designing space to do this. This does not imply that we are physically determined (this rather is like a field of intersecting forces) [9]. Real space is always inhabited and situated, becoming place. Over time, by inhabiting space, we appropriate it, interpret it, and give it further meaning. The relation is bidirectional. People might identify existing physical affordances for new uses of a given place (think of skateboarding and parcours), which then changes its meaning through the new (socially and culturally defined) use.

Ten years ago, Paul Dourish published his seminal book on embodied interaction, which greatly influenced thinking in HCI [10]. Seeing another Ph.D. student carrying this book or displaying it prominently on their bookshelves was like a secret Freemasons sign that triggered discussions ("Did you understand this

bit here?"). Dourish highlights how embodied interaction is grounded and situated in everyday practice, constituting a direct and engaged participation in a world that we interact with. Through this engaged interaction, meaning is created, discovered, and shared. Embodied interaction is thus socially and culturally situated. But phenomenologists and ecological psychologists would argue that being situated also means being situated in a body: Your body affects your experience of the world, changing your viewpoint quite literally as well as your experience of the world in terms of what it allows you to do (Husserl's "I can's"). In this sense the physicality of our bodies is tightly linked with our experience of the physicality of our surroundings. Physicality is a central aspect of embodied interaction. We are incarnate, physical beings that live in a physical world. Humans are not abstract cognitive entities (the Cartesian view of cognition); our bodies and active bodily experiences inevitably shape how we perceive, feel, and think. As McCarthy and Wright remind us, user experience is on many levels [11]. Extending their emphasis of felt life, our understanding of embodiment includes the "user experience" of the felt body. This may include both the ergonomics and the experienced aesthetics of movement [12, 13]. In embodied interaction we have to consider the experience of the living human body, as well as the materiality of the world we interact with and live in. This can call us to explicitly design for bodily experience, for the moving and feeling body, and to exploit our bodily intelligence.

A Meeting Place for Disciplines and Approaches

We enjoy breaking away from the screen, devising and experimenting with more physical ways of interacting with computing. The division between computation and traditional materials has become fluid, especially considering electronic paper and fabrics. Tangible interaction design transgresses disciplinary boundaries, requiring "a mashup of skills and methods," as Baskinger and Gross argue [2]. The approaches are diverse, making this a lively, intrinsically interdisciplinary field where designers and artists tackle engineering challenges and engineers learn about interaction and form design. This makes for a stimulating and dynamic meeting place of disciplines. Artists and designers are looking for engaging means of expression and interaction. For many product designers, TEI may already be a given: Integrated appliances permeate everyday life, and physical interaction has been their daily bread for decades. In a way it is a return to the roots of product design, using complex physical interaction mechanisms instead of merely sticking screens and buttons on devices. We are just rediscovering that physical interaction may increase both usability and enjoyment.

When we think of tangibles beyond small blocks on a table and change scale, we discover architects thinking about reconfigurable spaces and interactive furniture. Hardware tinkerers build new toolkits and solve mechatronic and engineering challenges to overcome the static nature of physical objects. Research on actuated tangibles has us talk to robotics, mechatronics, and material sciences. HCI and ethnographic fieldwork research investigates how these old and new devices and products are being used. In these analyses, the material aspects of interaction become more prevalent as objects can be handled off-screen, moved about, shared, and passed on to collaborators. This extends CSCW research (i.e., workplace studies) to think more of physical-digital resources and objects instead of on-screen digital versus traditional (i.e., paper-based) resources. Maybe at some point the physical-digital distinction stops making sense altogether.

On a more conceptual level the notion of embodiment has become a strong motivation for research. This rediscovery of the body has happened across several disciplines, including philosophy, cognitive science, anthropology, and in product design, which investigates the aes-

Photograph by Art Draugelis

thetics of movement in bodily interaction with products. TEI allows us to explore questions of embodiment through practical experiments.

Interactions, Not Interfaces

When we were setting up the TEI conference, we initially had long discussions about which title to choose. At the time, one of the main questions was whether to use "interface" or "interaction," both indicating a somewhat different perspective and intellectual tradition. While Tangible User Interfaces had become an MIT trademark, designers had begun to use the term "tangible interaction." I had also argued in one of my own papers that the emphasis should be on the design of the interaction not the interface, putting interaction dynamics and qualities into the foreground of attention [14]. Using the word "interaction" further encourages thinking of the tangible system as part of a larger ecology and located in a specific context. We felt that "tangible interaction" would bring together both perspectives and provide more openness, allowing for evolution of the field. The adoption of this umbrella term has supported the development of a larger interdisciplinary research community (the TEI conference series), but as a downside, results in some ambivalence as to where to draw the line between tangible interaction and other areas.

Meanwhile the conference has added "embodied" to the "tangible and embedded" title, reflecting the growing role of movement-based interaction and psychological or philosophical aspects of embodiment. Whole-body interaction is a new trend in HCI and ubiquitous computing as new technologies like the Wii, wireless motion tracking, and image-processing software have greatly increased our capabilities for using body movement as input.

A focus on physical manipulation and movement-based interaction takes Ishii's early credo serious of bringing some of the richness of interaction we have with physical devices back into our interaction with digital content, exploring the many facets of human sensory experience. An interesting development is while tangible interfaces are often portrayed as intuitive and easy to use, the advocates of movement-based interaction stress aesthetics and skill. We are most happy when we feel we perform an activity skillfully and gracefully even if it took us a painfully long time to get to this point. Tangible and embodied interaction can thus be a mindful activity that builds upon the innate intelligence of human bodies.

Epilogue

This forum aims to provide a glimpse of the discussions and approaches in TEI, reflecting the diversity of the field and the field's interest in the role of physicality in interaction. I hope you are looking forward as much as I am to the articles to follow, exploring this rich and diverse field.

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DOI: 10.1145/1925820.1925826
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"Community + Culture" features practitioner perspectives on designing technologies for and with communities. We highlight compelling projects and provocative points of view that speak to both community technology practice and the interaction design field as a whole.

Tad Hirsch, Editor

Productive Tensions: Approaching Community Technology Design

Tad Hirsch
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It's my great pleasure to introduce *interactions*' new Community + Culture forum, which will focus on designing technology with and for communities. I have spent most of my adult life involved with various kinds of community-oriented projects; I have worked in the nonprofit sector and in academia and am now based in a corporate research lab. While my own work has been concerned primarily with political advocacy, civic engagement, and community empowerment, I have an interest in and passion for the full spectrum of community technology design.

I've been reflecting on the wide range of technology projects that make some claim to community involvement. There is a lot of material to consider. Computer networks have been tied to notions of community ever since a group of idealistic techies wired up Community Memory, a network of public-access computer terminals in the Bay Area in the early 1970s. Almost four decades later, Community Memory's legacy is a dizzying array of concepts and ideas, including physical communities, virtual communities, online communities, online community managers, online research communities, communities of interest, communities of practice, user communities, support communities, community computing, community portals, social networks, social computing, social media, community media, community building, community informatics, community networks, neighborhood networks, rural networks, community technology centers, telecenters, telecottages, information kiosks, and so on.

(It would seem that technology designers have used "community" at one time or another to describe virtually any group of three or more people.)

It is beyond the scope of this article to provide a comprehensive guide to the field, or to resolve any of its many tensions and contradictions. Community technology design can be sliced and diced any number of ways. We can make distinctions between physical and online communities, between social and business concerns, between telecenters and mobile media projects. As forum editor, I hope to highlight thematics that cut across the field. I'm particularly interested in core concepts that are implicated in nearly all community technology projects and that also account for much of the divergence between methods and philosophies. Let's call them productive tensions: ideas about which there is little or no consensus, but that nonetheless shape the field. My guiding principle as I consider topics for this forum is the belief that thoughtful reflection about productive tensions helps us better understand the field, and our own place within it.

Agency

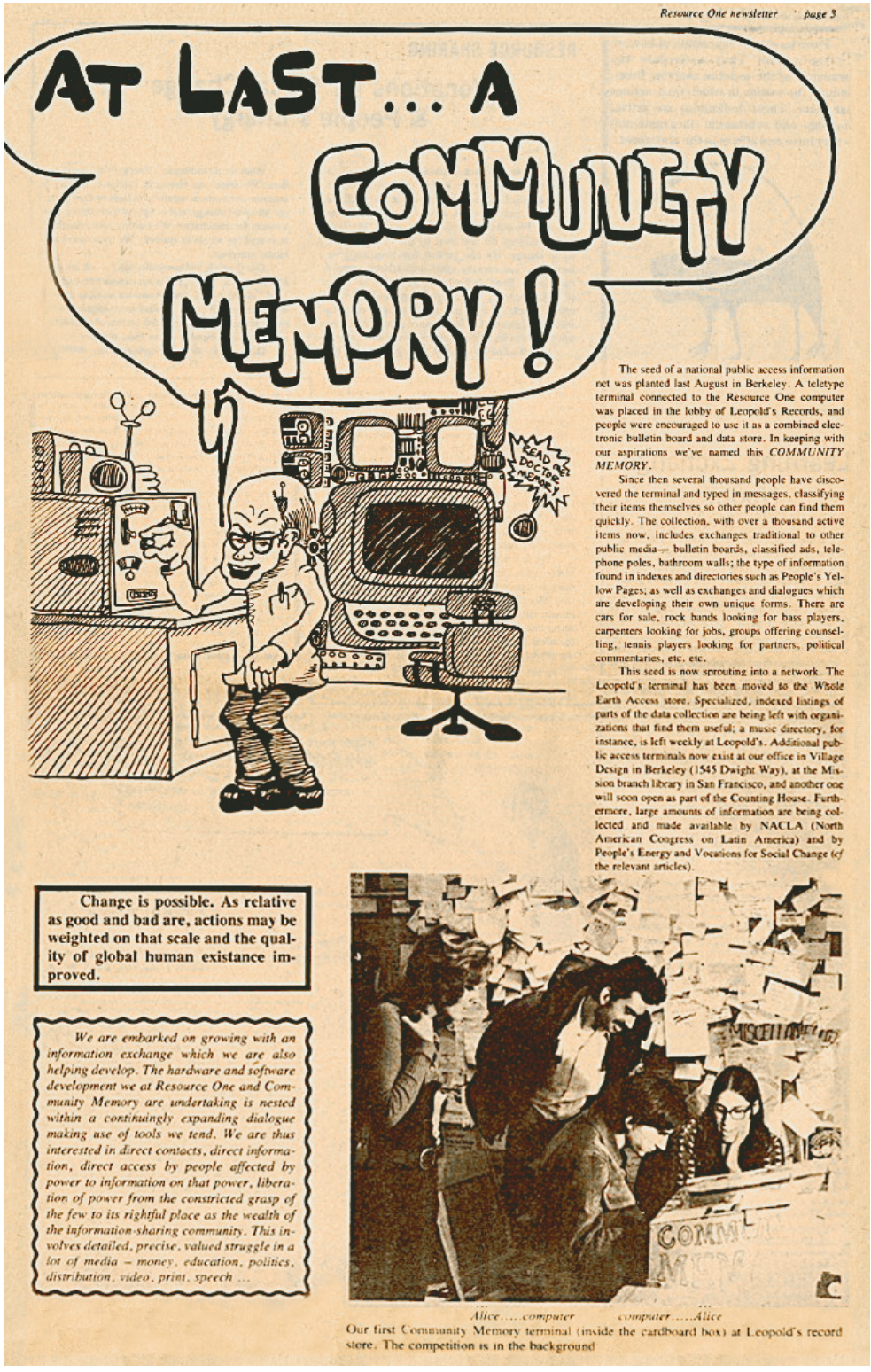
To better illustrate what I mean by a productive tension, let's consider how notions of agency play out in community technology projects. En masse, technology designers generally believe that agency resides chiefly within individuals and is expressed through decisions about which communities one might choose to join. At the same time, we understand individual agency is mitigated by a host of social, economic, and environmental factors, and that in some cases one doesn't choose to join a given community any more than one chooses one's parents. There are some communities of which one simply is a member (although the degree to which one actively participates is another matter).

While most designers will recognize this tension, there does seem to be a tendency to privilege one side of the equation. There is significant variance among designers over questions of how agency

functions in communities, which has implications for the projects we choose and the design decisions we make.

For example, one can make a meaningful distinction between projects that understand community primarily as voluntary association and those that consider a community to be a product of circumstance. The former includes all manner of so-called communities of interest or communities of practice—groups that are oriented around shared concerns or professions. Many of these communities are brought into being through the introduction of communication technologies—for example, communities that arise in online environments like Second Life, World of Warcraft, or YouTube. Other examples might include fan clubs, hobbyist networks, or professional organizations. The key characteristic is that these are all communities where membership is voluntary—members choose to join and are more or less free to leave as their interests, hobbies, or professions change.

Designers who think about communities as voluntary associations tend to ask questions like, "Why do people join?" "Why do they stay?" and "How can we attract new members?" Which in turn may lead them to focus on the material and emotional benefits that individuals derive from their community engagements. The design response to such questions is a system primarily aimed at lowering barriers and providing



▸ The Community Memory Project was the world's first public computerized bulletin board system. Users could add messages, include keywords, and find messages using those keywords.

We understand individual agency is mitigated by a host of social, economic, and environmental factors, and that in some cases one doesn't choose to join a given community any more than one chooses one's parents. There are some communities of which one simply is a member.

incentives for participation such as Facebook or LinkedIn.

On the other hand, some designers tend to focus on providing technical support for communities where membership is not strictly voluntary but rather arises out of the circumstances in which people find themselves. These are often geographically bounded neighborhoods, villages, or regions; they might also be based on, say, socioeconomic status, physical or mental health, or sexual orientation.

These designers tend to think of communities as groups of people thrown together by forces largely outside of their control. In such circumstances, collective agency and collective action often become a central focus for research and design efforts. Designers emphasize ways that members can combine their efforts in order to exert greater influence on the world around them (including on the forces that threw them together in the first place). For example, a designer might think of a telecenter not just as a place where people can come to learn job skills, but also in terms of how it can function to organize advocacy campaigns on behalf of the poor.

Obviously, this is not a categorical distinction: All communities are influenced by both agency and circumstance. And the approaches I've just described are not mutually exclusive. The online shopping network GroupOn is voluntary; members engage in collective action. Similarly, support groups like Alcoholics Anonymous are primarily concerned with providing benefit to their members and generally don't engage in advocacy. My point is simply that focusing the ways in which agency functions within and across projects is a useful way to understand the field and our own practice.

Scale

With the advent of social computing, the sheer size of social networks and online communities has increased by several orders of magnitude. Facebook, for example, has now surpassed 500 million users—more than 1.5 times the total number of people in the world who were online when the Internet bubble burst 10 years ago.

The massive adoption of social networking sites raises a number of questions for community technology designers. Many doctoral students will earn their degrees in the next several years trying to understand the dynamics of Facebook's user base. Chief among the questions they will address is whether a difference in scale really connotes a difference in kind—if the way 500 million people behave is simply a larger version of the way 500 people do, or if in fact something fundamentally changes with massive scale. And if so, we may ask, what are the implications for technology design?

More broadly, many communities wrestle with notions of scale. Whether it's an implicit understanding or a stated goal, community technology projects often operate with some notion of how many members they anticipate, the rate at which the community is expected to grow, and so forth. These factors inform decisions about physical infrastructure, financial goals, software architecture, and interface design, as well as the rules and policies that govern members' behavior.

It is worth noting that valorizing community technology by scale—the idea that Facebook's value is measured by the size of its user base—is really appropriate only for particular kinds of projects. For many geographically bounded communities, for example, the idea of massive scale doesn't make a whole lot of sense. Similarly, the notion that successful communities seek growth is also highly contextual. For example, one may fairly say that Bosnia and Herzegovina's Landmine Survivors Initiatives would prefer that the community it serves not get any bigger.

Identity and Ownership

Collective identity—the sense of "we-ness" shared among a group of people—is central to the expe-

rience of community. It is one of the key attributes differentiating communities from, say, demographics. But there are varying degrees of collective identity. Many participants in community technology projects experience a relatively weak form of collective identity: They may barely acknowledge their membership at all. But there is a wide range of experience. At its most intense, community spirit can be a source of great personal satisfaction and an engine for collective action and social cohesion. It can also lead to xenophobia and exclusion.

The extent to which collective identity surfaces in community technology projects—and what that surfacing enables—is often tied to the sense of ownership participants feel toward the project, which is largely shaped by the policies that designers establish to shape participation. For example, allowing users to exert control over a project in whole or in part or including them in design decisions encourages participants to feel that a technology offering is owned by the community, which in turn enables community engagement to arise through interactions with the system. The relationship between ownership and collective identity can cause tensions between institutions that host community technology projects (i.e., those who are legally and/or financially responsible) and the community those products are intended to serve (i.e., those who feel a sense of ownership).

Difference

While communities nurture and support their members, we should acknowledge that communities can also be fractious and unruly. Arguments and disputes are common within communities, as are factions that nurture longstanding disagreements or grudges.

Technology designers have never been particularly comfortable with tension. The rhetoric around online communities has always emphasized common interests rather than discord; when a dispute is considered at all, it is generally thought of as a disruptive force to be mitigated. Wikipedia, for example, is built around ideals of consensus and agreement and struggles to contend with ongoing disputes that defy easy resolution. But the productive power of disagreement is worth considering. Among individuals, disagreements can hone critical thinking and foster deeper interpersonal bonds. At the community scale, contention and difference are the prerequisites for democratic process.

Points of contention can also spawn innovation. Consider the role that forking has played in the development of open source software. While spinning derivative efforts off from existing projects (forking) is generally discouraged within the open-source community, forking can also be the impetus for important new initiatives that extend existing capabilities and strengthen the community as a whole. For example, Ubuntu Linux is an operating system that was forked from the Debian codebase in 2004 in response to criticisms about the rate at which updates had been released and complexity of installation.

Ubuntu has since become one of the most popular Linux distributions in the world, and the ease with which it can be installed has encouraged significant numbers of new users to begin using open source operating systems.

Looking Ahead

My goal for this forum is to foster a discussion by and for practitioners from across the field about questions and issues of mutual concern. I also hope to expand the discourse to relevant practitioners whose perspectives are seldom represented in ACM publications. In particular, I hope to foster dialog between community technology designers and artists who engage in public and community-based work. There is a long tradition of community engagement in the arts, within which there are a number of artists who work explicitly with computational artifacts. These practitioners share many of the same aspirations and deal with many of the same challenges as community technology designers, but their perspective is quite unique. I believe that we have a lot to learn from each other.

With these introductory remarks, I have tried to lay out an initial set of concerns that may provide fodder for future articles. Over the next several issues, this forum will present essays by distinguished practitioners that explore and expand the themes described here. In parting, let me also say that I am keen to hear from researchers and practitioners with compelling projects and provocative points of view. If you would like to propose an article for this space, please send a note to tadhirsch@acm.org.

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DOI: 10.1145/1925820.1925827
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Comparative Informatics

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Comparative informatics (CI) is the application of the comparative method to the study of information and communication technologies (ICTs) across diverse contexts [1]. CI systematically examines similarities and differences in the ICT life cycle—design, development, deployment, adoption, use, impact, and evaluation—in contexts including cultures, regions, nations, generations, socioeconomic classes, gender, organizations, and technologies. The objective is to generate nuanced, critical understandings of technology in human life in the world we inhabit together. The analytical aim is not laws or generalization, but heightened awareness of the uneven surface of ICT practices locally and globally. This surface is often taken unproblematically to be generically Euro-American in character, or even simply American.

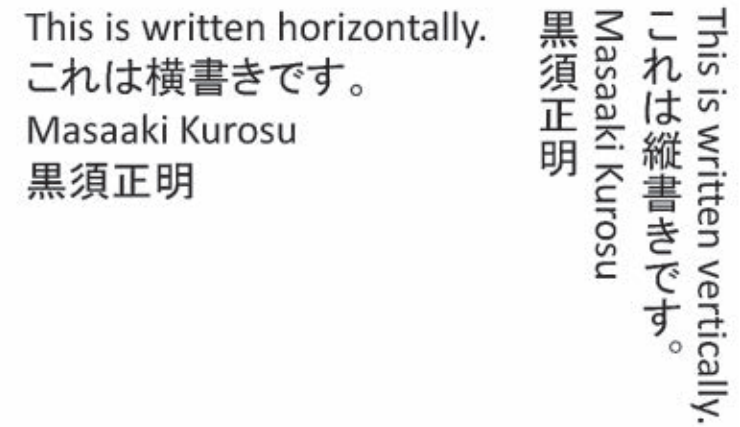
CI is motivated in part by a practical challenge: Any company designing for multiple countries and cultures must confront difference. Localization is the typical response, but often localization efforts touch only the most superficial contours of migrating technologies, leaving in their wake underserved users struggling to adapt to powerful but misaligned technologies. Understanding when difference matters for design ("the difference that makes a difference," to use anthropologist Gregory Bateson's useful phrase) is at the heart of CI.

We believe CI should center on diligent, critical, empirical analysis—what we call grounded comparison. To illustrate grounded comparison, we present a study of regional styles in word processing and an ethnographic investigation of online work groups. Both examples indicate the breadth of methodological approaches appropriate to comparative analysis, which also encompass traditional laboratory studies [2].

