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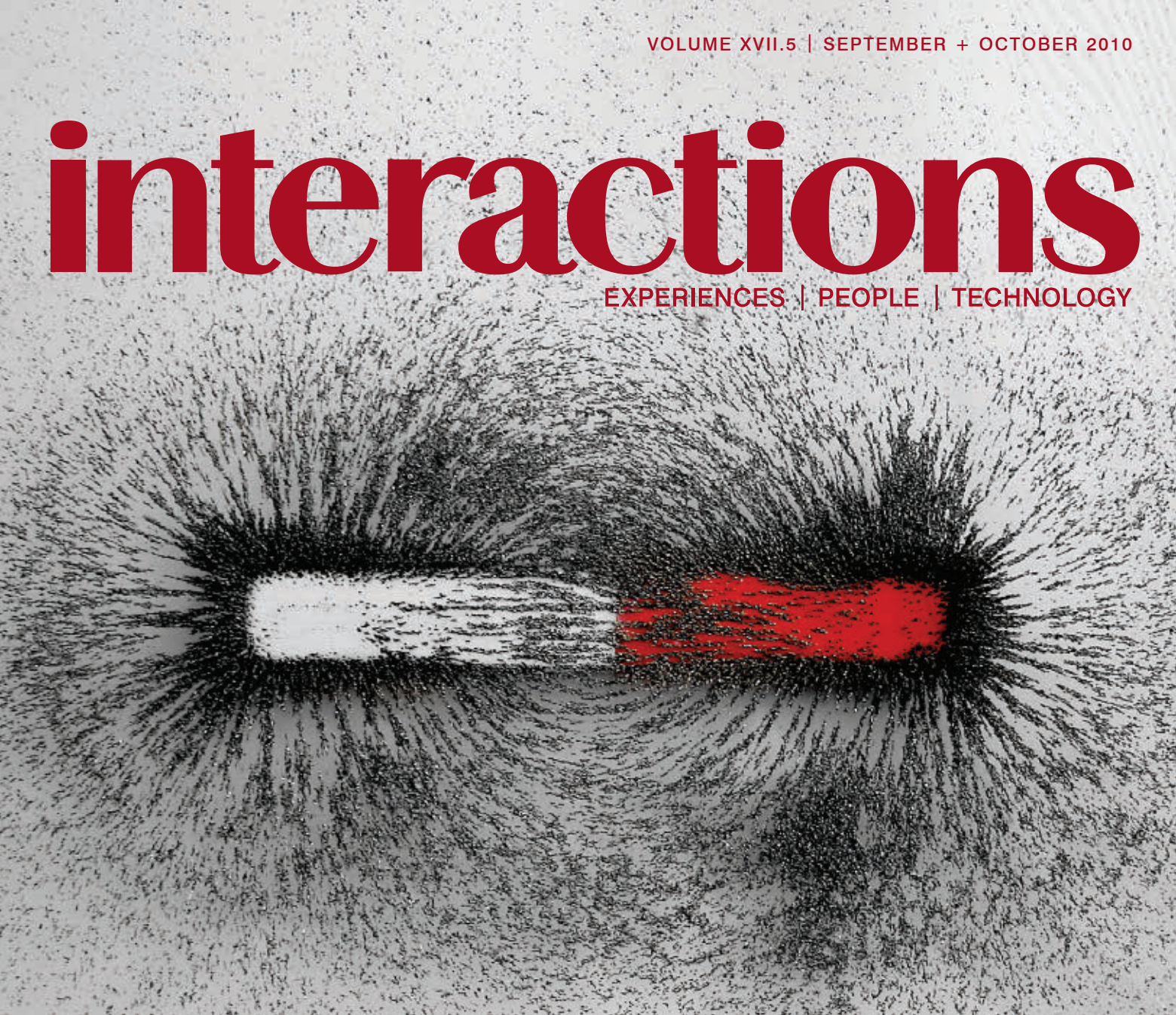