Grounded Comparison #1: A Comparative Case Study of Word Processing

We begin with recent work by Clemmensen [3], turning our attention to the "white rat" of human-computer interaction: word processing. Invented in California in the late 1970s, computer-based word processing rapidly attained status as a ubiquitous technology. Much of the founding research of

Photograph by Michael Caroe Andersen



▸ Figure 1. Example of horizontal and vertical writing in a Japanese word processor. Copyright 2011 Masaaki Kurosu. Used with permission.

▸ Figure 2. Effort involved in typing the word "Maharashtra" on a mobile phone. Reproduced from Katre (2006).

	KEY STROKES				TOTAL NUMBER OF KEY STROKES
Devanagari	म	हा	रा	ष्ट्र	
Nokia 3195	5	10	3	18	**36**
LG RD 5130	5	9	3	38	**55**
Samsung	2	4	4	8	**18**
English spelling of *Maharashtra* typed using all mobile phones	20				**20**

▸ Figure 3. The numeric codes for Danish letters æ, ø and å.

æ : 0230	ø : 0248	å : 0229	Æ : 0198	Ø : 0216	Å : 0197	@ : 064

HCI is concerned with this office-work task [4]. Given its basis as an anchor of conceptual development in HCI, word processing might be expected to be a technology with few or insignificant differences in styles of usage across the world. However, when we compare how word processing is developed and used across regions, important and sometimes subtle differences in HCI appear.

National differences do not by themselves necessitate deep differences in the design of technology; such styles are themselves changed by new technologies. New forms of human-computer interaction may emerge, or are required [5]. The question is: Will normal work processes and organizational changes, with sufficient time and effort, successfully overcome disruptions in the task-artifact cycle, or will forms of HCI emerge as negative and controversial?

Word processing in Japanese and Hindi. In HCI, the case of the introduction of the Japanese word processor is quite famous. Early on, Ito and Nakakoji pointed out that although the design of most American word-processing software was based on the typewriter metaphor, the use of this metaphor required a major shift in practice to print characters for Japanese people [6]. Most used hand printing until word processors became available; typewriters were not common in Japanese society. Japanese handwriting was accomplished within a 20x20 grid, written from top to bottom, one column at a time, and right to left. Tab stops were unfamiliar, and document length was measured in characters, not words.

We can only guess how word processing might have looked had it been developed in the context of the Japanese writing grid. An age-old tradition was destroyed by the introduction of new technology. At this point, the Japanese do not desire a different kind of word processor; they are used to the typewriter-look-alike word processor [6]. However, hybrid forms of word processing have emerged. MS Word (Japanese version) and Ichitaro (a Japanese word processor) allow Japanese writers to type vertically as well as horizontally, according to professor Masaaki Kurosu at The Open University of Japan [7]. Today most academic papers are written horizontally, because such texts use alphanumeric words, except for some social science and literature papers. Newspapers and comics use the vertical format, simply because of tradition. The grid is used for hand writing, which is sometimes used by writers; Ichitaro displays that grid for special purposes. The grid is not widely used today, because horizontal writing is the default for many word processors.

The changes that word-processing technology brings about in non-Latinate language cultures may be difficult to assess and sometimes surprising. Katre compared the number of keystrokes necessary to write the same word in different languages and on different mobile phones [8], showing in one case that it requires 38 (!) key presses to enter a specific sign in Hindi on a mobile phone. We can hardly imagine how this shapes Indian users' approaches to short text messaging in Hindi. Similar examples can be found in Indian PC word processing [9].

Word processing in Danish. Less obvious, but just as important, are discontinuities within a Euro-American cultural ambit. Countries that are supposed to share cultural values and practices with the U.S. include European countries like Denmark. However, in the design of word-processing technology, this doesn't hold true. For example, a Danish blogger shares his joy in using his new smartphone; life has become much easier, as he can now process email more quickly. Among the many input methods, he prefers the PC-like keyboard. This keyboard, however, is English, without the Danish vowels æ, ø, and å. The blogger would have to switch to a Danish-language keyboard to key the Danish letters. Not wanting to do that, he has developed his own special solution:

[To switch to the Danish language keyboard] I do not want to waste efforts to do that, when I merely want to send a short message. So I practice writing without using words that include æ,ø or å. In fact it is really fun, when you have a positive attitude towards the task. It sharpens awareness of language when you have to throw away sentences because they include a word that has æ, ø or å in it [10].

The blogger, remarkably, adapted to his smartphone by "throwing away" hundreds of common words in his native tongue to avoid "wasted effort."

Similarly, in a blog posting for a travelers club, Danish traveler Anders Andersen begins with an example in Danish: *"Kaere Aase En lille hilsen fra Oestrig. Haaber du nyder Aegypten..."* (Translation: "Dear Aase, A little greeting from Austria. Hope you enjoy Egypt…") and uses it as an illustration of the fact that many Danish people recognize the old-fashioned characters used in the sentence, though they never use them in everyday writing [11]. He then proceeds to explain it is possible to write æ, ø and å on computers with a keyboard lacking these letters—by using the numeric code for each letter, holding down the alt key while keying the code for the letters (see Figure 3). For example, press and hold "alt" while keying 0230 on the numeric keypad, and the letter æ will appear on the screen.

He further writes: "…it may sound a little troublesome, but in fact it is quite easy and after a couple of letters, you will remember these numbers in your head. You will write nearly as fast as when you used ae, oe, and aa, and it does indeed look much better."

This is not the whole story; Andersen explains how to find the alt key and how to make sure the numeric keyboard is set to be numeric, and not navigation, and why entering zero as the first letter of the code is necessary to make the identification of the letter unambiguous. One could ask, which is more old-fashioned, using letter-writing forms that were outdated by the Danish language revision in 1948 (made publically available in *Retskrivningsordbog udgivet af Dansk Sprognævn* 1955), or punching in codes like punching holes in a punch card? In both cases, California-bred word-processing technology transported to Denmark sets Danish word processing back 50 years.

Microsoft Word is widely used in Denmark. Both the user interface and the help system are localized to the Danish language. But Danish-language users of Word are left with a reduced version of the software compared with English language users. Up until recently, what Danish users could not do—and American users could do—included summarizing reports by using the software's built-in auto-summarizing functions, translating words from Danish to other languages such as German or English, and dictating words into the word processor in their own language. While some Danish-language users will never discover what they do not get, Danish-language users who also write in English may become aware of these limitations in the Danish versions of Word.

These examples of declinations of Danish writing practice suggest the limitations and additional resources required to use local versions of global technologies. We believe such local differences can be appreciated through comparative studies to develop our critical sensibilities as designers and users.

Grounded Comparison #2: An Ethnographic Study of Online Workgroups

A second example is Kow and Nardi's discussion of the rhetoric and values of an influential socio-

Comparative informatics positions itself relative to certain current efforts as open, broad, and inclusive in its analytic elements. We believe that openness and breadth are imperative at this stage of development.

technical paradigm: Web 2.0. With its celebration of sharing, interoperability, user-generated content, and collaboration [12], Web 2.0 has a normative structuring that presumes and codifies values so apparently sensible and humane it seems they scarcely need be examined. But empirical inquiry suggests Web 2.0 constructs are contingent and variable across nations and cultures in ways that have not been appreciated.

In American and European contexts, online "sharing," "user-generated content," and "collaboration" evoke a scenario such as the development of Wikipedia, wherein members who actively contribute and adhere to established, publicly stated community norms are promoted to positions of increasing responsibility [13]. Wikipedia is a meritocracy of independent, self-motivated contributors, democratic in spirit.

By contrast, online workgroups in China may emerge and operate quite differently [13]. Chinese "modders" (people who write software extensions or "modifications" to commercial video games) share many of the challenges as Wikipedians: producing content, maintaining communication, creating a workable organization. But Chinese modding workgroups are organized around a charismatic leader who recruits friends to join him in developing mods. He often knows recruits in real life and socializes with them offline. While others join the group in online venues such as chat rooms, the core team, as it is known, is central to the functioning and success of the modding workgroup. The core team is small, exclusive, and tightly connected. It produces most of the mods, controls the agenda, and provides friendship and companionship. Core team members may go out to dinner and socialize informally. If they are from different locales, they gather for a festive meal when a member happens to be in town. They maintain private channels of online communication not open to the rank and file. Members of Chinese modding workgroups do not ascend to more important roles simply through hard work, as Wikipedians do; they must be on the core team leader's radar.

Core teams are not peculiar to modding communities. The term "core team," 核心团队, is used pervasively in China to denote a group of key members in an online community or at a company. The term is frequently heard on Chinese television and seen in advertisements (e.g., restaurants advertise special rooms for core-team business dinners). Modders' core teams are an adaptation of a strategic organizing principle found throughout Chinese society.

Positioning Comparative Informatics

CI positions itself relative to certain current efforts as open, broad, and inclusive in its analytic elements. While this generalized approach is at a disadvantage in generating tightly focused conversations stabilized around highly stylized categories of discourse, we believe that openness and breadth—geographically, historically, and intellectually—are imperative at this stage of development.

CI aims to create and promote a global program of inquiry in which the analytic gaze may come to rest on any IT practice anywhere. This aim is particularly germane to research framed in a critical perspective in which relations of dominance and authority arise within and across First World locales—as well as in the developing world—and in research in which powerful institutional actors impel IT practice. For this reason, postcolonial perspectives, while useful, are not exhaustive; other cultural and historical circumstances and events may be of more importance, such as current global political activity.

CI departs from approaches such as Hofstede's, in which a small set of putatively stable cultural differences organize analysis [14]. The translation and transportation of culture theory in other academic disciplines to ICT settings create a perpetual loop of self-reference and self-inference rather than advancing understanding [1]. The purview of CI is larger than a discrete set of differences, including but going beyond culture to other differences, even differences that arise from a sin-

gle individual, as with the Danish bloggers. CI is, furthermore, oriented toward change, regarding it as inevitable in IT practice.

CI is sympathetic to popular notions of appropriation and domestication of technology that permeates the literature, but at the same time, CI's commitment to interrogating and conducting design, and accounting for powerful corporate and governmental institutions enmeshed in design activity, is paramount. In particular, providing academic resistance/dialogues to corporate and governmental interests is a key facet of CI's critical attitude. End users and consumers constitute elements of a complex system to be apprehended through a logic in which institutional forces remain visible and potent.

Grounded comparisons have clear design implications and should shape discourse that shapes design, even if comparisons do not indicate immediate business strategies. A goal of research is to open novel vistas of thought and to populate them with rich descriptive and analytic materials that carry the capacity to inform, provoke, and edify discussions in arenas of practical activity. CI can admirably serve this role by underwriting reflection and analysis, heading off scenarios in which we are liable to uncritically export what is taken for granted in the West (or the U.S. or California) to the rest of the world, lacking sensitivity to geographies and other dimensions of difference. By the same token, just as universal design in architecture and interior design emerged from the specificities of disability, grounded comparison potentiates the discovery of new "universals" as it reports and reveals precise, distinctive human experience in diverse arenas, experiences to tactically appropriate in multiple contexts.

While the idea of comparison is hardly new, by putting a name and a face to it and deliberately placing it within the warrant of informatics, we hope to promote and systematize comparison as an essential element of our practice. We desire to build a community of scholars and practitioners laboring together to forge denser, more global networks of collaboration in order to animate and transform what we regard as necessary comparative inquiry in informatics.

Acknowledgments

The First International Workshop on Comparative Informatics was convened at the Copenhagen Business School August 22–23, 2010. The Workshop was supported by a grant to Ravi Vatrapu under the First International Network Programme of the Danish Ministry of Science, Technology and Innovation. The Workshop brought together an international group of ICT researchers to develop a CI agenda. Participants were: Ravi Vatrapu, Torkil Clemmensen, and Janni Nielsen of the Copenhagen Business School; Ellen Christiansen of Aalborg University; Ruy Cervantes and Bonnie Nardi of the University of California, Irvine; Mara Miller and Scott Robertson of the University of Hawaii at Manoa; Zhengjie Liu of the Dalian Maritime University, China; and Yair Amichai-Hamburger of the Interdisciplinary Center, Herzliya, Israel.

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DOI: 10.1145/1925820.1925828
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Digital Interdependence and How to Design for It

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This article is about interdependence and what that means for design. It is about how computers, in particular those that are networked, have the potential to make global relations more apparent to us. And it is about how we, as interaction designers and design researchers, use this knowledge to support lifestyles in which these diverse connections are acknowledged and celebrated. What happens to interaction design if we keep social and causal links in the foreground and look beyond user experience? In these pages, I argue that it means lifting our heads from our computer screens and taking a whole-cost view of our work. And it means designing with networks to stress our interdependence and drive recognition of it.

The concept of interdependence used here is drawn from literature on child development. A baby is dependent on caregivers. As the child grows, he or she becomes independent. But a fully rounded adult is not independent of all care, responsibility, or ties.

Interdependence is a desired state in which links with others are recognized, acknowledged, developed and delighted in. Applied here, interdependence involves an acknowledgement of the interconnectedness of life: social, cultural, and environmental factors in all their richness [1]. (See "Stories of Interconnectedness," which suggests how these facets interrelate.) To work toward interdependence in this developmental sense is to recognize the impact of and collectively seek to interpret causal chains, which as individuals and societies we frequently ignore, not least because the impact of these chains is difficult to anticipate, attribute, or control. And it is to celebrate the interaction of social, cultural, and environmental factors for constituting us and making life meaningful. If interconnectedness is a fact, then interdependence is a goal.

My reason for talking about these relations now is political; we are facing an environmental crisis precipitated by climate change and exacerbated by profligate use of resources. Humans could use a groundswell of joined-up thinking.

However my reasoning also draws on something particular to the applications we can now build using digital networks. Digital networks harness the processing power of computation and support new platforms for connecting. Two new kinds of connection are relevant here. The first is social, characterized by Web 2.0 tools. Anyone with the right access can now find and organize people with specified characteristics across time and space—be that globally or in our own locale—and engage in generating materials with them. The second kind involves combining information sources. This might mean attaching data to physical objects or using specialized sensors to collect new types of information. Searching and cross-referencing major data sets to gather inferences provides insights into physical, social, and economic challenges. For instance, inference is already used to combat fraud by monitoring spending patterns, to join patients with suitable organ donors within a viable distance, and to create advertising targeting particular characteristics and desires.

If we combine the potential of connected groups with that of connected data, the mix could make a powerful force for informed change.

However, networked media does more than connect, it highlights connection. We notice people and organizations that use digital networks because they pop up on Twitter or Facebook, we read about new business paradigms involving collaboration, and we mull over predictions about the Semantic Web. Networked media makes this

▸ An RFID label on a wine bottle, when set on the accompanying RFID coaster, can provide various kinds of tracking information.

Photograph by Tod Kurt

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Stories of Interconnectedness

- On a street in the UK, an art collaboration posts bold demographic stereotypes on billboards and other public advertising locations so people can see what officially typifies their area. Residents are invited to make short reflective videos about the detail of their lived experience in the locale to counter these broad-brush statements drawn from census data. The stories are assembled on an interactive map available at local centers and on the Web so that others too can contrast market-research narratives with those of everyday life. The project invites citizens to think about who they are, how they are, and how they would like their communities to be, making way for a new understanding of the places people share (http://www.worldchanging.com/archives/007657.html).
- In regions of Congo, rebels clash over which faction controls the mines in which rare coltan (or columbite-tantalite) is found. It is used in the manufacture of cell phones and other digital artifacts. Warlords routinely use child workers and slave labor to extract minerals; the money from sales fuels war. Conflicts worsen when there is a surge in worldwide production and the value rises. Some governments have now acted to require consumer electronics manufacturers to declare the source of their coltan and/or ensure that none of it comes from Congolese rebel mines—with the further effect that companies are avoiding all Congolese coltan. (http://www.globalwitness.org/library/do-no-harm-guide-companies-sourcing-drc).
- At a conference on DIY citizenship (http://diycitizenship.com/) in Canada, a researcher shows a website recording the breadth of activity in the gas and oil fields of the U.S., collecting together the incidents—such as explosions and leaks—from the 34 active gas and oil exploration states to give a picture of the environmental and social threat bad practices cause on a daily basis. With the help of a specialist in neurological diseases, she explains that same website may offer the first chance of finding a link between public health and drilling energy reserves as people post reports on the strange health symptoms afflicting them in the areas where obscure chemicals are used to extract gas and oil when it is distributed finely through rock. (ExtrAct, eg: http://www.landmanreportcard.com/)

Photograph by Kevin Carter

▸ Landscape/Portrait, a collaborative effort between media artist Kevin Carter and artists throughout the UK, critiqued the role demographics play in defining a portrait of an area and its community.

connected way of life more visible, but it does not automatically make its own impact visible. Indeed, it easily masks this impact by allowing places and people without connectivity to fall off the map. So, in considering the power of networks, we must also consider the social geography of digital connections. The last reason to consider interdependence, then, is to consider how new forms of engagement supported by digital networks can disadvantage some while offering opportunity to others.

I was working on the Fair Tracing project (http://www.fairtracing.org) when I started to appreciate the importance of interdependence. Fair Tracing was conceived in response to the way product-tracking technologies supported by digital networks make it easier for large manufacturers and distributors to manage logistics and legal requirements for accountability to customers. They do this by joining up the commercial chain of production and allowing information to be labeled, searched, and sorted effectively. For instance, in Britain, the food and clothing chain Marks & Spencer has RFID-tagged products that, when scanned, will report on where they are to be placed in the shop and when they are sold [2]. These goods are part of an elaborate forecasting and management system that allows the merchandiser to control the passage of products through its hands—batching them, optimizing placement, and reducing costs associated with storage.

Fair Tracing received research-council funding under the Bridging

Related reading …

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the Global Digital Divide initiative of the EPSRC (Engineering and Physical Science Research Council) to look at the potential for offering small producers across the world the same tracking benefit as big companies are realizing, with the added opportunity for marketing through tracing—showing provenance so that customers can judge production methods and their impact. Could the research team design a system that gave micro-enterprises the means of tracing their output through the necessary stages of production, eliminating unproductive stages and presenting their wares, with social, economic, and environmental production information, to interested consumers? Could we create an open-source tool that each player in the production chain (including the consumer) could use to share information? We spent three years testing the viability of four aspects: Web 2.0 tools for sharing video at each stage in production; auto-capture to collect more mundane product data from traders' computers; electronic authentication to endorse the information's provenance; and the Web to make new markets in buying directly from producers. Specifically, we followed two ethically grown products, Indian shade-grown coffee and Chilean fair-trade wine, from soil to supermarket [3].

The team discovered that most of the collaborating micro-enterprises were far from ready to make video or have their data snatched automatically by adding some code to their business systems. They were sending handwritten product infor-

mation between stages in the production process, sometimes supplying no more than details to ensure that the right money could be paid to the right person. This was not a surprising result. But many micro-enterprises could see the value of tracking technologies to understand how to optimize the value chain to the customer from their end. Benefits could include more direct business, more profit, and more control over their product. Not only might there be benefits to being part of an open information system (tracing), but there were also drawbacks to being involved with a closed information loop (tracking) that did not extend as far as their business and was controlled by other interests. Micro-enterprises with paper-based accounting practices were unable to share in the commercial advantage of tracking, such as more efficient management of resources, or greater information about turnover and profit. Nonetheless, they were feeling the pressure of working in systems with those who could benefit: Operations were expected to become more streamlined, produce more data, and dovetail with scanning systems run by the distribution centers and stores they were supplying. And for the most part, no information and none of the profits of improved efficiency came back to them. Despite being in the midst of substantial quantities of rich product information, our producers were watching the tide leave them further adrift from the big players than ever before because they lacked the means needed to enter that information and process it [3]. It was a situation where the business world was getting harsher for the least powerful and least well equipped.

The ease with which new connections work for some and the impact on those left behind offer an ethical carrot and stick to thinking about interdependence. Fair Tracing research included evidence of the connection between use of tools in one part of the world and reduced self-determination and earning power in other parts. I was concerned as a consumer, and, further, I was implicated as a designer of technology [4].

Given the Fair Tracing tool was intended to support decisions using environmental, social, and economic production information; given the team found many moments when the three kinds of data conflicted, or were in other ways inadequate in choosing a path; and given the problems identified with capturing information and getting it into the system, it would be naive to pin our hopes on any simple process. But some policy initiatives are inviting accountability (see, for instance, San Francisco's 2005 policy to consider city procurement in terms of potential impact on human health and the environment and the availability of environmentally preferable alternatives, (http://www.sehn.org/sf3year.html). And some consumers are requesting a more informed way to make choices about lifestyle. We have this powerful networking tool at our fingertips—what is a designer to do?

I offer a disclaimer here. I am far from the first person to suggest joined-up design thinking. Further, network utopians abound. Some of their predictions are even beginning to play out, though class, race, location, education, beliefs, and values are significant in determining where and for whom. (For instance, about 40 percent of people in South Yorkshire, UK, where I work, do not use the Internet.)

I am not making predictions, but I have noticed that once a suggestion is in the public domain it becomes potentially self-fulfilling. So this article is meant as a provocation about practice. It is a call to design for the future, not the past. Much interaction design looks closely at existing user preferences, stakeholder needs, legacy systems, and incremental improvement, and less closely at impact information, long-term trends, or broad outcome-based targets about future quality of life. It is also a call to design for living with tools, not only the act of using them. This is the opposite of user experience, focusing on the moment and the equipment. It is to balance personal and immediate issues, such as usability, acceptability, and branding, with more social and enduring value.

So, what would design for interdependence using digital networks involve? Here are some thoughts...

Design resources and interfaces to resources. Show impacts that we couldn't aggregate and assimilate in earlier times. Provide the means to link cause and effect, establish provenance, and take apart and reconstitute the whole cost of production. Satisfy different levels of curiosity about data (and metadata giving provenance to data) for consumers, for people collaborating to collect group expertise, and for professionals responding to provenance-related legislation and driving corporate social responsibility (CSR). Make, show, and scale alliances [5]. Design to identify the sweet spot involved in successful trade-offs between activities. Design to manage and sustain limited sources of materials, time, and enthusiasm.

Design for connectivity and its absence. Online tools are often used to take attention away from situated concerns, but they can be made to direct focus anywhere. Use imagina-

tive interfaces to connect the global, local, physical, and virtual and bring everyone together for collective activities, value creation, combined purchasing influence, etc. Design for deliberate and accidental non-users, for mediators, and those people who rely on mediation for their access. Include the world beyond those connected and design to make resources available without the need for specific equipment or skills.

Design for active membership of society. We are increasingly able to analyze and report on our social/physical environment and well-being. Use these insights to reach beyond judgments on others' behavior. Social norms theory suggests that individuals' actions can be moderated by contact with the actions of their social group, but this is a finite model for social transformation. Challenge persuasive tools that inspire shame, manage conformity, or discourage undesirable activity with those that work to fire up people's sense of agency, love of inquiry, and desire to solve problems. Harness local wisdom as well as data on local conditions. Design to make people forceful and responsible.

Design for sharing. Use terms that capture supportive relationships in the household ("cohabitants"), locale ("inhabitants," "neighbors") or wider world ("citizens"). Affirm that we are each a custodian, rather than "consumer," "audience," or "user" (suggesting dependence), "designer" or "creator" (suggesting independence). Look beyond community. Interdependence forces consideration of social justice and complex resource-sharing issues. In any given locale, support negotiation across different groups and the inevitability of shifts in the balance of power. Interdependence involves seeking temporary equilibrium and building societies that transform and innovate well. Design for learning and growing together, for responding to emergent trends and handling flux.

Design to engage the powerful and protect the vulnerable. There is public relations value in responsible design. Give those controlling money and audiences a reason to buy in. As more tools are developed for exploring CSR, as open data legislation impacts, and as information about practices circulates, big commercial interests have more incentive to sponsor this work. But design also for the people in conflict with the biggest players about what should exist in the public domain. Make communication tools that inspire trust by balancing integrity and anonymity. Design to shelter exposed roles and sensitive information, acknowledging how different sensibilities may be.

I propose these five themes to spark debate. A lot is being written about new forms of consumption with many practical examples, such as Botsman and Rogers [6]. However many business writers are taking only a consumption perspective and offer limited analysis.

As designers and design researchers, we are not only observing change; we are also invested in making it. This has always called for a detailed understanding of materials, tools, and purpose. I've suggested here that the socio-technical systems around digital networks are particularly lively materials, and it is these systems rather than any particular application that should be our fabric. That way our practice can encourage timely reflection and offer the inspiration to act on it. We can cooperate to make tools that investigate our impact on the world and promote a sense of agency in those adopting them. We can resist the short-termism of design that generates financial profit at a cost to every other measure. We can understand interaction design as a means of promoting interdependence digitally, through discovering unstated links and making new connections in people's lives and minds. Designing for interdependence is yet more difficult than designing software. However, it has never been more important to look past our tools to the relations engendered by them, and there has never been so much information on impact to help us try.

END NOTES

[1] The term "interdependence" is drawn from my cultural perspective and throws attention on negotiated relations, however, it has similar commitments to *Ubuntu* in Sub-Saharan African life. See Winschiers-Theophilus, H., Bidwell, N.J., Blake, E. Kapuire, G. and Rehm, M. Being participated: A community approach. *Proc. of the 11th Biennial Participatory Design Conference,* (Sydney, Australia, Nov. 29 - Dec. 3). ACM, New York, 2010, 1-10.

[2] Light, A. Bridging Global divides with tracking and tracing technology. *IEEE Pervasive* 9, 2 (2010), 28-36.

[3] Marks & Spencer is used here as an example of cutting-edge practice in retail management. It was not involved in our research. This article does not suggest that any company deliberately undermines small producers.

[4] Fair Tracing did not produce a blueprint for a tool, but defined a socio-technical opportunity space and passed its findings to the Karnataka state government, India, which set up a working group. See Light, A. and Anderson, T. Research project as boundary object: Negotiating the conceptual design of a tool for international development. *Proc. of the 2009 11th European Conference on Computer-Supported Cooperative Work* (Vienna, Austria Sept. 7-11) 2009.

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DOI: 10.1145/1925820.1925829
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What I Learned on Change Islands: Reflections on IT and Pace of Life

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Our role as IT designers is to imagine and create the technologies of the future. In doing so, we are taking part in an ongoing cultural process of modernization that, since the early 20th century, has emphasized values such as expanding choice, productivity, and controlling one's time.

I am writing this article over what is nominally my Christmas holiday. Although the university is closed, work-related email messages regularly pop into my inbox from colleagues back home, reminding me that a professor's work is never done. If I don't feel like handling them, I can always spend time cleaning out my personal inbox, which is backed up with friendly email and notices from Facebook I haven't had time to deal with in the busy weeks of wrapping up the semester. Although I am 4,000 miles from home, I am taking care of my chores and errands online. Even if the local stores are closed for the holiday, there is still a world of e-retailers I can peruse to find the best goods at the lowest prices. In the always-on, always-accessible world of online activity, there is always more I can do. Although I take advantage of these opportunities, I am not convinced this is a good thing.

Though computers are attuned to it, they did not create this world; the cultural drive to continually use our time productively and to expand our range of choices predates computers. The modernist worldview that arose in the late-19th and early-20th centuries, inspired by scientific and technical advances, espouses the use of rational choice and means-ends analysis to optimize our activities and control our lives. This orientation is reflected not only in the technologies that we develop but also, and more insidiously, in our everyday habits as Westerners, and perhaps especially, dare I say it, as Americans. Though I understand it only imperfectly, the set of everyday strategies to optimize time use that have driven my career have become so much a part of me that I no longer experience them as such. Disciplining myself to work quickly and efficiently, continually seeking to fit more into a given period of time, and seeking out more information that will help me optimize my behavior and my

choices culminate in a thoroughly modern way to be.

In this context, task-oriented IT solutions fit such strategies and perceptions, hand to glove, and thereby reinforce them. My calendar software helps me control my work and personal time: good. The Web increases my options in goods and services: good. Search engines help me to find more information and use it to optimize my decision making: good. Everyday, mundane use of software reinforces modern habits. In small ways, without my being fully aware, they nudge me to become more modern.

I would like to share a story about my experiences, specifically about how I became aware of how I oriented to time and work and learned to orient to time in a new way. I use this narrative to raise more general questions about the experiences of time and work that are tied to being modern, and the ways in which we build them into contemporary software solutions. What does it feel like to be modern? How does the way we design and build IT solutions reflect a modern worldview? What are the shortcomings of this orientation? And what might it mean to build technologies that reflect a nonmodern point of view?

Change Islands

On June 30, 2008, I drove a Honda Civic, packed to the gills, off a small, rusty commuter ferry onto Change Islands, an archipelago off the northeast coast of Newfoundland, Canada, 1,600 miles from my hometown of Ithaca, NY. A gravel road led through 12 kilometers of stunted evergreen forest and shrubby marshes to the traditional fishing village of Change Islands, population 300, where I would be spending the next six months living and working in a clapboard house by the sea.

I came to Change Islands to experience a different way of life. Newfoundland, settled for 400 years, is home to one of the oldest nonnative cultures in North America. Because of protracted efforts by its residents to maintain the viability of traditional livelihoods, heritage culture on Change Islands is relatively intact. While Change Islanders are certainly modern Canadians, they maintain many traditional subsistence activities and clearly remember a completely traditional lifestyle, which began to be modernized only in the 1960s. I had found Change Islands by accident on a prior vacation to Newfoundland, and once I found it, I knew I had to study it. On Change Islands I would be able to observe, experience, and hear about a way of life with a centuries-old history, outside the mainstream of consumer culture. I hoped to use my experiences there as an inspiration to rethink the modern, urban values embodied in IT and to open a new space for design.

I arrived on Change Islands burned out. Six years of tenure

slog had established a grueling work pace as the new normal. For years, I had been vowing to get my workload under control, and for years it had remained incessantly not. The situation at home was little different, with weekends packed full of chores and tasks that I had set myself, with not enough time to accomplish them before another grueling workweek began.

This situation was not only unpleasant but also ironic. After all, my career to date had been built around the ideas that contemporary consumer society places too much emphasis on efficiency and productivity, and that we needed to take other values into account in technology design. A major focus of my work was technologies that opened up space for nonwork activities, including socializing and contemplation: precisely the things my lifestyle left little time for. The contradiction between what I designed for and what I actually did was clear. I hoped Change Islands would be a place where I could shift from overload and overwork to contemplation and reflection. It turned out to be a place where my understanding of myself and my work underwent massive revision.

Choices

The first noticeable perceptual shift that happened quite quickly on my arrival was that the world of opportunities in goods and services available to me narrowed considerably. Change Islands is an isolated, remote community. Given the ferry schedule, trips to the doctor, bank, or pharmacy on neighboring Fogo Island take about six hours, while visits for a wider range of goods and services to a larger town on the mainland generally take a full day. In the four small shops on the islands, none of which is much larger than an average American living room, a fairly small selection of goods is available. For example, fresh vegetables are generally limited to the Newfoundland root-vegetable staples: carrots, potatoes, rutabagas, onions, parsnips, and cabbage. Internet shopping is possible but is accompanied by prohibitive shipping costs.

At first I experienced these limitations as a real problem, but over time I became used to living with the available selection. I would sometimes buy exotic vegetables such as tomatoes, peppers, or avocados in a larger town, then find them languishing weeks later in the refrigerator because I didn't actually need them—what I had on the island was enough. After a while and somewhat to my surprise, I began to experience these constraints as benefits. In Ithaca, I would spend time driving from store to store or surfing the Internet to acquire the things that I believed I needed; on Change Islands, the thought that I could use something

was frequently followed just as quickly by the decision that I could easily live without it.

Because I could do less, my expectations for what I should do also were lower. Life became simpler. I began to realize that back home I spent a great deal of time and energy finding out and then doing what is "best": eating the healthiest and most ecologically responsible food, buying the best-reviewed and best-researched products, following the most optimal exercise routine, etc. Living on an island where you can't buy butter so you have to eat margarine finally led me to realize that "best" requires a lot more effort than "good enough," and "good enough" really, truly is good enough. Grocery shopping now consisted mostly of stopping by the general store on Tuesday afternoons after the fresh-vegetable delivery had come and buying whatever showed up that week. There was no need to think out complex menus; if I could just keep myself fed with something in the vague ballpark of healthy, I was happy. I lived in a fisherman's house that was small and simple by urban standards, and it was more than adequate. As Robert Ecke wrote, "In this country, anything that's good enough is plenty good enough and not to be fooled with" [1].

Because my options—in goods, in activities, in people to interact with—were so limited, I was able to expand my attention. When I first came on the islands, I was surprised at how friendly people were. Yet soon I found that I, too, was happy to visit, listen to, and help my neighbors to a degree that was unimaginable back home. Back in Ithaca, there were too many people who wanted a piece of me—people wanting my input, emails piling into the inbox, chores being shoved onto my to-do list, meetings being added to my calendar. In order to survive, I spent much of my mental energy fending off what was coming to me rather than building connections and relationships with those around me. On Change Islands, I lost interest in the input coming from off the island. I read email no more than once a week, with a sense of resentment for its siren calls back to the university world. I suddenly stopped reading the *New York Times* online because the concerns reported there (where and what to eat, what to wear, what to think about) no longer had relevance to my everyday life. With the space opened up by this narrowing of focus, I had the luxury to really see and pay attention to everything around me: to say yes whenever a friend issued an invitation, to stop and chat for 15 minutes with an acquaintance I met on the road, or just to notice the traces of autumn coming across the heathers.

Productivity

Change Islands was established in the 1700s and is traditionally a fishing community. It consists primarily of two islands separated by a narrow channel, or tickle. In the old days, the tickle and northern harbor were lined with merchants, where fishing boats on their way to the Labrador coastline would stop to fill up with supplies and, on their return, to sell their fish. Since the collapse of the cod fishery, many of the fishermen have been forced to retire or move away, although some local work is available at places such as the local school, shops, and tourist attractions. People generally live on Change Islands because of strong family ties and a love of the place, finding a way to make ends meet. Compared with what I was used to in more urban environments, residents spend a great deal of time on subsistence-related, home-based economic activities such as chopping wood, gathering berries, or home repair.

My job on the island was to do my field study, so I spent many hours holed up in the second-floor study of my house, crouched over a laptop, writing fieldnotes. When I looked out the window, I could see my neighbor working on his chores too: mowing the grass, building a new wharf for his fishing stage, repainting the chimney. We both worked hard, but I realized after a while that our orientation to work was quite different. Steeped in modern ways of thinking, informed by the time-management literature, my work was driven by planning and to-do lists; I strove to do a lot, to do it quickly, and to optimize my work process. Such a continuous, obsessive drive for efficiency and productivity seemed alien to my neighbors.

For example, at an island store that I frequented, frozen goods were not stored in the main shop, but in sheds below it. When a customer would ask for a frozen item, the shopkeeper would leave the store, go down the stairs to the shed where it was stored, and retrieve it. On returning, the customer might ask for another frozen item, and the trip would be repeated. This could continue for several more iterations. When a customer from off the island suggested that perhaps the shopkeeper could take the customer's shopping list and retrieve everything at once, the shopkeeper demurred, saying, "This is the way we have always done it."

Generally speaking, Change Islanders seemed uninterested in suggestions of how to improve their efficiency, and I quickly learned to stop offering them. Their orienta-

tion reminded me of Strasser's descriptions of 19th-century efforts by domestic economists to convince American housewives to apply streamlining principles to become more efficient [2]. Typically, housewives would reply, "What for?" The effort of optimizing their activities hardly seemed worth it. As Strasser details, domestic economists originally argued that increased efficiency would lead to more leisure time; in practice, however, increased efficiency in the home led to a rise in standards for housework and increased work, rather than more leisure. "What for," indeed?

To my modern sensibility, I realized, efficiency had become a stand-alone good. One should be more efficient simply because one can. To islanders, it seems, other values matters more. Life in an unforgiving climate has made it essential for islanders to rely on one another, and a great deal of effort goes into maintaining social relationships. For example, if one goes to someone's house on business, politeness generally dictates that one first spend time socializing over a cup of tea before announcing, almost as an afterthought, the errand one is tending to. Getting directly to the point, as efficiency would dictate, would undercut other things that mattered. And even in situations where efficiency didn't actually get in the way, it simply wasn't clear that it was worth the effort.

Being less efficient also generally means getting less done. At first, when a friend told me she didn't have time to talk to me that day because she had to clean her living room, I was taken aback that she could not squeeze me in. But later I came to respect this refusal to be rushed. While in the world of academia from which I had come, value seems to accrue to those who have talent at squeezing in ever more, on Change Islands there was a self-respect embodied in saying, "That's all I am willing to do," a self-respect that I had to come to the islands to learn.

Control

As I began to see and better appreciate the orientation to work surrounding me, I experimented with trying it out myself. This was difficult. On some days, I would take things as they came, allowing tasks to take the time they would, rather than hurrying them to an end. Invariably, on the following days, I would panic about falling behind on my field study and work into the evening to try to catch up on my omnipresent to-do list. I was like someone learning to drive stick shift, lurching back and forth between different paces of work and unable to find a comfortable pace for myself.

One day, when I was helping a friend with some chores, I turned to her and on a sudden impulse asked her how she planned her day. She looked at me, dumbfounded, then started to laugh, unsure whether to take me seriously. When she had finally convinced herself that I really meant it, she thought for a few minutes, then said that when she woke up, she simply knew what the day would bring. Of course, things could turn out differently than she had expected—an emergency could happen, an unexpected visitor could turn up—but generally speaking, there simply was a given order to her days. I got similar answers—including the uproarious laughter—from other islanders.

Such an order was, unfortunately, alien to me. I could articulate exactly how I planned because, as a modern worker, my days were driven by an enormous and well-structured to-do list, which had for years tyrannized my time. Islanders generally do not engage in this kind of planning and hence seemed unfamiliar with the sense of moral obligation to continuously do what this kind of to-do list generates. Why do they not do so? In part, this is because they see no need to pack as much as humanly possible into a given day and therefore do not need to have internalized such strategies of productivity. In part, this is because they simply do not try to control their time so proactively.

After a while, I started to be able to see how islanders choose to spend their time. Generally speaking, they rely less on figuring out what to do through a process of reasoning from first principles, and more on cues from their social and natural environments. For example, men's work on the islands traditionally takes place outside and is therefore weather-dependent. One neighbor therefore talked about organizing his projects mentally into a rainy-day list, a sunny-day list, a windy-day list, and so on. Similarly, if a visitor stops by, activities might be rearranged to accommodate the visit. Activities are also organized by common rhythms of activity: In moose season, you go hunting; after the first frost, you pick patridgeberries. In contrast to my experiences as a modern actor of planning out my time from first principles and based on high-level goals, on Change Islands, commonly held social knowledge, rather than means-end analysis and optimization, could tell you what to do. And this means that the moral responsibility for knowing what to do does not fall on an individual's shoulders alone; it is shared with the community.

Being Modern

I learned a lot over the course of my stay on the islands. I learned a small slice of the subsistence skills my neighbors had developed to an art form: how to pluck a seabird, find the good partridgeberry patches, bake my own bread. I learned what it meant to be a good citizen in a very small, tight-knit town: to make cakes for the bake sale, to come calling without an invitation, to sit for an hour over a cup of tea and really listen to someone—things I had had little time for in my university life but found remarkably rewarding. Most challenging of all, I tentatively adopted a different orientation to work and time: to let things happen at their own pace, to do less and to make do, to see no need to optimize. It was particularly through these shifts in perception of time that I first came to realize, even while becoming less modern, how deeply, unexpectedly, and painfully modern I truly was.

A major milestone in the evolution of modern culture is the development of scientific management at the turn of the 20th century, which developed principles to measure and optimize the activities of factory workers. Scientific management was a sign of a broader cultural shift in which the postindustrial workplace came to place a heavy emphasis on efficiency and productivity. What I realized in Change Islands was that 100 years after the development of scientific management, we have come as a society to the point where efficiency, productivity, control, and planning are not simply attributes we rationally apply to work but have, to some degree, also become the measure of every activity, a pervasive habit that infiltrates all that we do and how we see the world. Coming back from Change Islands, where I had learned to see the value of letting go of some of this, I started to realize how pervasive these ideas were in my own everyday activities. I started recognizing in myself what I ironically called "the seven habits of highly modern people," including filling any free time with task accomplishment, continuously disciplining myself to efficiency, and feeling that optimizing the outcome of any task was a moral necessity.

Being on Change Islands had made me aware of pervasive habits of efficiency and productivity that I had in every aspect of my life. These habits had made it possible for me to achieve what I had in life; they definitely had value. But being on Change Islands made me aware, also, of their costs. I recognized the cost of time doing research to allow me to optimize my purchasing decisions instead of making a straightforward choice, or not aiming to purchase anything at all; the cost of going to the store to get things I believed I needed, instead of just making do with what I had; the cost of stress in cramming more things to do into my life, and guilt when I didn't achieve them; the cost of buying new clothes, learning new things, being in style and up-to-date, instead of just being who I am.

Reflections

This story may sound like it is just about me, but what I have aimed to do in this article is to unpack and make available for critical reflection common cultural baggage that I had unwittingly taken on board. I am not alone in a modern orientation to time. Indeed, having switched into Change Islands mode, I started to register how much social pressure we put on each other to behave in a modern way. A sales window in a sports shop exhorts passersby to "achieve your own personal record!" A Droid ad shows an office worker gradually turning into a robot, offering to "[turn] you into an instrument of efficiency." When I reassure a fellow traveler on a flight that she does not need to rush to get out of my way, she snarls at me: "*You* may not be in a rush, but these other people are." These examples suggest a broader cultural logic in which optimization, efficiency, and productivity are not simply methods to achieve an end but have also become stand-alone moral values that measure the worth of a person.