The Meaning of Affinity and the Importance of Identity in the Designed World

Cover Story by Matthew Jordan

Association for Computing Machinery

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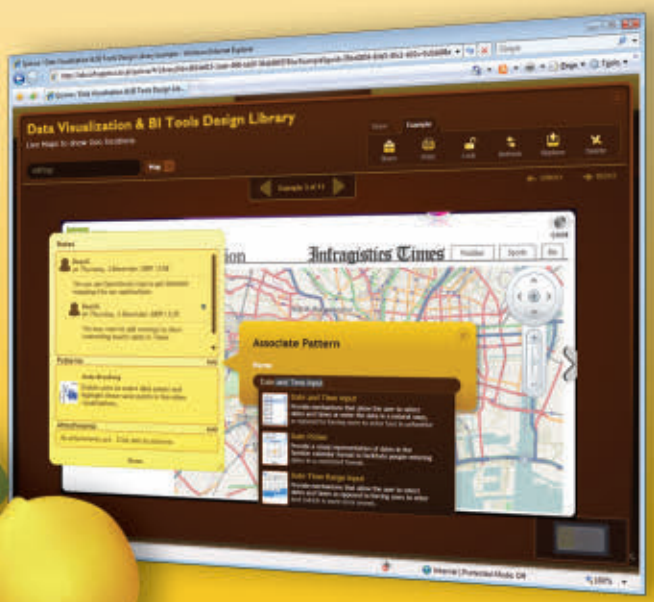

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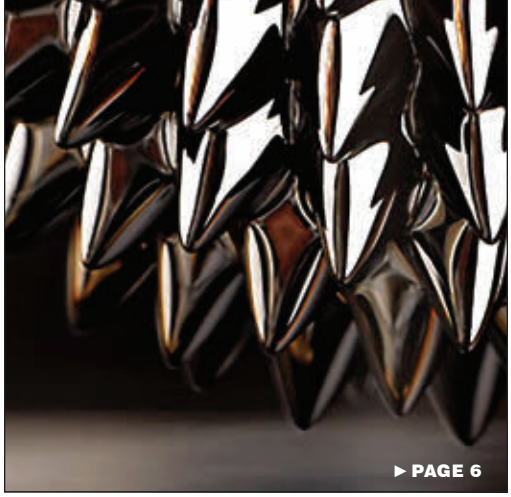
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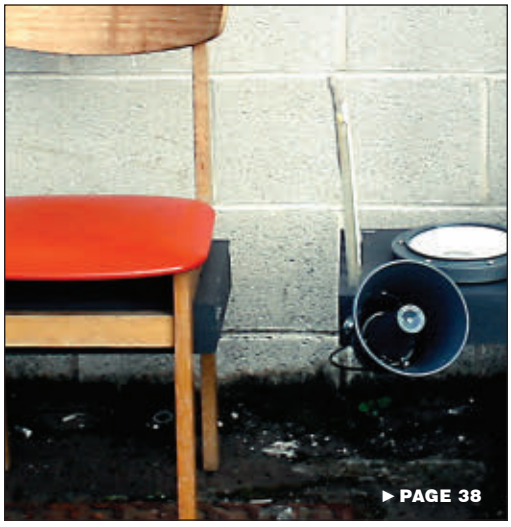
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Authenticity in New Media

Exploring the nuanced qualities of going "social"–capabilities that substantiate the integrity in new products, systems and services.

The Complexity of "Advancement"

These pieces explore both the simplicity and complexity of our designed world.

Design and Usability

New technology presents opportunities for enabling those with disabilities, but also challenges for all users.

The Politics of Development

Social innovation is tremendously political; these pieces describe some of the political challenges of social, cultural, and military work.

What is Design?

Design is a complicated discipline of research, synthesis, problem solving, and behavior shaping. These pieces explore this discipline.