With the cultural power of these ideas, IT design and marketing take

part in this logic. Software applications often seem to be oriented directly around these values, their advantage being seen in making more choices and information available to you. Even "free time" software, such as Facebook or Twitter, functions to connect you with more friends and to access more social information. Task-oriented software is generally sold as increasing efficiency and productivity. From the to-do cloud application Remember the Milk to Google Calendar, we have extensive software solutions intended to support scheduling and control over our time. These software tools may or may not actually make us more productive, but what they certainly do is leverage and underscore our cultural belief in the value of productivity.

Clearly, there are benefits to choices, productivity, and control. But my experiences on Change Islands suggest there may also be benefits to taking the values with a grain of salt; i.e., to think about how IT might support making *fewer* choices, accessing *less* information, making productivity *less* central, keeping our lives *less* under formal control.

If we take these lessons seriously, we might think not about how technology can give us access to more choices, but about how we can design technologies that help us create constraints on our choices. Technologies might help to reduce the burden of choice for us by automatically excluding things we wish to keep out of our current field of vision. On Change Islands, when the last ferry leaves at 7 p.m., a feeling of peace settles over the island: We are on our own now. I fantasized there about a similar Internet moat that would allow connections only during the daytime,

leaving the evenings for a local peace. More realistically, we could think about applications, such as email readers, designed to make it transparently simple to specify which emails should reach us instantly, and which could safely be delayed to be read less frequently. Or, as Ben Fullerton recently argued in *interactions*, perhaps technology should support not only connectivity but also solitude [3].

My experiences on Change Islands also suggested efficiency and productivity did not deserve an all-encompassing value. We have realized this, of course, in HCI, where the value of usability in terms of task-time completion has been supplemented with the idea of optimizing user experience, and where ludic applications have demonstrated the value of moving beyond task completion, especially in the home domain [4].

We might build on these ideas by asking how specifically task-oriented applications might also foster or support inefficiency. Another way to put this is to ask whether efficiency in some task domains is misplaced. For example, email readers send all email at the same speed: express mail. But for many emails we send, it may not matter if the mail really goes out that quickly. What if the default speed for email was once a day, and we had to specify when we wanted the email to go more quickly? Would this slow down email conversations enough to make their cumulative total more manageable? Would it lead us to reflect on whether we really needed to be in a hurry? Or is there so much social pressure to move quickly that we would end up always specifying "express mail," whether or not this made societal sense?

A wealth of software solutions currently exist that help to plan, control, and schedule our time. Arguably, these solutions act not only to help us control our time, they also reinforce the cultural idea that not having control over one's time is a problem and that it should be solved by better juggling rather than letting go. Over the course of my time on Change Islands, I settled more and more into Change Islands mode, in which activities could take the time they needed and it was OK to do less. Is it possible to imagine software applications that could encourage entering a Change Islands mode? If, for example, to-do software

afforded only listing a few things to do on a day, would this help people keep their workload manageable, or would it simply become an irritant to be worked around?

Conclusion

I have attempted to trace the contours of a modern orientation to work and time, and in doing so to expose a common, Western, unconsciously held set of values for critical reflection. I have done so through the lens of my own experiences in order to show how these values are not simply objective facts that people leverage in their activities but also something that forms an indivisible part of our everyday consciousnesses and shapes how we experience the world. Because we invariably draw on our worldviews in designing software applications, IT design tends to reflect and reinforce these values.

I have examined particularly the attributes of choice, productivity, and control over time, which are highly valued in modern Western culture. By aiming to understand and take on an orientation to time that does not place these attributes at the center, I have attempted to show that there are reasonable alternatives to taking these attributes as central to IT design. My goal is not to argue that there is no value to choice, productivity, and control, but to demonstrate that in addition to their benefits, these attributes also have very real costs. These costs suggest that it makes sense to open a design space for alternatives. If current software applications frequently depend on and reinforce modern values, then perhaps alternative applications could help us to become, if only temporarily, non-modern.

Still, there may be real limits to the extent to which it is possible to push a countercultural ideal through technology design. Until I came to Change Islands, I had based my career on the idea that design should promote and be a vehicle for critical reflection, as I have attempted to do here. I believed that doing so would support a better world, as individuals would be able to make freer choices in their lives. Living on Change Islands convinced me that communities matter much, much more than individual choice.

Until I came to Change Islands, I lived my life in a pressure cooker of overwork, in which peer pressure to be and act busy was intense. Even outside of work, urban yuppies expect themselves to be competent and knowledgeable in many arenas. On Change Islands, on the other hand, nobody cared how many papers I wrote; how much I owned, how much I earned; how quickly I could cook dinner or how gourmet I could make it; whether I invested my retirement account competently; or how much I knew about politics, current affairs, or anything else. Although I, as an individual, could certainly use critical reflection to understand that working constantly is probably not the best way to spend my life, I struggled for years with trying to find some kind of a balance in my life. It took my time on Change Islands and the examples of people who work hard, but not obsessively, and who take their families and home lives equally seriously to realize the pervasive habits and unconscious values that drove the hamster wheel I was on, and finally to be able, to some degree, to step off of it.

I continue to believe that we as IT designers need to think about the values we propagate through our work, and if some values can be propagated, surely others can as well. But can IT design as an influence compete with a pervasive cultural atmosphere of overwork and overload? I honestly don't know. My experiences on Change Islands suggest it may be most fruitful to try by integrating critically reflective technology design with other activist modes for influencing individuals and communities.

Acknowledgments

This research was supported by the NSF under grant ISS-0847293, "SGER: Rethinking Drivers for IT: Lessons from a Newfoundland Fishing Village." Many thanks to the residents of Change Islands, who donated graciously of their time to make this project possible. Support for project activities was provided by the Change Islands Town Council, the Stages and Stores Heritage Foundation, the Squid Jiggers Tourism Assocation, and the Change Islands Newfoundland Pony Refuge. My reflections on overwork were greatly enhanced through conversations with Gilly Leshed and David Carlson.

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DOI: 10.1145/1925820.1925830
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Where is the Thinking in Systems Thinking?

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Systems thinking has a long history. Its influence on design can be traced back for many decades. However, systems thinking remains almost unknown today among practicing designers and design researchers. Systems thinking is relevant, especially in light of all that is going on in modern society.

When designers work, they commonly create two models in their practice: a model of the current state, describing the situation to be improved, and a model of the idealized future state that a design solution will address. While these models are useful, they can remain high-level abstractions, failing to document a system in detail. Understanding how systems are organized and analyzed and applying this understanding in moving from an abstract model to create a design solution are invaluable skills for designers.

The concept of a system is easy enough to comprehend, but understanding a whole system can be difficult. More often than not, we can grasp only a few parts instead of getting the whole structure. Understanding systems can help any designer, or anyone collaborating with a designer, to understand the context around a problem and how to create an actionable solution.

What is a System?

Systems are identifiable everywhere in nature and the developed world. As a young child, you probably learned about the solar system—a group of planets that rotate around the sun. If you have received medical care recently, you most likely interacted with the healthcare system. A local neighborhood group may be working to save the ecosystem in your community.

The solar system, the healthcare system, the local ecosystem, neighborhoods, church groups, organizations, cities, and societies are all examples of systems.

A system in its most basic definition is a whole, acting as a unit of interacting parts. A system has interrelated elements whose relationships are both structural and functional. Structurally, a system is made up of subsystems that also contain subsystems themselves. Each system also relates to greater systems in the universe. Functionally, every part of a system depends on other parts of the system for something. If part of a system changes, another part of the system will likely also change as a result. The emergent properties of a system are greater than the parts of the system themselves. A system maintains a relationship with everything within itself and with larger and greater systems.

As a basic example of a system, consider a miraculous one: the human body. The respiratory system works in tandem with the circulatory system, the muscular system, and the nervous system. Products can also be collected and used as a system. Products can be used to extend the capabilities of the human body. An athlete or camper has a system of products that she relies on for an event or excursion. We use a system of products, including cars, bicycles, public transportation, shoes, coats, canes, and walkers, to get around. A service can be considered a set of products, or touchpoints, that collectively offer a transaction or experience to a customer. The products within a system can be intangible or tangible things.

How Can a Systems Approach be Used in the Design Process?

Anyone who engages in the design process—using human power to conceive, plan, and realize products that serve human beings in individual or collective goals [1]—engages in a systems approach. Consider the following examples.

A simple use of a system for a visual design is considered in this

A system in its most basic definition is a whole, acting as a unit of interacting parts. A system has interrelated elements whose relationships are both structural and functional. Structurally, a system is made up of subsystems that also contain subsystems themselves.

example. A graphic designer is tasked with designing the layout for a book. After creating a number of hand sketches to ascertain the overall feeling of pages and chapters, she is ready to give form to the design. She will first establish a set of repeating measures, or modular units, upon which to base the design. She will take an inventory of the text and visual elements needed to communicate the design, choose a type family or two to work with, and find suitable designs for each of the elements. Working guidelines for the design of each of the elements will be created. Excerpts of text will be tested with all of the element designs for legibility and aesthetic balance. Finally, single pages and double-page spreads will be subjected to what designers call "the squint test"—assuring the design looks good holistically, with balanced visual contrast.

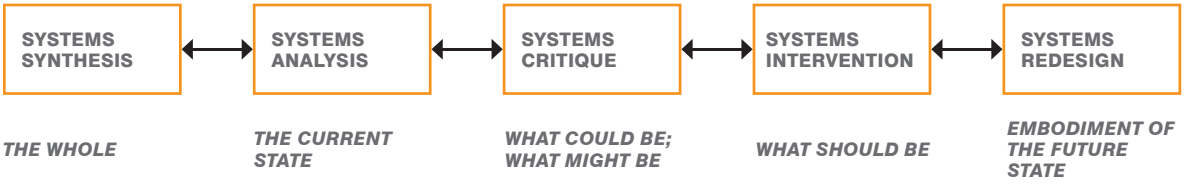
A more complicated example of how a systems approach can be used in the design process is in seeking a solution to problems that are complex, unique, and not reducible to smaller sub-problems. These types of problems are called "wicked problems," a term coined by Horst Rittel [2]. As an example of using a systems approach to derive a solution to a wicked problem, consider the problem of supplying fresh drinking water to people around the world.

There are many large aspects to this problem, including the basic human right of access to clean drinking water; the realities, demands, and resources of supplying water all over the world; the cultural differences in how we consume water; and the laws, regulations, and public policies around water supply. There are many small aspects to this problem, including how water is bottled and supplied; the design of the bottle; the material that is used to create the bottle; the disposal and reuse of the bottling material; and the functional, symbolic, and even aesthetic aspects of the bottles themselves. Deciding which aspects of a wicked problem should be focused on is done through human judgment. The bias that one brings to deriving a solution to a wicked problem can be deemed good by some and bad by others.

Consider bottled water as a means to a solution. Certainly, for some, it is a reliable, more accessible form of drinking water. In many places around the world, it is a safer source of drinking water than tap water. Statistics show that bottled-water consumption has grown exponentially in the past decade or two. But in some places, it has also become a lifestyle product—a symbol of comfort, wealth, and discretionary income.

The material from which water bottles are made, polyethelene terephthlate, or PET, is produced from fossil fuels but is recyclable. However, much of the packaging from bottled water ends up as waste in landfills. As bottles settle and degrade, CO_2 is generated as a by-product, creating tons of CO_2 emissions.

Clearly, one of the issues in producing bottled water is the strain it places on our ecosystems. In response, many solutions have been considered. For example, the design of PET water bottles has been modified to use less material, decreasing steadily over the past five years. In addition, product designers are considering new materials and making bottles that are not disposable and not harmful to the environment. Nalgene and Sigg bottles are two non-disposable product lines that have gained popularity in the U.S. These products force consumers to think about whether or not using PET bottled water is really more convenient, safe, or environmentally beneficial than carrying fresh drinking water in an alternate container. In addition, the symbolic appeal once associated with "spa"-brand drinking water is being replaced by the symbolic appeal of carrying an Earth-friendly container. However, while these design solutions achieve the goal of producing fewer PET bottles and reducing the sale of bottled water, they do little to address larger issues around clean drinking water, including the public policies around water testing, water consumption, and water control.



▸ An organizing framework for social systems assessment, after Nelson Churchman.

So, in focusing on a solution to this problem, a designer or design team could create many interventions, ranging from a better PET bottle to a biodegradable bottle to a durable, Earth-friendly bottle, or even new policies and practices around this diminishing resource. Many framings of this problem are possible. A designer or design team can use a systems approach to shape design judgment in creating a solution to this kind of wicked problem.

Is Systems Thinking Relevant Today?

Horst Rittel, a mathematician, architect, and designer, extensively studied and compared rational and creative approaches to problem solving over a variety of disciplines [3]. Rittel differentiated problem types as either tame or wicked. Tame problems have trivial concerns; are quickly identified; and are solved rationally, practically, and efficiently using linear problem-solving methods. On the other hand, wicked problems do not lend themselves to simple characterizations or to simple procedures for solution. According to Rittel, wicked problems are a "class of social system problems which are ill-formulated, where the information is confusing, where many [shareholders] have conflicting values, and where the ramifications in the whole system are thoroughly confusing" [4].

One issue is the way in which Rittel's characterization leads to what Nelson calls "assessment paralysis"—there is no simple or direct way to go forward [5]. However, using a systems approach, a wicked problem can be reframed from an irreducible situation to a design situation.

One of the conceptualizations of systems thinking that halted assessment paralysis was in the work of C. West Churchman, who stated that a person could be a component in a system. From there, a strategy for social systems assessments was created by Churchman's student, Harold Nelson; it combined a multitude of systems models, theories, approaches, and methods into an actionable framework (see Figure).

Nelson's process has five stages, but the stages are neither linear or crisply delineated. However, the process contains identifiable transitions. In the first stage, designers *synthesize* a system—getting a holistic grasp of the system and using their judgment to frame the problem. In the second stage, designers *analyze* the system—understanding details and interconnections between components and making lists of attributes. In the third stage, designers *critique* the system—identifying problems with the current state. In the fourth stage, designers *intervene*— making explicit the proposed solutions. In the fifth stage, designers *redesign* the system—implementing their vision of an improved future state.

Using Nelson's framework, we can see how a systems approach can provide a resource for designers to rely on their judgment in framing and solving problems and looking at a problem in a rigorous way. This approach is relevant today, because design is moving into new and more complex areas, including the design of the intangible, such as service design and public policy. Conventions for how to deal with these problems are largely absent from design research and practice today. For this reason, the design community should revisit systems thinking. Systems are everywhere; systems approaches should be everywhere, too!

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DOI: 10.1145/1925820.1925831
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Designing for Everyday Interactions in HCI4D

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During the past few years, there has been an explosion of interest in human-computer interaction for development (HCI4D). But what does this mean for the HCI community? It is not simply design for development, which emphasizes producing technologies that address goals such as poverty reduction and increasing literacy. While these are important goals, there are other ways in which HCI research can benefit users in the developing world. First and foremost, it's necessary to understand and design technology that supports users' routine activities—child rearing, reading the paper, puttering around the house, and communicating with family and friends—that are as much a part of life in developing countries as they are in developed ones.

In this article, I draw from data collected during fieldwork conducted at home and abroad in which I focused on users' everyday interactions with technology. In both studies, I examined understudied user groups, higher-income professionals in Nairobi, Kenya, and Kenyan immigrants in Atlanta, GA. Findings from these studies highlight how studying everyday ICT use in developing countries and transnational communication can broaden current HCI4D discourse in two ways. First, prior research in this area tends to create a "here versus there" dichotomy that restricts understanding of how limited access to technology is a global and local issue. In other words, lack of technology infrastructure and access to computers are problems not confined to developing countries, but that also have implications for users in the U.S. Second, I hope to broaden how the HCI4D community imagines users in developing countries. Specifically, studying users' everyday interactions has the potential to expand the community's current focus on developing technologies to address poverty and literacy to include a broader range of issues.

Background

HCI4D research primarily examines how to apply user-centered design principles to developing and evaluating ICTs for users in low-income countries. Notable projects include Parikh's development of a mobile-phone application for microfinance institutions in rural India [1] and Kam's work on using mobile-phone games to improve literacy among students in underserved communities [2]. These efforts rightly focus on the design and evaluation of new systems that could help uplift emerging nations economically and socially. In doing so, this research reveals significant differences that emerge when deploying ICTs outside of traditional sites of study. Some differences are due to lack of infrastructure or resources, while others center on cultural dissimilarities between Western and non-Western users. These studies have broadened HCI discourse to include users living in developing regions and imagine innovative ways in which computing can address poverty reduction and illiteracy. Yet these studies arguably shape how users are characterized in developing countries, and in turn, these factors limit our understanding of these users and their technology needs.

Prior HCI4D research focused on a particular user population. A review of older HCI4D literature noted existing research overwhelmingly concentrated on users living in rural areas, with low income and education levels [3]. By contrast, my interest is users who interact with computer technology in ways that are comparable to those in previous HCI4D studies, but whose actual styles of use are shaped by their different social, economical, and technological contexts. Specifically, those I interviewed and observed in Nairobi lived in an urban area, were literate, were college educated and in some cases had advanced educational degrees.

Photograph by Sean Nash

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These individuals traveled to the UK and U.S. and often exchanged email with family members and coworkers living in these countries.

Second, prior HCI4D studies—like many formative studies in HCI—tended to take place in a single society. This approach unintentionally conceptualizes users and technology as if they were disconnected from other spaces and times. While the community's attention has broadened to include global concerns such as HCI4D, sustainability, and religion, HCI researchers' dominant approaches to conducting user studies remain focused on disconnected sites rather than the relationships between them [4]. To understand global phenomenon, HCI researchers must consider how some topics can no longer be considered in purely local or disconnected terms. I present findings from my fieldwork and use them to elaborate on these issues and to discuss their significance for HCI.

Findings

Following six weeks of fieldwork in Nairobi [5], I uncovered several factors affecting the exchange of information online, specifically differing notions of responsiveness and limited bandwidth. First, for participants working in transnational organizations, the challenge was the frequent need to communicate with people in other countries. For example, participants regularly received email from American coworkers but unreliable Internet connectivity affected how quickly they could respond to these messages. When participants were not at work, they were unable to follow the ongoing email threads taking place among their coworkers in the U.S., because they had limited Internet access outside of the workplace. During interviews, participants told me they were concerned that their colleagues overseas would view their delayed email responses as an indication of a "poor work ethic" rather than a reflection of their Internet access. Managing different expectations for responsiveness and alerting those in more connected environments about their colleagues' intermittent and (at best) slow Internet access was a struggle for participants.

Second, participants consistently told me how the scarcity of Internet access affected their ability to communicate online. Even in environments where a given location (such as an office) had good connectivity, available bandwidth to international websites (such as free webmail providers or photo-sharing websites) is limited, which not surprisingly frustrated many participants, particularly when they were communicating with coworkers in infrastructure-rich settings such as the U.S. and the UK. For example, Kenyan professionals employed by Western transnational organizations noted how colleagues abroad were sometimes unaware that they lacked constant high-speed Internet connectivity. Exchanging information artifacts such as documents, spreadsheets, URLs, and presentations is an integral part of distributed collaboration, and users with fast connections distribute such attachments effortlessly. However, downloading and uploading large files can take hours without high-speed broadband, crippling some email software that does not allow users to refuse or defer attachments.

While Kenya's internal and

external connectivity is improving steadily, these issues will likely persist. Increasing the availability and reducing the costs of network access requires expansion of network infrastructure, which is costly. Bandwidth in developing countries will remain an issue until bandwidth prices significantly drop and Internet services improve. Social norms surrounding timely responses to email will likely resist change. Thus, there is a need to develop technology interventions that account for the infrastructural differences between developing countries and the U.S. Collaborative tools and email clients can be augmented to help reconcile differences in response times to alert those with higher connectivity speeds and easier access to the Internet about those with different levels of access. A simple idea along these lines is illustrated by the Google Mail feature that exposes the "sender's time zone." I imagine a similar feature could be designed that communicates whether users have access to the Internet. In turn, this might create greater awareness among users in the developed world about infrastructural differences in countries like Kenya.

In addition to highlighting design opportunities, this project also prompted me to consider how ICT access was an issue not confined to developing countries, but one that also had local implications. This led me to examine users who understood the possibilities and limitations associated with global Internet access: Kenyan immigrants living in the U.S.

Thus, in a second study I interviewed individuals who regularly navigate the infrastructural obstacles affecting global engagement online. The study involved observational fieldwork and unstructured interviews with members of a Kenyan immigrant church located in metro-Atlanta. This understudied user group provided me with an excellent entry point for investigating how limited Internet access affects both people overseas and those in the U.S.

During a two-month study, I saw some similarities between computer use among immigrants and participants interviewed in Nairobi, such as a reluctance to exchange large files with people overseas. For example, participants often took pictures documenting their life in the U.S., such as photos of children graduating from school or images of a new car or home. Although they wanted to share these experiences with friends and family in their "home" country, they knew the slow download speeds might frustrate those with limited Internet connectivity. Thus, rather than relying on the Internet to exchange pictures with friends and family abroad, participants sent photos via postal mail or with a person in their church who was traveling to Kenya. Interestingly, this finding illustrates how new forms of digital communication do not always replace analog ones.

During interviews, I probed to understand why this analog form of exchange was prioritized over newer digital forms; participants noted the infrastructural and cost problems uncovered during my fieldwork in Nairobi. Surprisingly, they also spoke of the convenience associated with this form of information exchange. This struck me because the dominant idea underly-

▸ Despite Nairobi's outward image of modernity, there are significant technological gaps crippling, not only the private sector, but social communication as well.

Photograph by Fernando Arroyo

ing technology development was its role in making life more convenient for users. Indeed, in my own mind I perceived sending and receiving photographs via email as easier and more efficient than printing and mailing them. However, for many participants, sending pictures to friends and family in Kenya meant asking them to access a computer at a cyber cafe. Given that the Internet is vastly slower in Kenya than in most parts of the U.S., sending large files meant making someone spend extra time and money at a cafe waiting for images to download. Thus, asking a friend from church to take pictures on a return trip to Kenya or even sending them via postal mail was preferable to using the Internet. Further, participants appeared to enjoy the personal touch that came with sending a package of pictures, as well as other items, to friends and family at home. This feeling could not easily be replicated online.

Transnational HCI

In addition to highlighting new design opportunities, these findings highlight the limitations of investigating ICT use in a single context (e.g., solely in the U.S. or solely in Kenya). Accelerated movements of technologies, finances, and cultural migrants have generated an understanding of place and community that can no longer be considered in purely local terms [4]. However, HCI research tends to focus on local, place-based scenarios, overlooking the new forms of interconnectedness resulting from flows of capital and labor, especially with regard to immigration from sub-Saharan Africa to the U.S. These global changes suggest focusing on connections between sites, rather than the sites themselves, may be useful for uncovering how changing contexts condition the meanings and uses of technology. Fieldwork investigating the linkages between sites, or what is described as multi-sited ethnography, can provide greater insight into how world systems affect local and global communities [6]. This knowledge is essential for HCI researchers studying global problems such as sustainability.

Multidimensional Users in HCI4D

There are parallels between this work and Gaver's recent exploration into designing for older adults. He and his colleagues developed the Prayer Companion, a device created as a resource for the spiritual activity of a group of elderly cloistered nuns [7]. It is important to note that they did not build the device for older people in general, but for a specific category of people—nuns—who happened to be old. Rather than focusing on disability, memory loss, or other unpleasant changes that occur as people age, Gaver's focus on spirituality presents the HCI community with another dimension of older adults. Understanding that faith, like declining cognitive and physical abilities, is a part of growing older motivated a novel design idea.

There is a lesson in this approach that can shape the communities' understanding of designing for users in developing countries. Specifically, my focus on everyday communications between users in Kenya and the U.S. presents the community with a more holistic, or multidimensional, way to imagine users in developing countries. Like Gaver, I believe developing a more holistic understanding of users is an effective way for designers (including myself) to overcome stereotypes that unconsciously affect how users are imagined and, in turn, how the technologies are developed for them.

To be clear, my intention is not to criticize prior HCI4D efforts. Indeed, my own thinking about these topics could not have evolved without the prior groundbreaking work done in this area. Instead, as other researchers work in this area, I hope to see them build on these early efforts by focusing on a broader range of topics and understanding the commonalities, rather than differences, among users living in different countries.

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DOI: 10.1145/1925820.1925832
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Sketching with Stop Motion Animation

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Unlike product designers and architects, many current interaction designers have not had design training in its traditional sense, i.e., studio work, model building, and design critique sessions. Rather, they typically come from computer science, informatics, engineering, psychology, behavioral sciences, or anthropology. Others have joined from media studies, Web design, or advertising. Some are autodidacts. Needless to say, this diversity has brought with it the skills, practices, and perspectives that together shape what we today call interaction design. Yet the diversity has one distinct disadvantage. Unlike designers from the traditional disciplines where it is considered a core skill, many of these interaction designers have not been introduced to the prominence of sketching as a way of thinking and progressing in design work or received proper training in it. Quite to the contrary, sketching is still often considered ad hoc, unsystematic, or simply unscientific—not least in academic circles—and as such unacceptable as a basis for making design decisions and evolving serious work.

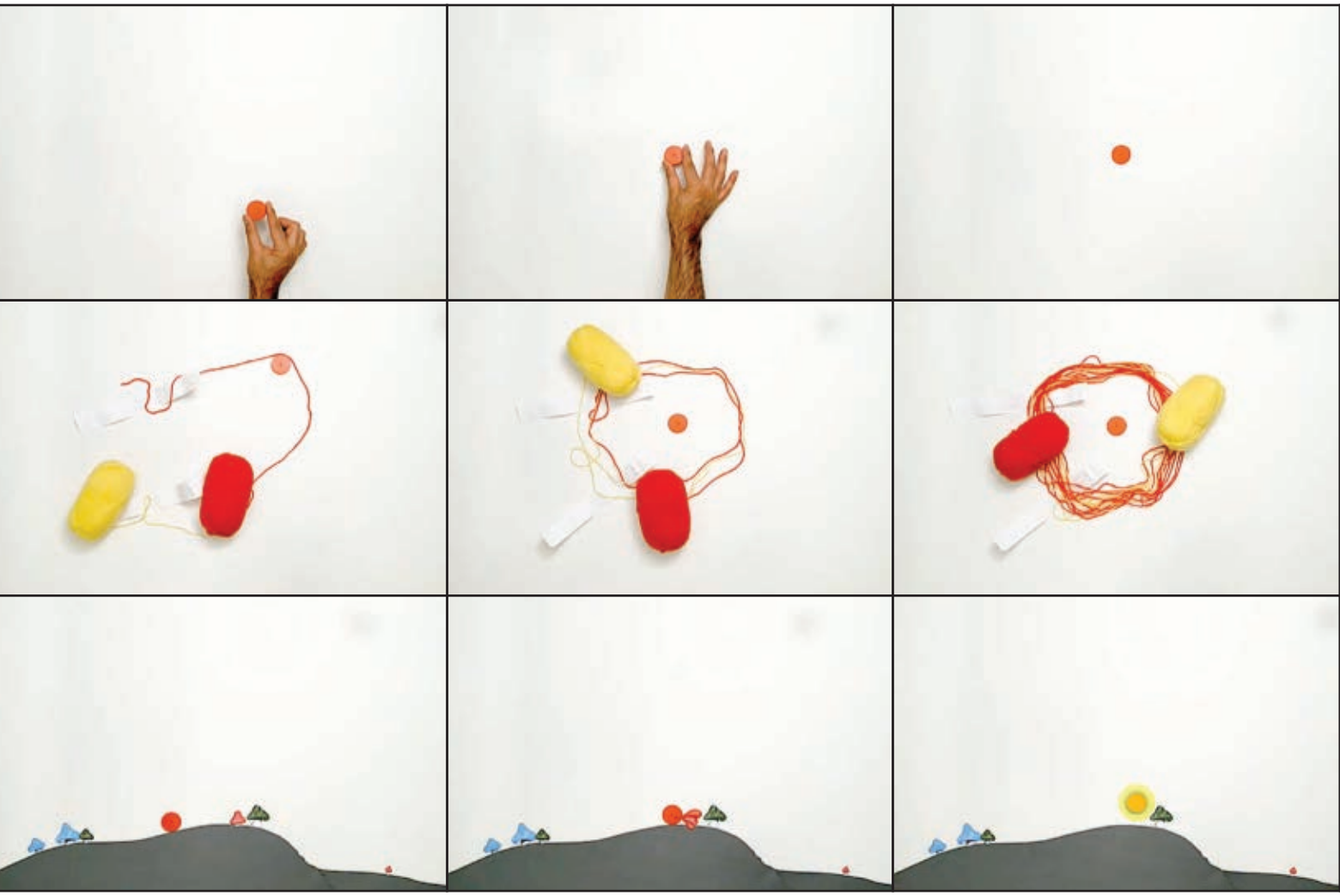
As the field of interaction design is growing steadily in scope, importance, and recognition within academia as well as industry, there is a need to further develop and professionalize what it means to be an interaction designer [1]. We argue that one of the most important skills of such a designer is the ability to use and feel confident in sketching as a tool for thinking [2].

In traditional design fields, sketching has long been recognized as a core professional skill [3]. Sketching is even considered, by some, to be the very essence of what design work is about [4]; some would say from the earliest stages of design work, the designer's thinking is "mediated by the sketches or visible notes that they make to familiarize themselves with the material they are manipulating" [5].

A rather insistent view is to think of sketching as a way to externalize "images" already present in the mind of the designer, that the form, appearance, and character of artifacts yet intangible are transferred from the designer's mind through the hand holding of the pen onto paper. Recent design theory, however, points to the role of sketching as a tool for thinking—the designer, when sketching, is reading and interpreting the sketch, explaining it, reinterpreting it, and eventually rephrasing it. Goldschmidt notes the interplay between different modes of seeing that is needed on the part of the designer in this process, between seeing-as and seeing-that [6], a process Stolterman characterizes as "externalizing ideas and interpreting external representations as ideas" [3]. The sketch itself, i.e., the artifact, still reflects the designer's vision, but it is not a replica of that vision. In fact, the distance between the vision and the sketch provides a useful space for thinking; it provides a window of opportunity for experimentation, play, and lingering with details, wholes, and the relationship between them.

Substantial effort is currently being invested in human-computer interaction (HCI) and interaction design in developing and proposing new theoretical approaches, methods, and tools that are intended to support designers in their practice [7]. Likewise, prototyping has a long-standing history in HCI, and an interest in the role and meaning of the research prototype itself has recently surfaced [8].

The role of sketching—the tools and techniques for practicing and



▸ The last exercise of the week was a collaborative work in which each interaction design student had to animate a red dot from the left to the right of the canvas. The sequences in between the two known states were totally open for the students to explore. This particular scene uses everyday objects (in this case mustard, candy, and cardboard). The designer carrying out this animation has an initial vision but also improvises and changes course during the shoot, keeping his animation materials in close reach at all times. The camera (not seen in the picture) is mounted over the table and connects to the computer with live preview software installed, which allows the animator to constantly monitor the next frame against the previous ones. See the video at: http://vimeo.com/17263496/

improving it, and differences and similarities between sketching and prototyping—is still not a major topic. This seems rather surprising on many levels, mostly because digital artifacts generally have qualities and characteristics that are hard to capture with traditional means of sketching. Pen and paper are excellent for thinking through and catching the spirit of a new car, a table, or a building, but they cannot as effectively capture the flow of a computer interface, the seamless experience of a ubiquitous environment, or the pliable quality of a multitouch system.

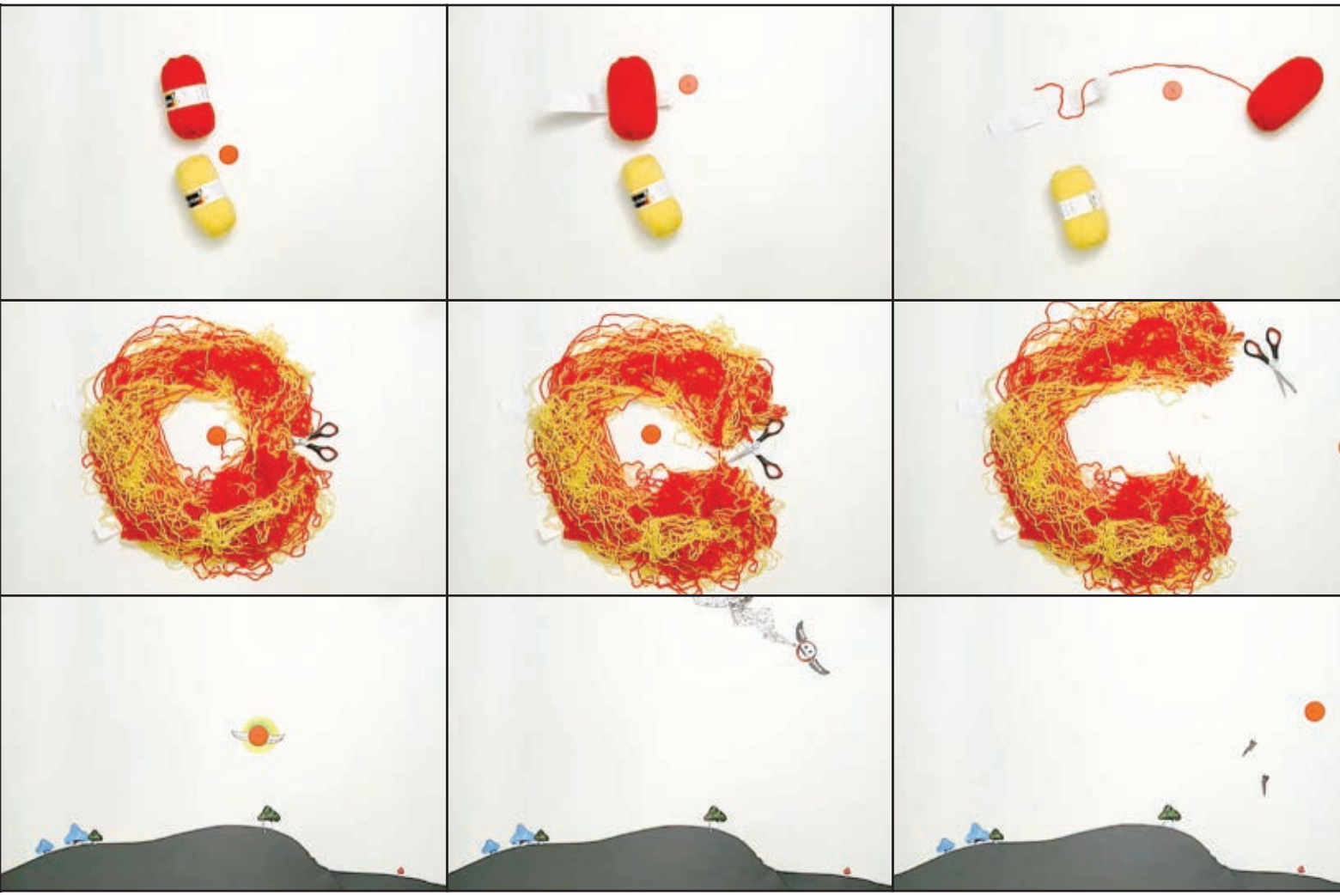
To find ways of dealing with some of these qualities, we have explored the potential of stop motion animation as a sketching technique.

Stop Motion Animation

Stop motion animation, sometimes called stop-frame animation, is a basic form of animation typically applied to make everyday physical objects appear to be alive. It builds on moving objects in small increments between individually photographed frames; when the series of slightly different pictures is combined and played back in continuous sequence, magic happens. The illusion of movement is created.

For example, to bring an ordinary object, such as an office chair, to life, stop motion animators would set up a digital camera, typically on a tripod, and prepare the scene, i.e., what the camera sees from its position. The office chair is then moved around in front of the camera in small increments, with the animators capturing a new photo in between each manipulation. Using the same step-by-step technique, the chair is not only able to move but also to jump, turn, twist, fly, stand on two legs, and so on, using relatively simple means to defy gravity: fishing lines, sticky tape, and wiring. Substitution materials such as foam, cellophane, and chicken wire can also be applied creatively to make the chair disappear in a puff of smoke, turn into fluid, or morph into another object.

Stop motion animation has a long history in filmmaking, beginning in 1898 with "The Humpty Dumpty Circus" [9]. Other milestones include "The Automatic Moving Company"



(1912), "King Kong" (1933), and some famous scenes from the original "Star Wars" trilogy (1977–1983). But when stop motion animation is mentioned these days, people tend to think of clay-animated movies like "Chicken Run" (2000) and "Wallace and Gromit: Curse of the Were-Rabbit" (2005). These successes show that despite the advancements of computer animation and the recent 3-D trend, there is something about stop motion animation that captures the audience, whether it is the tremendous skill of the clay animators or the authentic ambience often achieved.

For such a basic animation technique, stop motion animation is conspicuously absent from the HCI and interaction design literature. In *Sketching User Experiences*, Buxton briefly discusses a few related techniques, such as flipbook animations and animated gif pictures [10]. Buxton also points to Baecker's early work on picture-driven animation [11]. Recently, Bonanni and Ishii have suggested stop motion animation as a low-fidelity prototyping tool for concept development in tangible user interfaces [12]. They make several interesting remarks about the technique's potential, for instance in exploring and revealing various consequences of technologies that do not yet exist. While they argue the technique might be best suited as an easy way to draft interaction with people and objects before investing the time and effort to build working systems, they discuss the technique primarily as a presentation aid with which designers can show their results. Indeed, stop motion animation can be quite successfully used as a low-fidelity tool for presenting concepts and ideas generated elsewhere. Our view, however, is that stop motion animation also implies a way of working that has some interesting characteristics, which we have sought to capitalize on to explore its potential as a sketching tool, i.e., as a technique through which concepts and ideas are not just presented, but generated.

Experimentation

During the past two years, we have been introducing stop motion animation to our master students in interaction design at Umeå Institute of Design, Umeå University, Sweden. The aim has been to explore how stop motion animation can generate, develop, and communicate interaction-design ideas and concepts. The courses were relatively short, one week, but in a very intense format in which most students ended up working 10 to 14 hours a day. Lectures and presentations were given each day for about one hour in the morning, after which the students went

on to work on their exercises in teams of two to four students.

The students initially learned about the basics of animation, lighting, and photography but were quickly tasked with various exercises to explore (and fake) some general interaction-design notions such as movement, gravity, transitions, and state changes. The first tasks (ease-in/out, bouncing, and disappearing) were executed with everyday objects. Despite the apparent simplicity, students learned producing convincing animation requires its share of work. About halfway through the course, the exercises became a bit more elaborate and demanding. We explored pixilation (animating humans), animated objects, reverse timing, and other related techniques that require a bit more organization and preparation. Some students recorded an audio track with comments for timing purposes; others produced full storyboards in advance, detailing all scenes. The level of planning was highly varied and constantly adjusted as the students refined their ideas and started shooting. As the first few frames are captured, one quickly notices if things are too challenging or do not make sense or match. Due to the nature of the stop motion animation process, it is possible to make changes, rectifications, and adjustments, and these were often made in real time as the shooting continued.

A strong time restriction was enforced for all stop motion animation exercises. Students had a maximum of 24 hours to plan, prepare, shoot, and compile their animations. The time constraint was meant to force the students to be realistic about their ideas in relation to achievable results.

During the courses, some students chose to work with their own digital cameras and improvised lighting equipment. Other teams used our design school's semi-professional photography equipment and studio lighting. Generally, students with access to the better equipment did not generate better animations—in fact, students with the simplest gear often ended up producing the most interesting results. What proved to be most essential, however, was the overall stability of the setup and the ability to preview and review work directly on the computer while shooting. This is partly because beginners at stop motion animation tend to move, morph, and blend objects too fast, using too few frames. Here, a camera setup with a direct, live connection to video-editing software is very useful, as you are able to review and play through the animation as it is being created. Some means of live preview thus helps to prevent huge mistakes, which, due to the nature of the process, are difficult to correct afterward; live preview also aids in projecting future frames.

Although stop motion sequences can look simple or trivial, either way they require a substantial investment of time, involvement, and engagement. What you dedicate in time is balanced, however, by the unrestricted creativity of the medium. The work the students produced was extremely varied and presented ideas that would have taken weeks or months of hard work to animate using 3-D animation software, code in Flash, or to achieve via certain special effects applications.

The course received very positive feedback from the students, for both years. That they had to rely on an almost fully analog tool set (if we omit the digital camera and the live capture software) was seen as unusual but fun. The students also appreciated the use of low-tech approaches and not having to work directly on-screen, as well as how the course helped refine their photography skills and team-working abilities.

From our students, we have learned some valuable lessons for how to keep focused on the content of the process rather than on the process itself. For us, this is an essential, basic requirement for any technique aspiring to become a tool for sketching. First, it is a good idea to keep a stack of objects and props that do not decay or degrade quickly. Having duplicates of objects allows for even more creative choices. The more objects you have in your stack, the less time you will have to spend making unanticipated objects between frames. Second, it really helps to find ways of immobilizing objects properly (use blue-tack, magnets, double-sided tape, etc.). Spending time recreating lost or partly damaged scenes takes a lot of time and focus away from the content. This is also true when it comes to camera stability, so make sure to fix, secure, and tie down your tripod and other gear. If you are leaving the setup overnight, make sure other people know to keep their hands off.

Sketching Qualities

A key characteristic of stop motion animation is that the setup, equipment, and computer applications that are needed are very basic and cheap and most often already available. The work is also best performed in pairs or groups, one operating the camera and the others moving objects in between frames. This brings groups together and encourages teamwork. That the process itself is usually quite fun helps too.

The technique requires a lot less setup, planning, and equipment than regular moving-image film-

making. In stop motion animation, the sequences are built frame by frame, which allows animators to avoid many technical and physical constraints, making it relatively easy to bypass materials and physical properties and realities. This has proven to be very valuable for rapidly realizing very futuristic concepts and far-out ideas. We purposely avoided clay as an animation material throughout these courses, as we feared it would put too much focus on the craft of making and manipulating the clay figures, which is an art form in its own right.