▶ **ON THE COVER:**
Photograph by Dayna Mason

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Interactions: Authenticity, Complexity, and Design

▶ Richard Anderson

▶ Jon Kolko

Frequently, designers find themselves reflecting on the nuances of what makes us human—matters of cognitive psychology, social interaction, and the desire for emotional resonance. This issue of *interactions* unpacks all of these ideas, exploring the gestalt of interaction design's influence. Sarah Kettley, a researcher and an artist, is most interested in understanding the relationship between wearable computing and body adornment. She writes about the relationship between craftsmanship and authenticity, illustrating a potential divide between design and craft. We can see a similar exploration of the ethereal in William Odom, Richard Banks, and Dave Kirk's piece "Reciprocity, Deep Storage, and Letting Go: Opportunities for Designing Interactions with Inherited Digital Materials"; these authors are looking to understand "how the digital residue of a person's life could become the property of someone else and be representative of a person after they have passed on." And Liz Danzico's column focuses on the nature of serendipity and design. If design is careful planning, and serendipity is a desired state of unplannedness, what can interaction designers learn from serendipity—and what can we reappropriate in our work?

Several pieces in this issue look less at how to integrate human qualities into design, and instead at how to evaluate the qualities of design on human problems. Steve Baty examines why design is suitable for—and perhaps best prepared for—handling complex problems, and Graham Pullin and Andrew Cook show how this form of problem solving can lend new capabilities to those with a form of disability. In Dana Chisnell's review of Pullin's book, *Design Meets Disability*, she explains that the text is "a call to action against an old way of thinking, in which design for disability is solving a medical engineering problem rather than meeting a cultural, societal challenge." Our old friends Don Norman and Jakob Nielsen take gestural interfaces to task, exploring the usability—or lack thereof—in a number of the most popular touch devices we've come to take for granted.

Our cover story offers a thoughtful reflection on the qualities of affinity—of emotional attraction, nostalgia, identity, and language. Matthew Jordan describes affinity as the "emotional connection someone feels for a product or service as driven by these notions of beauty and identity. Unlike usefulness and usability, affinity is about unexplained desire or want. It is often irrational, fluid, and intense. Affinity is the opposite of aversion, and affinity is always positive. Along with usefulness and usability, affinity is the third influencer on a design's success." While Norman and Nielsen remind us that usability is still not "solved," Jordan's cover story creates a framework to extend design judgment beyond the old metrics of usability.

And there's more: Lisa Nathan and Batya Friedman describe projects in Rwanda; Jodi Forlizzi teases apart "experience design" and "service design"; Valérie Bauwens offers insight into the capabilities and approaches of Swisscom; and Nicolas Nova describes how we can learn from our failures in design.

This issue is about authenticity, complexity, and design—and the political, social, and human qualities of our work. We hope you enjoy it.

—Jon Kolko
eic@interactions.acm.org

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The Meaning of Affinity and the Importance of Identity in the Designed World

Matthew Jordan
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When a designer is thinking about ways to create experiences that deliver meaningful and lasting connections to users, it is helpful to consider the notion of our personal affinities and how they affect perception, adoption, and use in the designed world [1]. The term "affinity," when illuminated by definitions from chemistry and biology, gives us a deeper understanding of the form and importance of these connections people have to products and services. An exploration of what affinity means can lead us to consider new and useful ways of informing design thinking and ultimately help us design with more success.

The Meaning of "Affinity"

In chemistry and biology, affinity has two separate but equally interesting definitions that are both useful when considering how we approach research and design as practitioners.

1. The first definition of affinity, from chemistry, is "an attractive force between substances or particles that causes them to enter into and remain in combination." [2] The most interesting part of that definition is the notion of a force, or attraction, between elements. Similarly, in the designed world, we are often drawn to a certain design with a natural attraction simply because of its aesthetics and beauty. An inexplicable gravity pulls us toward some designs and creates a true elemental bond.

2. A second definition of affinity, from biology, is "a relation between biological groups involving resemblance in structural plan and indicating a common origin." [2] This definition also relates to design thinking, specifically in how we often see an inherent similarity between a design and ourselves. Our identity or self-image, as reflected in a product or service, can also lead to strong passions for certain designs.

Affinity in design, therefore, can be summarized as the emotional connection someone feels for a product or service as driven by these notions of beauty and identity. Unlike usefulness and usability [3], affinity is about unexplained desire or want. It is often irrational, fluid, and intense. Affinity is the opposite of aversion, and affinity is always positive. Along with usefulness and usability, affinity is the third influencer on a design's success.

Of course, price and access are other factors that drive product and service adoption and use. However, if the price, in addition to features and functionality, between two offerings is comparable, then affinity takes on a greater role. Novelty is another factor that may drive adoption and undercut design intent. While price and novelty do have influence, they are less the focus of design thinking and more in the sphere of strategic marketing.

The Importance of Identity

Before we look at how to effectively research and design with affinities in mind, let's first explore the notion of identity and discuss why affinity is challenging to incorporate into a design initiative. The role of beauty as a factor in design success needs little exploration; the world's greatest philosophers and writers, from both the East and the West, have given the notion a deep history of thought and attention, [4] and the principles and mechanisms of aesthetics like balance, tension, and contrast are well known.

The notion of identity and how it relates to affinities, however, is worth some additional exploration. Identity may be best explored in terms of the self-image we all have, and we can

[1] The physical world as we know it can be sorted into two camps: that which occurs naturally and that which is artificial or man-made. Everything in the second camp has been in some way, to some degree, designed. This camp can be considered "the designed world."

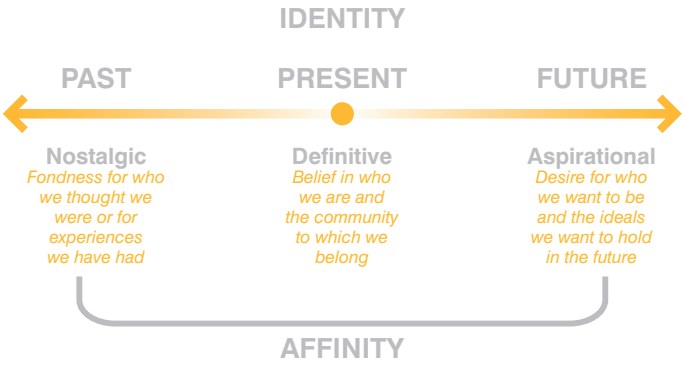
[2] *Affinity* Merriam-Webster Online Dictionary. 2010. *Merriam-Webster Online.* 19 April 2010 http://www.merriam-webster.com/dictionary/affinity/

[3] In the simplest terms, usefulness can be defined as why we seek a product or service and how it helps us accomplish our goals and objectives; usability means we are able to use a product or service to an effective end, as it was intended.

[4] Philosophers and writers who have explored the notion of beauty include Confucius, Socrates, Plato, Aristotle, William Shakespeare, John Keats, Immanuel Kant, and Wallace Stevens (to name just a few).

Photograph by Thomas Hofer

▸ Ferrofluid, a liquid that becomes strongly magnetized in the presence of a magnetic field, forming, in a sense, a liquid attraction.



break that down into tenses of time: past, present, and future. Affinities based on self-image come in the same three tenses. Affinity may be nostalgic (past tense) and relate to who we thought we were or a fondness we have for past experiences. It can also be definitive (present tense) and help us communicate who we are and to which community we belong. And affinity may even be aspirational (future tense) and allow us to project who we want to be and our ideals for our future. Thinking about identity in these three tenses helps us to better understand this type of affinity and how it impacts our designs.

A few examples of nostalgic affinity come to mind when thinking about brands and public personas. My brother (in his late 30s, an established English teacher, and pursuing a second master's at Harvard) has a poster of Walter Payton, the record-holding Chicago Bears running back from the 1970s and 1980s, tacked to the wall of his Cambridge apartment. To my brother, the poster represents a simpler, more innocent time from childhood, when our minds were filled only with pretending we were our sports heroes, jumping over the back of a couch as if it were a pile of Green Bay Packers at the goal line—not with the troubles of adult life, like jobs and relationships. The pervasiveness of Hello Kitty paraphernalia targeted at high-end consumers (the Pink Ceramic Diamond Hello Kitty watch retails at Neiman Marcus for $2,900) is another example of the same nostalgic drive.