Depending on what content you work with, a quick stop motion animation can be easier and less time consuming to produce than work made with Adobe Flash or a similar application. In addition, conceptual work in Flash tends to result in on-screen action only, whereas stop motion animations often mix users, artifacts, and contexts. Using stop motion animation, you thus tend to sketch a larger, real-world-use situation.

Stop motion animations have a natural funky and sketchy feel to them, and they are generally far from perfect. This is partly due to the analog, irregular qualities that result from human manipulation of objects and cameras and from noise and subtle environmental variations, but it's also due to limitations of available resources, such as time, equipment, and materials. These limitations are inevitable and sometimes an annoyance. Yet they together constitute an interesting and valuable constraint that makes it easier for designers as well as others who are in contact with the animations to focus on the concepts and ideas rather than on pixel-level details, graphics, effects, etc. The very nature of stop motion animations makes it apparent that what you work with is not the final design, that your work is not the final product or what you will see on the screen in the end. Here, we find it interesting that the technique itself—perhaps especially when applied in the area of interaction design—does not either implicitly or explicitly promote pixel perfectionism. Such a condition is not unfamiliar to many interaction designers. We see this characteristic as a key element for its use as a sketching technique rather than as a prototyping tool.

Stop motion animation also spans a lot of potential sketching needs in interaction design. You are free to sketch anything from simple on-screen interfaces, tangible interaction and advanced integration between physical and virtual objects, to human consequences of being in physically responsive environments. All this comes without a steep complexity curve or an incremental time scale. In fact, the time expectancy for any stop motion animation is quite linear—it takes about as much time and effort to animate a progress bar using pen and paper as it does to make a sheep fly from the Earth to the moon. As we see it, this quality of the process encourages wild ideas and creative thinking.

To summarize, when working with and reflecting on the process, we have come to regard stop motion animation as useful process for thinking through and revealing what may in fact be quite complex ideas—situations and consequences involving technology, environments, and people—in a straightforward fashion that requires very little in terms of infrastructur e and equipment. At the same time it allows complexity, it also provides support for quite detailed explorations of movement, flows, transition, and timing, all crucial elements of user-experience-centered interaction design. Going forward, is stop motion animation the pen and paper of interaction design?

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DOI: 10.1145/1925820.1925833
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Open Sesame!

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Companion books are typically glossaries—for example, *The Oxford Companion to Shakespeare* [1]—but there are also companions that deal with aspects of their subject in more depth [2]. To produce companions in the past, it was necessary to have enough material for a complete book. These days, however, there is companion content on the Internet that is only a few pages in length.

Imagine open content: As articles are increasingly published using computer-based devices, it is possible to imagine that users could invoke companion content directly, i.e., by pointing at the relevant item or place in the article, rather than having to access the companion separately.

In order to connect companions to their articles in this way, there must be technical standards—preferably independent industry standards—that are implemented in the devices used and to which the articles and their companions conform. More important, however, authors must agree to their content being connected in this way [3]. Content that is "open" to such connections is analogous to an open IT system, which allows customers and third-party vendors to connect independent hardware or software components via agreed-upon interfaces [4].

While there are currently no open-content articles with connected companions from which to draw examples, it is at least possible to conjure up examples based on existing real articles:

Few modern works have attracted as diverse companion content as Patrick O'Brian's Aubrey-Maturin historical novels set in the early 19th Century [5]. His two principal characters (Aubrey: a sea captain, and Maturin: a ship's surgeon) first meet while attending a musical performance in Minorca. Music is a part of their friendship and throughout the novels the two play together during their voyages. A companion CD of music from the period was published in 1996 entitled "Musical Evenings with the Captain" [6]. Were the novels to be published in an open content form, the reader could invoke the relevant piece of music directly from the text. For example, the reader could suspend reading in order to listen to Mozart's oboe quartet in F major at just the point in *The Yellow Admiral* at which it is played [7].

Puddings and other dishes of the period are served up on Aubrey's English warships. *Lobscouse and Spotted Dog: Which It's a Gastronomic Companion to the Aubrey/Maturin Novels* [8] is a companion book of the food of the period. In an open content form these recipes could be connected to descriptions of the meals in the novels so that the reader could find out immediately what, for example, "lobscouse" is, and how it is cooked.

Hopefully it is obvious that there are many other opportunities for companions to make connections

Photograph by Chris Howard

to these novels: biographies of the historical characters, technical data and diagrams of 19th-century ships, glossaries of the medical terms of the period, and so on. In the future, not only might companions be bought as articles in their own right but also for connection to the content on which they are based. There are a number of ways for companion authors and artists to obtain reward for their creations; open content just offers them more opportunities.

The connection between a companion and its open-content article is a technologically layered process. The author or creator of an article of content will not necessarily have foreknowledge of its future companions, and the author or creator of a companion will not necessarily have knowledge of other companions or of those yet to come. It is, therefore, incumbent upon the creator of each companion to make its own connections with the underlying article.

The term "companion" is really a product rather than a technical term. The technical requirement is more basic: A specification associates one piece of content with another so that a connection between them can be implemented in the device they "co-habit". A collection of pieces of content that have been connected may add up to what might be described as a companion in current publishing vernacular, but there may also be small pieces of independent content that would not merit the title. It is convenient for the purposes of this article, however, not only to retain the term "companion" for its current product usage but also to allow it to signify any piece of content that makes a connection to an open-content article.

The creator of a companion also must define the nature of each connection: What happens when the user invokes the companion and what types of parameters, if any, are passed and returned in the invocation?

A companion may make multiple connections with an article, and multiple companions may be available simultaneously at any point. The most obvious companion for an online book is an online dictionary. In an open-content world, the reader should be able to point to an unfamiliar word and call up its definition instantly. Creating a context-specific dictionary is not yet a completely algorithmic process, but such a dictionary would be a more valuable companion than a mere generic overlay. A foreign word might be part of an idiom, and a companion dictionary of idioms may make a connection to the same part of the foreign-language text. Similarly, a grammar companion would very likely overlap with the companion dictionaries.

In general, therefore, when the user attempts to invoke a companion at a particular point, the user interface might first have to offer a menu to help the user choose, in the process showing, perhaps, to which portion of the underlying content (if any) each available companion relates. Users should be able to configure which companions they wish to include from time to time.

Where it is not obvious that companions are available, the user might ask to "Show Companions," say, so that some visible cue appeared in the article. For example, a "compass rose" symbol might be displayed wherever a chart (map) is available; or a DVD symbol might be displayed to show a film extract is available. In opening an article to companions, its owner also must decide what rights, if any, companions will have to manifest themselves in such ways. Multiple independent companions must either be compatible in their use of cues or, for example, the user may have to "Hide Companions" selectively in order to avoid conflicts.

There are circumstances in which the user might want a companion not merely to signal its availability but to be constantly present: The ultimate foreign-language help is a translation. The reader might call up the translation phrase by phrase, sentence by sentence, etc.—it depends on how the source has been translated—but the reader may prefer to have the whole translation automatically displayed, either en face or interpolated.

Articles of content may also be companions for each other, in which case the user should be able to navigate back and forth between them:

An audio companion could be linked to its foreign-language text to pronounce words or speak phrases and sentences. Users might also want to alternate listening to and reading successive segments, navigating between the text and audio.

Obviously, companions can also have their own companions. Not understanding something heard in a foreign-language audio book, the listener might call up the corresponding text; not understanding the text completely, the reader might then call up a translation of it; and so on.

And, of course, users should be able to produce their own companions using open-content tools; and it should also be possible for multiple users to attach suitable companions to a *tabula rasa*, such as an initially empty calendar, diary, or blog.

Now, imagine how open-content technology might change conventional publishing. Here are a couple of examples:

Children's books often include illustrations. At any time, other artists might also wish to produce illustrations, but these cannot be substituted into the books in print

for obvious reasons. Were books to be published as open content using a computer-based device, however, other artists could offer to substitute their own illustrations.

Authors do not want their work tainted by poor illustrations, of course, and the best illustrators may refuse to illustrate works except on an exclusive basis. Degrees of "openness" are possible, however. At one extreme, a publisher may be completely open to third-party illustrations to allow the market to decide which ones are best. At the other extreme, the publisher may prefer to be closed to alternative illustrations (even while remaining open to other types of substitutions or additions, perhaps). In between these models, a publisher may accredit a limited number of "approved illustrators" from time to time.

For films, substitution and addition are already common practice—films are dubbed into foreign languages, and subtitles are added for foreign viewers or the hearing impaired. Foreign-language versions may be judged to be not commercially viable for minority languages, such as Breton for example. For Breton speakers, and those interested in preserving the Breton language, however, there may be much more incentive to produce subtitles or a Breton soundtrack. If films were published in an open content form, then interested third parties could obtain permission to add their own subtitles or dialogue.

Currently, the soundtrack of a film would not be described as a "companion", of course. But once one conceives of all content as potentially open, articles like this are no longer an immutable fusion of their constituents but can be conceived as an *ensemble* of companions [9].

Since open-content technology enables connections between pieces of content, it could also be used to create new ensembles even when no third parties are involved. Here are a few examples:

A cookbook could have a video companion of the cooking techniques: Wherever the technique is called for in the text, the relevant video demonstration could be connected and invoked by the user if needed [10]. There are many similar opportunities to attach video demonstrations to instruction and reference manuals. For example, how to train an espalier fruit tree in a pruning guide, how to change the head gasket in a car-maintenance manual, and so on.

Usually, opera lovers study the libretto before watching an opera because it is difficult to understand the words when they are sung (even for native speakers), and some of the language may be archaic. When a person is watching an opera on a computer-based device in the future, it should be possible to pause to refer to the libretto at the start of an aria or recitative. Vice-versa, it should also be possible to read a part of the libretto and then watch a performance of that part, repeatedly if desired.

During the radio broadcast of the BBC's "History of the World in 100 Objects" [11], the image of that part of the object corresponding to its audio description at that moment could be displayed automatically. Apart from describing objects such as historical artifacts, antiques, and works of art, there are many other uses for audio files with image companions attached that are more lightweight and, possibly, more suitable than videos—online lectures, virtual guided tours or product instruction manuals.

A companion invocation need not return content only; it can provide any sort of gadget:

As part of a cookbook ensemble, the user could invoke a companion to remember the list of ingredients of each recipe chosen for the coming week. On completion, the companion could return a shopping list for the chosen recipes.

Hopefully, sufficient interest will have been stirred by this short introduction to open content to bring other imaginations to bear upon its opportunities (and many outstanding questions). Like the magical command used in the title, maybe an open approach to content will unlock a cave of treasures [12].

END NOTES

[1] By Stanley Wells (contributor) and Michael Dobson (editor), OUP Oxford, 2005.

[2] See, e.g., *The Cambridge Companion to Shakespeare*, Margreta de Grazia and Stanley Wells (editors), Cambridge University Press, 2001.

[3] Established authors and media firms can be ambivalent about the value of 'companions'. See for example Rowling v. RDR Books at http://cyberlaw.stanford.edu/case/rowling-v-rdr-books/

[4] Here, therefore, 'open' refers to the ability of companions to make connections rather than to the property of being publicly available.

[5] See, for example, http://www.patrickobrian.com/home.html/

[6] Philarmonia Virtuoisi, 1996

[7] Patrick O'Brian, HarperCollins, 1997

[8] Anne Chotzinoff Grossman, Lisa Grossman Thomas, W W Norton & Co., 2000

[9] The term "ensemble" implies bringing together content elements in a controlled environment to create a new article, cooperatively when more than one author or artist is involved. In contrast to some bootleg content, or mash-ups, it is not meant to imply that elements are altered significantly in the process.

[10] The BBC recipes website: http://www.bbc.co.uk/food/recipes/ inserts hyperlinks to video demonstrations into its recipes. Using companion videos is an alternative and potentially less intrusive method of illustrating cooking techniques.

[11] http://www.bbc.co.uk/ahistoryoftheworld/explorerflash/

[12] http://en.wikipedia.org/wiki/Ali_Baba

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DOI: 10.1145/1925820.1925834
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Reflexive Design Thinking: Putting More Human In Human-Centered Practices

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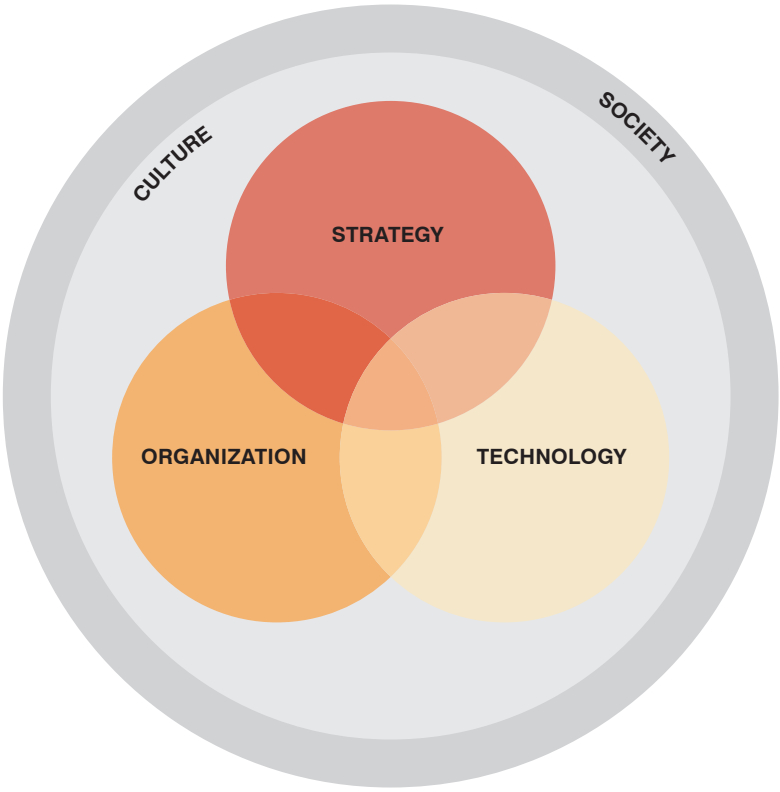
Over the years we have been involved in practices of applying methods and insights of human-computer interaction (HCI) for client engagements. Specifically, we emphasize a human-centered approach employing ethnography and participatory design that we collectively refer to as human-centered design practices. Yet we have become increasingly aware of a gap between what we do in our practice and what HCI offers us by inherently delimiting outcomes to technological solutions. Unlike research projects in HCI, where researchers have the luxury of exploring technologies they like, practitioners hired by clients need to focus on providing value to the clients regardless of any innovative technology they develop. Human-centered practices involve spending a lot of time inspiring and guiding members of the client organization, facilitating their reflection on their own practices, and thinking about alternative strategies and visions together. Technology has become only a small part of the story, and to this end, we advocate a research direction that extends human-centered design practice across a variety of domains.

To illustrate what we do in our practice, we describe one case:

One of the authors, Friedland, became involved with biomedical startup Beta, which had implemented an intranet for facilitating information sharing and collaboration. Beta's CTO explained to Friedland that the intranet was used in only a rudimentary way and that he saw a need for potential improvements. In response, Friedland proposed using ethnography so that the CTO could understand people and their needs instead of jumping immediately to developing new technologies. Ethnography revealed that integrated information management for the laboratory was the critical area for the organization. Through more than 30 interviews, Friedland constructed an integrated image of all the information for the lab from various operational groups. Beta then worked with Friedland to develop the software system to achieve the integration. The system reduced the time it took to set up, run, and analyze an experiment from more than 1,000 hours to less than 12 hours. Not only were more experiments conducted, but larger ones with larger data sets were also per-



formed, which has had profound implications for the organization's business strategy. Yet the most significant change was not limited to the above-referenced work-efficiency improvement. Of greater value to the organization was the fact that people started collaborating more and shared more information across groups. This was enabled not by the technology per se, but by enabling people to design their own working environments. Beta thus began an ongoing cultural process in which different groups continuously experimented with alternative work processes together, which were continuously refined and improved.

This case provides a clear example of some of the ways in which human-centered practice can contribute to the development of organizational strategy, work practice, and technology, as well as positively affect the way people relate to one another and their workplace. The practices we employ affect not only the design of technology but also the organization's fundamental business strategies. Our observation is that regardless of the organizational application, the underlying practices of design are equivalent. A phenomenon we have observed is that various disciplines, ranging from organization theory and strategy to HCI, have inadvertently erected domain-specific boundaries while employing similar underlying practices. Researchers and practitioners alike would benefit from a forum in which the broader, more integrated style of practice we are describing here can be researched and discussed. However, the results we describe cannot be readily reported and discussed in the HCI community, where an interesting technology is a prerequisite.

We therefore assert that the notion of human-centered design practice would benefit from extending its scope: by putting more "human" in human-centered practices. These practices aim at transforming the culture of the organization, not just technologies. It is not enough to involve users in design. We have found that one key to transforming culture is learning on the part of an organization's members. One kind of learning in particular, we realized, was crucial: design thinking. This refers to a specific approach to problem solving and incorporates a unique epistemology recognizable in the practice of designers. Once individuals acquire design thinking, they take a more reflective stance in relation to their own work, experiment with different ways of seeing it, and continuously revise their work practices. We still think that technologies play a central role—not as an end in themselves, but instead as a means to facilitate continued human learning.

A New Research Direction

To begin, we need to understand what it means to "design" an organization. It is clearly different from what is meant by designing a technological artifact or a work process. Here the distinction between natural science and social science can be helpful. The goal of natural science is to identify the laws that govern nature, like Newton's law. Nature works according to these laws, although they are always open to falsification—e.g., Newton's law does not apply to quantum physics. On the other hand, social science seeks to understand rules that are normatively maintained. If we say to someone, "Hi," he or she should reply, "Hi." These are normative rules that we comply with but can also break. If somebody breaks the rule, he or she gets punished; e.g., a person gets mad and considers the person rude or perhaps reckless.

Normative rules are different from scientific laws because anybody who is socialized to the culture acts on them. In other words,

people have reflexive understanding of the rules. To engage in the "design" of an organization means to address and reflect on these rules, whereas designing a technological artifact is done according to laws that correspond to the natural sciences. Because normative rules are reflexively understood and produced by people, any "design" of the rules necessarily involves the people they affect. Thus, no one can design an organization for someone else. The only thing that someone can do for another is to design representations and constraints such as formal roles, staffing, processes, and hierarchical structures. Designing an organization therefore involves other activities, such as supporting members of the organization in reflecting and bringing attention to the normative rules of their own organization.

Despite this important distinction, these two applications of design have much in common. There appears to be a basic way of framing the important elements of what it means to design. Scholars have named this design thinking and design attitude. Nigel Cross also used the phrase "designerly ways of knowing."

First of all, design embodies a distinct epistemology. Schön contrasted it with the dominant epistemology of technical rationality, which emphasizes rational problem solving based on theory and science [1]. On the other hand, actual professional practices in general and design practices in particular embody reflection-in-action. This means designers face each unique situation and, at the same time, see it as something familiar. Through this, they frame the situation and test successive frames by taking actions experimentally and reframe the situation based on what they learn. To many in management, this kind of practice appears unstable and subjective.

Second, in many modern workplaces, design is less emphasized. People are expected to analyze a problem and derive a solution to solve it. Solutions are often framed in terms of decision making, where an option among given options is chosen. Design is form-giving, the creation of what has not existed. As such, designers often take a solution-focused or abductive approach, by which they explore solutions and problems together and often use a potential solution to better understand the problem [2, 3]. Resulting designs can vary from situation to situation, from designer to designer. In contrast, an emphasis on analyzing a problem and rationally choosing the best solution occludes design possibilities.

Third, design is also a moral matter. One indication of this is that we label designs "good" and "bad". "Good" designs often have a coherent thought, idea, or concept running throughout the parts. Designers simultaneously pay attention to the whole while designing the parts. To guide the design, designers typically develop a key simple concept or metaphor that guides the design throughout. This concept is not given from the beginning but discovered and created as the design proceeds. When members of the organization design, this core concept becomes even more important because multiple people have varied goals, ideas, and personalities. In order for an organization to achieve a coherent design, its business strategy needs to be examined, revised, and implemented. Unfortunately, this is not what always happens in practice. Regardless, strategies are neither developed nor executed in abstract. In each instance of detailed parts (e.g., technical features, roles, communication, work processes, language, documents), strategies become salient, emerging over time, often in ways that are not intended, ultimately impacting interpersonal behavior.

Technologies play a crucial role in this learning, although, as we've emphasized, technologies are only a means, not an end. We therefore need to broaden the role of technology. Technology can be a tool for learning design thinking and facilitating cultural change.

Fourth, design involves power relations. Buchanan claimed that design is rhetorical, as "the art of conceiving and planning products," which are "vehicles of argument and persuasion about the desirable qualities of private and public life" [4]. We have experienced the process of design in an organization as a political process. One group tries

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to take more control by designing a process that favors them; other groups refuse. The power conflict renders the design inconsistent and therefore costly to implement and maintain. Much of this struggle around the placement of power and responsibility comes from the fact that people are often resistant to change, viewing the change from their existing personal perspective. Once members of the organization acquire design thinking and develop the discipline to see problems from fresh angles, many of these conflicts can be anticipated and addressed more directly.