Though much has been written about Apple's iPod, one very specific design attribute of that product line relates to our discussion about affinities, and particularly definitive affinity—namely the distinct white color of the headphones. In addition to the core function of producing sound, the headphones serve an important purpose of aligning the user with a group: forward-thinking technologists. The white headphones are a signifier to all those around of the community to which the user belongs. In fact the iPod was not the first music device to use color distinction as a way of enabling users to belong to a group. The yellow body of Sony's Sports Edition Walkman in the 1980s served a similar purpose, only that group was communicating an image of healthiness. Definitive affinity is not exclusive to industrial design but relates to other design as well.

Aspirational affinities are also an important type of affinity based on identity. This type of affinity allows us to project who we want to be and our ideals for our future. The online dating site eHarmony is a particularly explicit example in the interaction design sphere. This website and service offers a "compatibility matching system" to help singles project their values system, character traits, and personal interests (all of which may or may not be accurate), with the hopes of finding meaningful romantic relationships. A second example is Twitter and Facebook, which allow us to communicate what we are about to experience. One element of these offerings relates directly to aspirational affinities: The ability to select what we broadcast about ourselves—in contrast to what we decide to censor—allows us to project an exact image. The pooling of followers and friends that both Twitter and Facebook afford, and again our control over who we do (and do not) associate with, also helps us refine the image we want to project, based on the inclusion or exclusion of others. All of these services allow us to be someone we aspire to be in a community to which we desire to belong.

But the emotional connections wrapped up in these affinities are very challenging to include in a typical human-centered design approach. This is true for a number of reasons. To start, emotions in general, and often the most important ones, link to past experiences that may be distant and difficult to recall. And even

if past emotions can be recalled, they are fluid in form and tone. Language is another challenge in any discussion about emotions. Words have different connotative meanings, which may be exaggerated when two people speak for the first time, as is often the case between a researcher and a study participant. People may simply be uncomfortable speaking about emotions with strangers. Lastly, emotions are abstractions and cannot be easily observed, documented, and shared with a design team like photographs, video, and artifacts can.

Researching Affinities

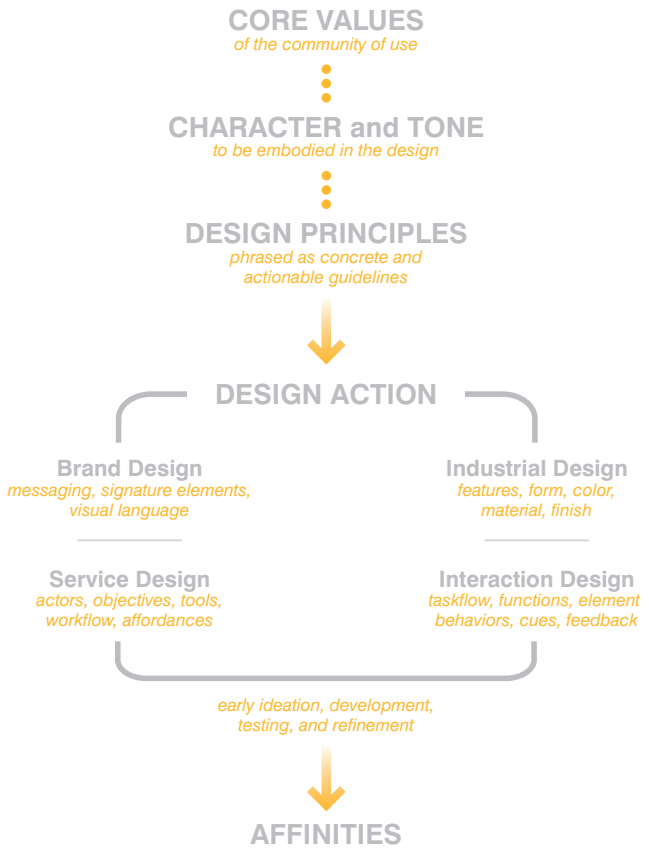
Before we can address affinity as a design goal, we must first focus on uncovering people's emotional connections from a research perspective. Despite the challenges of researching emotions, the good news is there are a number of specific techniques that can help. In general these techniques are discussion-based because of the cognitive, emotive, and social issues tied up in affinities. The traditional observational or ethnographic techniques researchers use are not applicable, because what is being researched is primarily internal and psychological. For the most part, these techniques are also open-ended, as direct questions imply a discussion trajectory, and participants need to define the terms of the exchange. Lastly, to be successful, these techniques depend on the researcher's ability to build a rapport with the participants so that they will feel safe talking about their emotions.