Nonetheless, non-designers cannot acquire design thinking easily or without applicable real-world opportunities for practice. The biggest challenge for people in the acquisition of design thinking is their ingrained knowledge. As they acclimate to life in the organization, they may take many aspects of the work and the organization for granted. They typically do not think about alternative ways in which the work could be organized. For users, their work practices become a reality, and alternative work practices, particularly ones that contradict theirs, can represent a threat to that reality. For this reason, when we engage clients as practitioners, we emphasize members' self-reflection. We often use ethnography to represent people's own practices and "hold up a mirror" for them—which is a key reason that we've come to use video as a reflection device. We create short video podcasts to report ethnographic findings and help people to start reflecting on their own reality. Video conveys the details of the phenomena, e.g., work, interactions, conflicts, strategies and learning.

Those people who are doing the work are generally not profes-

sional designers. Their goal is not to design the work but to do the work. Furthermore, design thinking cannot be explained such that people can then be ready to practice design; practicing design differs from the theoretical understanding of what design is. Learning design thinking therefore requires actual participation in designing in which experts can "coach, not teach, learners," to use Schön's phrase. On one hand, design thinking is a general skill that everybody possesses—many people can write coherent, well-crafted prose, cook a creative new dish, or arrange a living room nicely. Yet not everyone can learn to become a competent designer.

Technologies play a crucial role in this learning, although, as we've emphasized, technologies are only a means, not an end. We therefore need to broaden the role of technology. Technology can be a tool for learning design thinking and facilitating cultural change. This is one area in which we see HCI as offering a somewhat limited purview. As an outgrowth of engineering, HCI tends to treat technologies as an end. In the case we presented earlier, members of the organization acquired design thinking experientially, initially by working with the practitioner and designing with simple intranet tools. Gradually, they started proposing new tools and new ways to organize the work. Instead of designing abstractions such as roles, communication paths, and strategies, they designed tangible artifacts. We believe this played an important role in helping them acquire design thinking.

Therefore, to help acquire design thinking, as practitioners we need to constantly challenge people's assumptions. In this relationship, we are always conscious about our relationship with the client. We do not take our relationship with them for granted and instead try to design the relationship as part of our project. Inherently we become part of the situation that we seek to change.

Power is also an issue here. Because we are hired by the organization to deliver some value, members of the organization tend to think of design as our job. They believe they can simply say what they want and we will design it. The new research program should take this reflexivity seriously. In most studies in HCI, computer-supported cooperative work (CSCW), and even participatory design, practitioners are seen as observers outside the situation. Much research is needed in this aspect of practice.

Research Agenda

While practitioners like us can talk about many folk theories as to how to help clients transform their organizations, we feel that more grounded theories to guide us in practice are needed. There is a lack of existing theories that could guide us through the clients' learning process. It is not clear in what process clients acquire such skills as design thinking while they initially have no idea and become defensive. Furthermore, while theories emphasize the political nature of organizational change, little guidance is available as to what specifically practitioners can do. We require theoretical insights more substantive than participatory design methods, such as future workshops, card sorting, and games.

For this reason we would like to call for research that is sensitive to the issues practitioners really face. We propose a research agenda that incorporates a broader organizational frame, taking into fuller account how organizations actually change (e.g., cultural change and power relations), and one that still emphasizes the valuable roles of technology, communication, and coordination. Just as HCI was highly successful in its goal of improving the relationship of a user to a computer by integrating multiple disciplines, this new research will also require many disciplines. Social scientists have a larger role to play here, one that's much more important than finding ways to make technology more useful: We also need to better understand the broader role of technology and its design. We need to understand not only usability and the usefulness of a technology for a certain work practice, but also the interactions the technology affords in transforming human conditions and learning.

END NOTES

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DOI: 10.1145/1925820.1925835
© 2011 ACM 1072-5220/11/0300 $10.00

This forum looks at how the fields of interaction design and HCI can extend to cover "developing" communities around the world, ones that are gaining access to digital technology for the first time.

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While the Meter is Running: Computing in a Capped World

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Most readers of this magazine live in an always-on, ultra-connected world. Many of us enjoy all-you-can-eat bandwidth at reasonably high speeds. But what happens when your Internet use is palpably constrained? What happens when you only have a fixed amount of bandwidth per month and where every byte you access uses up this precious resource? Or worse, what happens when you have to share that bandwidth pool with the three other Internet users in your household? These are the questions raised when we begin thinking about how users interact with the Internet in metered bandwidth situations. By answering these questions, we can help Web developers, interaction and application designers, and even Internet service providers (ISPs) customize their experiences for situations in which each byte delivered has a monetary value. In this article, we report initial insights from our experiences studying how households in South Africa use metered bandwidth.

To be clear, a metered Internet connection is not the same as a slow Internet connection. The HCI community has already approached the issue of bandwidth speed. For example, researchers have explored how families adjust when internal bandwidth bottlenecks are made more visible [1] and others, such as M-Lab and Glasnost [2, 3], have focused on how to make external network speeds more transparent to end users. Recent studies also describe how slow Internet speeds affect how users in resource-constrained settings browse and experience the Web, with their interactions being more planned, purposeful, and deliberate [4]. On the other hand, the structure of bandwidth pricing has received less attention. Yet, metered bandwidth, consumed either as a pay-as-you-go per megabyte or in relatively small monthly bundles, is worthy of exploration by the HCI community, because it imposes different constraints to slow internet speeds..

Low-bandwidth caps are common for digital subscriber line (DSL) users in South Africa, Australia, and India, and in some entry-level broadband plans in Canada. Elsewhere, the prospect of lower caps on home broadband is sometimes discussed, as ISPs seek ways to mitigate the high demand for bandwidth by more customers. Most important, with the rapid spread of Internet-enabled mobile devices and wireless modems for laptop data access, more users will be connecting to the Internet via a metered connection than we might have ever imagined. Some will retain the convenience of an all-you-can-eat plan at their home or workplace and will be metered only when using their mobile devices. For others, particularly for

resource-constrained users in the developing world, the only means of Internet access will likely be though a metered channel, via a cybercafé, a mobile device, or a metered DSL connection at home.

We have chosen to study bandwidth caps in South Africa because most broadband users in the country have known no other way of accessing the Internet at home; the rituals and practices to cope with shared, metered bandwidth are well understood in connected South African homes. Due to relatively scarce undersea international data connections and a somewhat sleepy domestic market, broadband has been quite expensive. Prices have begun to fall more rapidly in the past few months, as more capacity (and more alternatives, including some all-you-can-eat plans) are coming online, but as of late 2010 the price of broadband was still out of reach for the half of South African homes living below the poverty line [5], and a considerable expense for those with a middle-class income [6].

In 2010 most broadband providers offered varied monthly plans in South Africa, with caps ranging from 1GB to 5GB, generally fashioned in a use-it-or-lose-it style—if a user doesn't consume the resource within the month, the balance does not roll over to the next month. If users exceed their allocation, they are moved to a slower connection or their Internet access is terminated. Of course, if they have the means, users can "top up," or buy another gigabyte of data, which is also "use it or lose it" for that month. If not, they must live with limited or no Internet access for the remainder of the month. In some cases, operators offer websites where users can track monthly balances and purchase top-ups. Many will send an SMS or email reminder when the cap is looming. Which plan a household ultimately chooses is related to the gains perceived from investing in a broadband service. More so, plan choices correlate with how affordable the rates are for the caps, on top of the expense of the telephone line which is required to deliver the DSL service.

We set out to investigate how households choose their plans and how these metered plans affect their patterns and norms of Internet use. Questions we aim to answer are: How does Web behavior change or differ when there's a bandwidth cap? What strategies do households use to manage their caps? What information do users require to help them best use their cap for their needs? And finally, how well do users approximate their needs and match them to the best fitting plan? We believe studying how metered usage affects home computing is important for the following reasons:

Caps shape how, when, and for how long people browse. As we saw in work by Wyche et al., constraints can change how users surf the Internet [6]. For instance, Kenyan Internet users in the workplace were more deliberate in their browsing style, planning their online activities before getting on the Web to avoid excess metering charges at Internet cafes. They were also frustrated by the time spent downloading large files and email attachments, often sent by colleagues in better-resourced settings, because of slow speeds and bandwidth limitations. In our work in South Africa, we're noticing the constraint of metered bandwidth similarly affects how people browse the Web. For example, our participants tend to avoid high-bandwidth sites at the beginning of the month so they can stretch their caps to the end of the month, when the meter starts running again.

Caps force people to put a price on their Internet use. Caps cause users to approximate the monetary value of their household's Internet use. In our work we looked at what plans people chose and whether they actually ended up using their allocated bandwidth for the month or consistently went over their cap. By doing so, we seek to understand how well the bandwidth amounts offered by providers match up to the online needs of our participating households. Moreover, we wish to understand how users view and ascertain the value of various types of digital bits and content. By understanding the value that users give to each bit, we can better predict the desire for and choice of certain forms of online content over others, and design accordingly.

Caps create a need for tools that show people how they are using their bandwidth. Although ISPs offered basic per-day or per-month reports on bandwidth consumption, most of our participants were not sure which specific online behaviors were eating into their caps. Yet to help them stick within a budget, avoid "top up" gigs, and have bandwidth last to the end of the month, they require transparency about the bandwidth costs of various sites and actions.

Because of the inherent limitations of last-mile and wireless-access technologies as well as congestion from increased demand by users, applications, and devices, it is likely that metered bandwidth plans will persist. In the mobile space in particular, metered caps ensure a quality of service for everyone and help to control traffic on already-burdened infrastructure. This makes metered bandwidth use an interesting topic of investigation, not only in infrastructure poor settings.

Our fieldwork in Cape Town has taken us to a wide range of

Photograph by Charles Roffey

▸ A storefront in Jijiga, Ethiopia offering Internet connections and service.

homes—from a massive mansion with sprawling gardens, to a four-room home in which seven people shared a single 3GB monthly connection—and to a variety of situations in between. We are struck by how almost everyone we spoke to was aware of the bandwidth constraint, adopting similar strategies to manage this limited resource, regardless of income level. In this way our research illustrates a way to blur the boundaries between the traditional dichotomies of studies of "household" use in developed markets versus those of "resource constrained" users in the developing world, the focal point of many ICT4D and HCI4D studies.

Moving forward, we suggest the HCI community should consider the implications of metered bandwidth situations on matters of inclusion, usability, and usefulness. Specifically, we need to better understand how a cap affects Internet use, what tools and information people need to help them deal with metered usage, and how existing websites and tools can be more accommodating of people who are on usage-based bandwidth plans. Whether via landlines or, increasingly, mobile phones, metered bandwidth may challenge the freewheeling metaphors that we have allowed to become synonymous with Internet use, such as "browsing" and "surfing." By examining Internet use under this form of constraint, we will broaden the HCI4D discourse by opening up conversations and avenues for research along a continuum of users, beyond the easy dichotomies of developed and developing. In doing so, we may improve the ways in which we design and build experiences for the next billion Internet users.

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DOI: 10.1145/1925820.1925836
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In this forum we will celebrate research that helps to successfully bring the benefits of computing technologies to children, older adults, people with disabilities, and other populations that are often ignored in the design of mass-marketed products.

Juan Pablo Hourcade, Editor

Universal Interactions: Challenges and Opportunities

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Welcome to the new forum on universal interactions. When contemplating how to design technologies, interaction design professionals may often first think of designs that will work for people like themselves. This can end up adversely affecting populations with needs and abilities that differ from the majority of our field. In this forum we will share and celebrate research and practices that focus on these populations, including children, older adults, people with disabilities, and people with low socioeconomic status (SES). In this column, we discuss some of the key challenges for our field in designing technologies for each of these populations.

Children

There are several obstacles and opportunities in designing digital technologies for children. First, children are beginning to use digital devices at a younger age than earlier generations. Touchscreen devices in particular can make it simple for very young children to interact with software. These new opportunities also raise issues not only about understanding how to design interactions for these new age groups, but also about learning how using these devices affects the children, which brings us to the concept of digital natives.

Certainly, many children in developed regions are using digital devices from a very young age, in many cases not remembering when they did not use a computing device. However, each generation will be a different kind of digital native. The technologies they grow up with will change, and this will continue to spur interaction designers to identify the guidelines and interaction techniques that are most appropriate for each generation.

We must also be vigilant of technology in children's lives in respect to the potential negative consequences of isolation, a sedentary lifestyle, exposure to harmful content, and a lack of creative endeavors. At the same time, technologies can be used to alleviate and reverse such situations.

For example, technologies can augment and encourage face-to-face interactions instead of isolating children. In elementary schools, the most common practice in the U.S. is for children to use computers in a laboratory where desktop computers are available and the children often use headphones that keep them tethered to the devices. With such setups, it is difficult for children to get help from the teacher and learn from one another. Most of the positive social interactions that can take place in a classroom vanish. On the other hand, when we observed children using laptops from One Laptop Per Child (OLPC), we found the exact opposite [1]. The mobility of the laptops seemed to actually encourage social interactions, with children seeking help from teachers and peers and information quickly spreading. These observations suggest child-friendly netbook computers could encourage positive social interactions in the classroom.

At home, playing traditional video games can lead to a sedentary lifestyle in which children stay indoors and exercise infrequently. New gaming technologies such as Microsoft Kinect can have the opposite effect; Kinect requires physical activity for it to work. Narcis Pares and colleagues have taken this idea a step further with augmented playground equipment [2].

Also at home, a common concern of parents is children accessing harmful content, such as advertisements for sugary food. A related threat is the excessive use of computers for entertainment, which can take away from time spent on schoolwork. A recent study from the U.S. National Bureau of Economic Research suggests unsupervised Internet access in the home can lead to negative consequences in children's math and reading scores [3]. A way of countering these negatives is to provide children and parents with enough structure and literacy on media sources to guide children toward meaningful computer use. Another way to move children away from passively experiencing media and games with preset scenarios is to provide them with technologies that enable them to be media authors. Technologies that appeal to their strong interests and give them the tools to be creative can prove quite entertaining.

As part of information literacy, it is also important to teach children how to gain insight from the large amounts of digitized data they will eventually access in their lifetime. We already use digitized data to find inexpensive flights, movies to watch, and homes for sale. In spite of these advances, we currently do not even have appropriate tools for children to search the Internet, let alone gain insight from large amounts of data, so much research remains to be done.

Older Adults

Older adults make up an increasing portion of the world's population, with developed regions leading the way and other regions quickly catching up. The World Health Organization estimates that by 2050 there will be two billion peo-

Photograph by Keel Andrew

When designing, there is a need to connect to people's needs, abilities, context, and daily realities.

ple age 60 and older. A fast-growing generation of older adults, as well as higher levels of computer literacy, can provide a strong incentive for technology companies to design products that target this population. Designing for older adults can also be a pathway to design for people with disabilities since with old age come declines in cognitive, perceptual, and physical abilities.

One of the challenges we have in designing for older adults is that many of the guidelines available in the literature are based on studies conducted several years ago. The problem is that older adults and technology are quickly changing. Baby boomers, for example, have much more computer experience when compared with the typical older adult of 10 years ago. As a matter of fact, each generation will bring its own strengths and weaknesses into its golden years.

A second challenge is most of the guidelines available treat older adults as a monolithic group, when in fact there is a great amount of variability. For this reason, there is a need to match specific design guidelines to specific declines, or to specific kinds of lifetime experiences. This means that future studies with older adults should attempt to characterize participants as clearly as possible in terms of their abilities and experience, using standardized measurement instruments if possible, in order to understand the impact of each factor on the use of technology.

Societal changes are also bringing new needs. For example, older adults are often living away from family and have much smaller families than in past generations. When they can no longer take care of a house by themselves, they are increasingly moving into retirement communities or assisted-living facilities. Many researchers are looking at how to use technology to support older adults in these environments to fulfill their medical and emotional needs.

A related issue is the increasing number of older adults in good physical health but with severe cognitive declines, such as dementia. Recent estimates of prevalence point at about 35 million people worldwide suffering from dementia, most of them in developed regions. The numbers are climbing at a fast rate, with worldwide diagnoses increasing by 20 percent between 2005 and 2009 [4]. Human-computer interaction researchers have rarely explored supporting older adults with such cognitive difficulties, or their caretakers.

People with Disabilities

The increasing need to use technologies to fulfill basic needs and rights, such as voting, paying for groceries, and buying tickets for public transportation means that, as technology designers, we have a responsibility to ensure that we design for the strengths of people with cognitive, perceptual, and physical impairments. The good news is that human-computer interaction researchers and practitioners have developed useful sets of guidelines for some of the most common impairments (e.g., people in wheelchairs, people with severe vision loss, and people with severe hearing impairments). On the other hand, we still do not have a clear enough understanding of how to help people with mild impairments, people with multiple disabilities, and people with temporary or new disabilities.

Multiple impairments are of particular concern. For example, an older adult who has developed mild to severe vision and hearing impairment could have great difficulty using technology. The accommodations for people with visual impairments (e.g., screen-reading software) would not be appropriate for those with hearing loss. Hence, it is not sufficient to address specific disabilities separately when designing technologies. It is also necessary to consider what happens when they intersect.

Temporary or new impairments are also a great challenge. For example, an adult who has recently become blind will not know how to read Braille. Likewise, someone who has recently lost the ability to hear will not know American Sign Language or an equivalent signing language. This type of impairment is common in people who have suffered trauma, strokes, or similarly impairing health setbacks.

From a computer science perspective, it would also be easier to develop software for people with disabilities if software libraries incorporated better support for them (e.g., every visual widget should have an accessible equivalent for people with severe visual impairments). There is certainly room for research in this area for people working on operating systems, programming languages, and toolkits.

In addition, there are many opportunities to go beyond simply

providing access to technologies designed for the general public by designing technologies to improve the lives of people with disabilities. For example, it is not uncommon for people with language deficits, often due to stroke, to have speech-initiation problems. However, digital support can help them unobtrusively self-cue, such as with Lingraphica's iPhone application SmallTalk Aphasia. Applications such as this one, developed for widely available mobile hardware, can be more easily integrated into an everyday routine.

People with Low Socioeconomic Status

Poverty is a global problem, with half the world's population living on less than $2.50 per day and the poorest 40 percent of the world's population accounting for a mere 5 percent of global income, while the richest 20 percent account for three-quarters of world income [5]. In the U.S. alone, 43.6 million people live beneath the poverty line, including one-fifth of children [6].

People with low socioeconomic status (SES) have less access to digital resources such as high-speed Internet access. In the U.S, 36 percent of households with an annual income under $25,000 have broadband access, versus 94 percent of households with an income greater than $100,000 [7]. In spite of this gap, the growing popularity of mobile devices means we can reach many more people (e.g., 93 percent penetration in the U.S [8] and 41 percent penetration in Africa [9]).

When designing, there is a need to connect to people's needs, abilities, context, and daily realities. For example, in the U.S, people with low income spend significantly more time than the national average traveling to grocery stores and may lack the knowledge or time to prepare healthy food. Priorities such as ensuring fullness become more important than meeting nutritional guidelines [10]. A digital application could help someone find the most nutritious food given a certain amount of money and the closest place to acquire it.

Similarly, people with low-SES might not have access to channels of reliable and relevant information for their lives, such as how to avoid scams and fraud (e.g., predatory lending), or how to access useful community resources. This challenge again provides opportunities for digital technologies to help, keeping in mind that these efforts should be culturally relevant.

In all cases it is important to remember that access alone will not lead to equality. While we imagine the Internet to be an egalitarian forum open to all, it replicates some of the stratification present in the non-digital world, as seen in the racial and class divisions between Facebook and MySpace users, with low-SES youth generally preferring MySpace [11]. If a job recruiter reaches out to potential applicants through Facebook only, MySpace users never see the initial chance to apply. Therefore, we need to design technologies that encourage and enable participation in social, economic, and political processes as well as promote upward mobility and positive growth.

Conclusion

We hope our review of challenges and opportunities for research both provides a preview for the type of articles we will feature in this forum and encourages more professionals in our community to pursue these research paths. If you are interested in writing an article for this forum, send your ideas to juanpablo-hourcade@uiowa.edu

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DOI: 10.1145/1925820.1925837
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Endless Nights—Learning from Design Studio Critique

I'm intrigued by the nostalgic magic of the culture of design education. Most designers I've met who have gone through formal design training are passionate about their experiences; they talk with fond recollection of long nights, endless critiques, and sneaking into the computer-lab closet to catch a few hours' rest before the final review. What is it about the design-studio critique that's so memorable and drives so much reflection?

One of my colleagues, reflecting on a favorite professor, recalled a critique on a visual design printed piece; all of the students had put their work on the wall and were talking among themselves, waiting for the professor to arrive. A few minutes past 9 a.m., the professor walked in. He looked at the wall for about 30 seconds. The students grew quiet. He turned and looked at them, slowly panning across the room. He looked back at the wall. And then he turned and walked out of the room.

Another student, now a visual designer at frog, recalled her most vivid memory of design school was "getting a D on my first project in fundamentals of design my freshman year. It was my first D ever—I cried in front of my professor and thought I needed to quit school."

During my first semester of teaching intro to industrial design, I found myself reading and rereading a paper from a student that referred to a jester. The paper, describing how he had designed a candleholder, was full of grammatical errors but lacked any reference to a jester. Then it hit me—he was talking about *gesture* drawings. His jester was a sorry homonym. When I showed the paper to my wife, an English major, she suggested I shred it and hand it back in a ziplock baggy.

The Value of Criticism

The rough treatment of students in design school isn't just fodder for comical stories. It has immediate and practical value for these designers when they get into the real, harsh world of the consultancy or corporation. In these environments, clients and creative directors pull no punches, and there is rarely time for sugarcoated feedback. Design work becomes a point of departure for iterative revisions, and so a harsh and thorough critique is one of the best outcomes of a design review one can hope for. Put another way, the more detail that emerges during a negative design review, the more opportunity for corrections during subsequent revisions.

Perhaps most obvious, but most important, a critique requires something to critique—it forces a student to make something, to *do something*. A designer is equipped with the magical ability to conceive of something that doesn't yet exist and manifest it in some way other than words. Designers can make things real. The looming critique forces action, as designers drive toward a deadline with an expectation of public delivery.

A negative but structured design critique helps design students learn that design is not entirely subjective, and isn't about either beauty or the eye of the beholder. Design has rigor, structure, and method, and a critique should systematically articulate the framework selected and then objectively compare the work with that framework. This is the discourse that evolves during a critique, and it's the same discourse described by Donald Schön in his work describing the reflective practitioner. For a "good designer, they will reflect-in-action on the situation's back-talk, shifting stance as they do so from 'what if' to recognition of implications, from involvement in the unit to consideration of the total, and from exploration to commitment" [Schön, 1982]. But for a designer who is not yet "good," a critique is a chance for reflection-post-action that allows the designer to make all of these shifts, albeit after the fact.

A Critique in Action

Consider this real excerpt from a class critique. Students are looking at a wall with wireframe flows showing how a user navigates through a fictional mobile-purchasing website.

Professor: *"Can you describe what's happening here?"* [Points at a wireframe showing large, bubbly letters and a number of vivid balloons and streamers]

Designer: *"Well, when the user visits the site for the second time, I wanted to celebrate their return by recognizing them; this element here* [Points to balloons] *is congratulating them on their choice of plan."*

Critique Participant 1: *"That doesn't make any sense. Wouldn't something more subtle be appropriate?"*

Critique Participant 2: *"Yeah, I mean—this is a cell phone company; it's not like a greeting card company or something. It's not working at all.* [In a mocking voice] *'Congratulations on your rollover minutes!'"*

Professor: *"It makes a lot of sense to overtly recognize that the user returned to the site, because it will help them understand state—that they are logged in—and reinforce personalization. But is celebration really the right emotive quality?"*

Designer: *"Yeah, maybe not—I was trying to make it more happy, to form a brand relationship…."*

Critique Participant 2: *"But that relationship can come over time. It's not going to happen on this particular screen."*

Designer: *"OK, so if I keep the idea of recognition, but shift toward something less playful..."*

Critique Participant 3: *"Yeah, save the playfulness for appropriate times, like maybe if you go over your minutes, the company rewards you with a one-time free overage waiver—that's a celebration."*

This is a public dialogue between the designer and others (including the professor and the other students). During this dialogue, the conversation flows through open-ended questioning ("Can you describe what's happening here?") to rationalization ("I was trying to make it…" or "I wanted to…") to very detailed value judgments ("That doesn't make any sense" or "That's not working at all"). The dialogue works for a number of reasons:

1. The designer is receptive to criticism but also has a chance to engage in an explanatory dialogue. This implies a power balance. The group recognizes an opportunity to criticize but also recognizes the ability for the designer to justify his or her actions.

2. The professor acts as a moderator but is not impartial. He guides the discussion through the open-ended questions and provides continual summary of the discussion, while participating as a reviewer.

3. The relationship between the designer and the participants is not defensive. We can assume that the group has a positive working relationship; otherwise, the sarcastic comment from Participant 2 would have been seen as mean-spirited, and would have likely been ignored by the designer.

4. The material that the group is looking at has enough detail that the group can criticize thematic elements as well as detailed nuances. If the balloons were not there—if they were presented as boxes with the words "celebratory element"—this discussion would not have occurred. The artifact acts as the prompt, and the group reacts based on their experiences, the context of the problem, and the facilitation provided by the professor.

It's also useful to note how the critique excerpt ends with an idea for a new feature. The critique is generative; it doesn't simply offer response to what is shown but also produces new ideas for further iterations. The process hones existing design details while simultaneously suggesting new ones.

A negative but structured design critique helps design students learn that design is not entirely subjective, and isn't about either beauty or the eye of the beholder.

Learning to Be Critiqued

The profession of interaction design is growing organically; there are a number of practitioners engaged in interaction design who have never formally studied design or attended a design school. These folks fell into the profession through marketing or engineering, or slowly grew into it as their existing role evolved to include interface design and development. For these practitioners, learning to critique and to be critiqued is critical for career advancement. In many cases, it's going to be up to this individual to both demand a critique and to define the rules of engagement. And it won't be pretty, as most design students struggle through four years of criticism before finding a confident voice and appetite for review. But the critique adds immense value to the design problem being addressed and is fundamental in advancing an individual design idea, in refining details of the idea, and in ensuring that quality work gets the attention it deserves.

DOI: 10.1145/1925820.1925838
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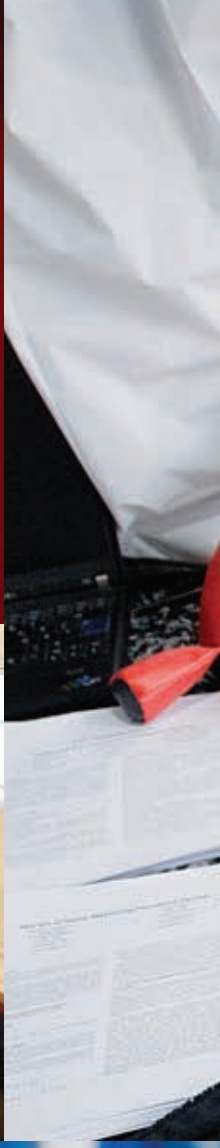
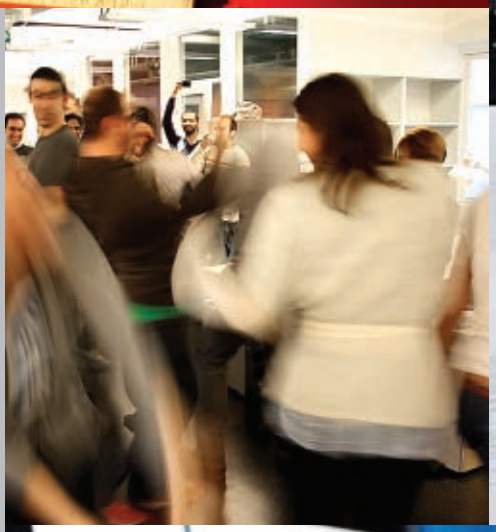
Mobile Life Centre: Mobile Applications for Fun and Pleasure

How would you describe your lab? The Mobile Life Centre at Stockholm University in Kista, Sweden, does research in mobile services and ubiquitous computing—focusing on consumer-oriented mobile and ubiquitous services spanning.

It was founded in 2007 as a VINN Excellence Centre with a 10-year grant selected by VINNOVA (the Swedish Governmental Agency for Innovation Systems). The Centre is hosted by Stockholm University with the Swedish Institute of Computer Science (SICS) and Interactive Institute as co-executors. The Mobile Life Centre has quickly established itself as an internationally recognized research locus in the area of mobile services.

In the academic world, the Mobile Life VINN Excellence Centre is known as a vibrant and interesting research facility. After three years, the Mobile Life Centre has emerged as a research endeavor that fully engages in pursuing experiential, leisure-oriented, and playful topics. The Centre's strategic importance lies in doing serious research on slightly unserious activities; results range from publishing ambitious books





on new playful activities, such as pervasive games and social media on the road, to generating and demonstrating innovative mobile as well as leisure-oriented applications.

What is the unique feature of this lab? The Mobile Life Centre is an exciting place to be. The environment is characterized by openness and cooperation cross borders—here you will find academic researchers from different disciplines intermingling with researchers from strong industry partners. The research often results in working prototypes that can be tested by end users.

We provide a neutral arena where researchers and industrial partners work together; we focus on creating new interaction models and finding efficient and user-oriented methods for developing mobile services.

In essence, the Centre explores a range of novel mobile services for mobile media creation, play, social interaction and bodily awareness, and the ways in which such technology shapes everyday life. This exploration results in concrete examples for mobile services that have been designed, implemented, and tested to possibly be deployed to market within the short or long term; results also include studies of various social practices.

What is the focus of your activities? The main focus of our research is applications for pleasure and for the good life. Our approach to research gives us all food for thought and knowledge about the way we live our lives. It is inspiring—not just for us but also for industry and the public—to think about how life will be in the future.

An important feature of the research is studying new ways to interact in a fulfilling manner. The researchers from the industry partners play an important role in the Centre's activities. They often contribute with so-called spin-ins—research ideas that could be deployed by the industrial partners.

What is the one thing you see as the most important thing you do here? In short, we are a sort of playhouse for technology. We want to do research with a twinkle in our eyes, and we want to combine playfulness and seriousness. That is the core of our activities.

How many people are in the studio, and what is their mix of backgrounds and roles? There are currently 50 people working in the Centre itself and another 40 industry partners collaborating with us. That makes a total of around 90 people con-

A Few Key Projects

Mobile 2.0 Mobile-in-the-world
Creating truly mobile services requires a completely different approach from just moving existing, stationary Internet services to the mobile platforms. We call services that take into account these unique properties of the mobile setting Mobile 2.0 services.

A number of such services have been designed and implemented in the project, and we are now seeing how they are being deployed both in real-world situations with public-sector partners such as the city of Stockholm, and used as examples of cutting-edge technology developed by industry partners such as Ericsson. *Contact: Lars Erik Holmquist*

Affective Health
This project explores mobile services that empower people to monitor and understand their own stress levels in their everyday activities. The current prototype aims to provide users with an easy grasp of data visualization captured from body sensors and mobile devices. The system empowers users to take control of their own behavior and cope with stressful situations, and increase activities that promote their well-being. *Contact: Kristina Höök*

MoreVideo–Mobile Collaborative Video Production
We invent and investigate mobile collaborative live-video production. First-generation, mobile-broadcasting applications make it possible to share live video streams from various types of use contexts over mobile networks such as 3G (for example, see bambuser.com and qik.com). We explore second-generation applications, in which professional techniques for collaborative live video editing are made available on mobile platforms.

Patent pending and advanced plan to be incorporated into public, commercial applications. *Contact: Oskar Juhlin*

Pervasive Games
Pervasive games are games that are played in the world around us, rather than on a computer or mobile phone, or on a prepared playground. The main attraction of pervasive games is that they are reality-based, drawing upon a real world that is richer, more varied, and emotionally and historically more interesting than any made-up game world can be.

Two companies have been started within the project. *Contact: Annika Waern*

nected to the Centre in one way or another.

The Centre has two professors, four associate professors, eight senior researchers, and four researchers. Furthermore, there are 12 Ph.D. students, 10 junior researchers, and 11 master students within the Centre.

There are 13 nationalities represented in the Centre. We attract people from computer and systems sciences, sociology, anthropology, design, media studies, and media technology. The interdisciplinary research collaboration is performed within computer-supported collaborative work, human-computer interaction, and ubiquitous computing.

Who are your external partners? The Centre is located in Kista Science City—a world-leading ICT cluster. Internationally, Kista Science City is comparable to Silicon Valley, Bangalore, Sophia Antipolis, and the Multimedia Supercorridor in Malaysia. It's where you'll find many of the world's foremost ICT companies, gathered to take advantage of Sweden's strong position in mobile communications.

The Centre has strong industrial partners: Ericsson AB, TeliaSonera AB, Microsoft Research Ltd., and Nokia. In subprojects the Mobile Life Centre works with Philips Research, P AB, Bambuser, Street Media 7, and Do-Fi AB. Through Kista Science City AB, we also have access to many small and medium-size enterprises in the mobile-services fi eld.

The public-sector representatives are the City of Stockholm municipality and Kista Science City AB, and our innovation system partner is Stockholm Innovation & Growth (STING).

The Centre has a management team consisting of four senior researchers, two professors, two associate professors, and the Centre coordinator.

There is also a board of directors consisting of representatives from the partner companies, Ericsson, Microsoft research, Nokia, TeliaSonera and City of Stockholm municipality, as well as representatives from Stockholm University, Swedish Institute of Computer Science, and the Interactive Institute.

What is around the corner for Mobile Life Centre? The Centre already has strong industry partners, and through a partnership with Stockholm City Municipality, we have access to a number of exciting research environments in different social areas. The ambition for the future is to get a broader industry-partner base, including companies in retail, fashion, and interior design, for example.

Next, we are going to start a kind of pre-incubator for our researchers. This could be a way for researchers to work with their results in a slightly different manner; it will be a new and strong feature for us.

Any final words? The Centre director, Oskar Juhlin, wants to take the opportunity to invite all colleagues to Mobile HCI 2011, which the Centre is hosting.

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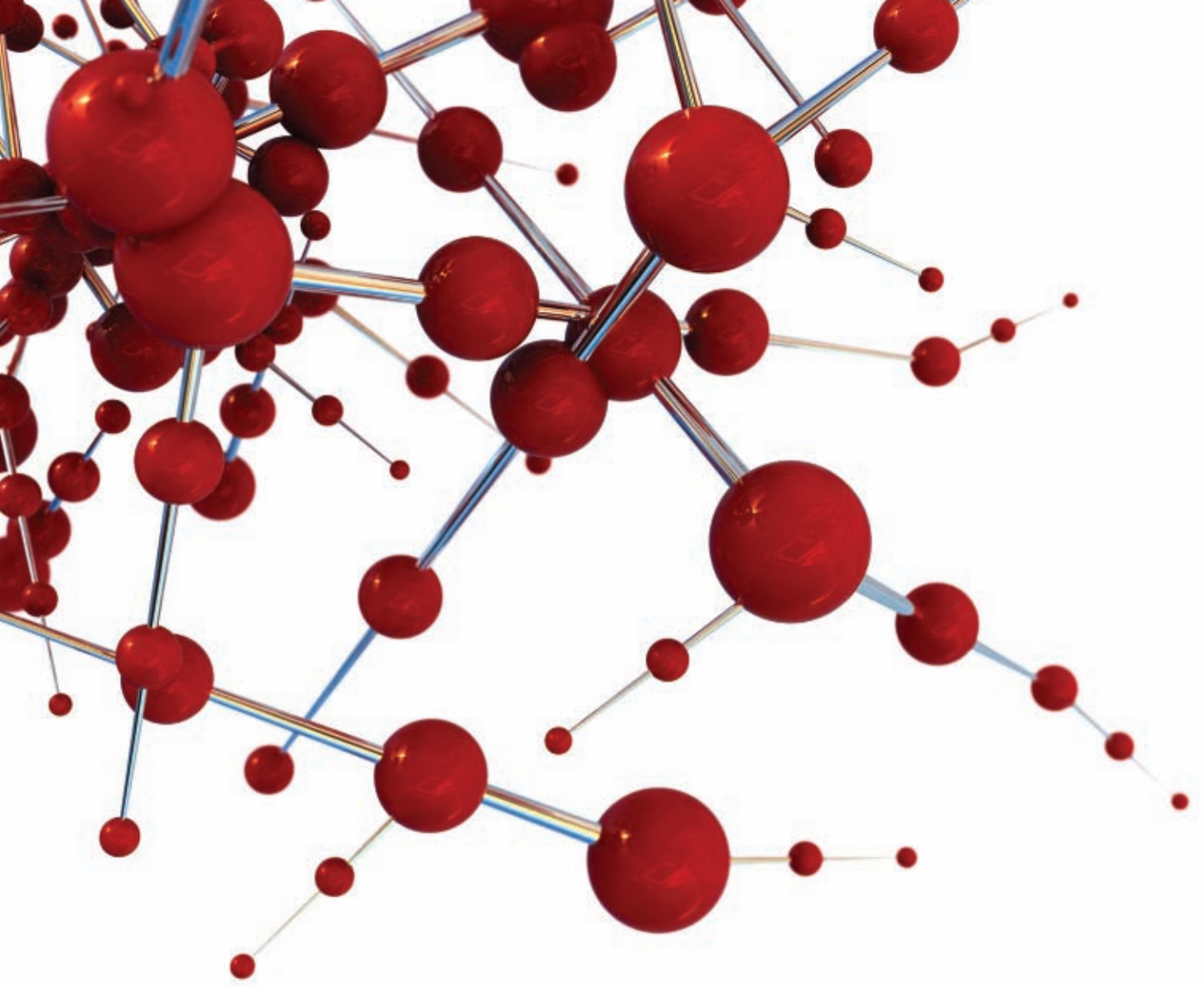

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Computer Support Cooperative Work 2011 (CSCW 2011)
Conference date:
March 19-23, 2010
http://cscw2011.org/

Eighth ACM Conference on Creativity and Cognition
Call for submissions:
March 25, 2011
Conference date:
November 3-6, 2011
http://dilab.gatech.edu/ccc/index.html/

Information Architecture Summit 2011 (IA 2011)
Conference date:
March 30-April 3, 2010
http://2011.iasummit.org/

FUTURE TALKS 011: Technology and Conservation of Modern Materials in Design
Call for submissions:
March 31, 2011
Conference date:
October 26-28, 2011
http://die-neue-sammlung.de/event/

April 2011:

The Life of New Materials
Call for papers:
April 1, 2011
Conference date:
November 17-18, 2011
http://www.pachs.net/newmaterials/

Ambience '11
Call for submissions:
April 1, 2011
Conference date:
November 28-30, 2011
http://www.ambience11.se/

Ninth Annual Material Culture Symposium for Emerging Scholars
Conference date:
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http://www.h-net.org/announce/show.cgi?ID=179642/=

DTRS9: Design Thinking Research Symposium
Conference date:
April 18-20, 2012
http://www.designophy.com/calendar/article.php?UIN=1000000196&sec=conference

May 2011:

CHI 2011
Conference Date:
May 7-12, 2010
http://www.chi2011.org/

Cabinet: Connection and Collection
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May 17, 2011
http://www.plymouth.ac.uk/pages/view.asp?page=33920

June 2011:

EICS 2011: ACM SIGCHI Symposium on Engineering Interactive Computing Systems
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DPPI 11: The Fifth Conference on Designing Pleasurable Products and Interfaces
Conference date:
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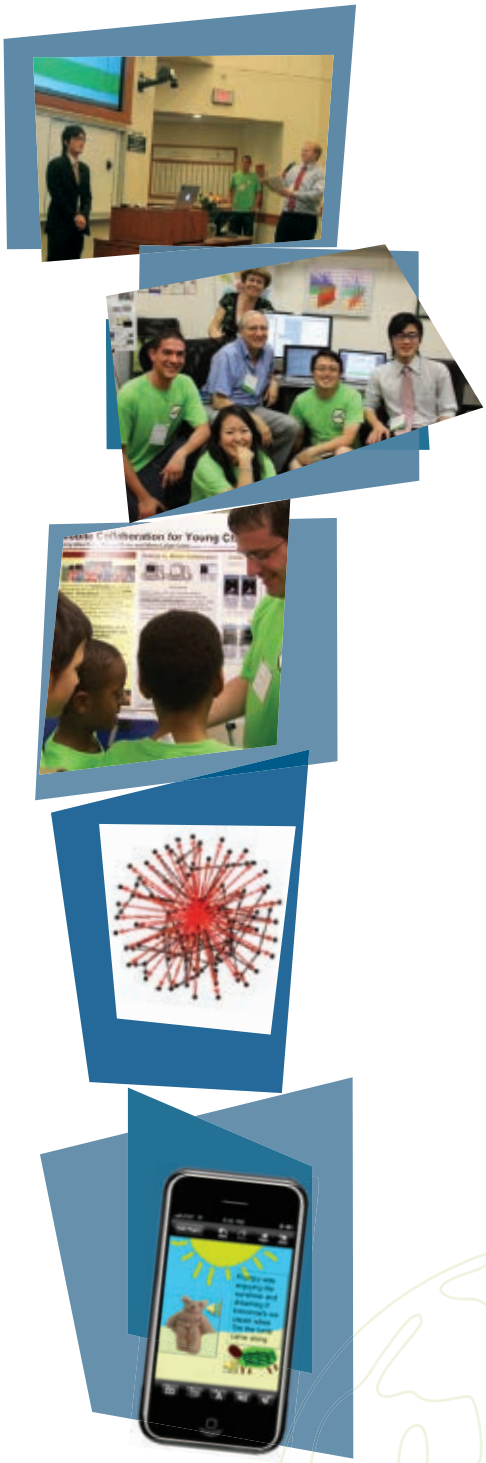

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