There are four categories of techniques useful for exploring people's emotional connections to designs:

Narrative techniques. The first category of methods for exploring affinities involves narrative techniques. Storytelling, where we ask participants to tell a story about an experience they've had that's related to the research inquiry, is one particularly useful narrative technique. It works best when image boards—showing a collage of relevant objects or scenes—are used as a launchpad for the discussion. The participant selects one image and tells a story about it; the selection of that one image (as opposed to the others) indicates what is top-of-mind to the participant and what he or she is most passionate about. The technique gives the participant an easy entrance into a story and absolves them from having to be creative without a starting point; it also helps focus the participant on a single memory or emotion, making the discussion less abstract. When a participant tells a story, it reveals the influences beneath routines, behaviors, and perceptions. Besides uncovering the type and tone of emotions themselves, the narrative arc of the story reveals the structure of the experience and the relationship between emotions.

Projective techniques. A second category of methods for exploring people's emotional needs includes projective techniques. Scenario building is one successful method. In scenario building, research participants are given an abstract, open-ended scenario onto which they project their ideal experience or outcome. For example, if we are researching senior citizens' expectations for emergent medical care while away from home, we might offer as a scenario a mythical being (a sprite or a fairy) that can travel at the speed of light (but not through time) and then ask the seniors what they would want the sprite to do. The seniors may tell us about their wishes for the sprite to bring their medical records no matter where they are, or their desires for family members, in addition to their doctor, to be notified, or their need for their exact location to be immediately known to EMTs (emergency medical technicians). This method allows participants to think beyond the constraints of current technology so they can represent their true desires and expectations.

Differential techniques. Another set of research techniques is based on semantic differentials. These techniques link even more explicitly to design action than the techniques discussed here. Semantic differentials are cognitive opposites that are meaningful to people. When organized on 2x2 style boards that represent semantic differentials, images of existing or conceptual designs clustered into distinct aesthetic categories can lead to useful discussions about preferences for design directions. Research participants can easily respond to the style boards and indicate in which aesthetic category they would expect to see a future design and discuss why. The creation of the style boards is best done in collaboration between researchers and designers, since the more meaningful the categories are to designers (with obvious form, color, material, or finish groupings), the more actionable the research will be. To



provide initial design direction, the style boards can be created with images of familiar, real-world products. A second round of style boards, this time showing the team's design concepts, is then presented to validate the initial input.

Associative techniques. The last category of methods includes associative techniques using sensory stimuli as discussion starters. This method can garner very direct input on people's expectations for the tone of an experience. Research participants react to texture or material samples, color swatches, word cards, or even simple time-based media (like sounds or animations) to draw out stories and subtle, unarticulated emotional connections about all senses. For example, if we are researching mothers' expectations for post-natal support services, we may show a range of material samples to elicit input. The moms may not just gravitate toward soft, natural materials (like raw cotton) and talk about their concern for their baby's comfort; rather, they may also gravitate toward strong, rigid materials (like copper piping) and describe their desire for agents to protect their baby's safety. This technique is not simply about implementing the materials that participants discuss, but rather about giving participants a starting point for articulating the emotions they want to feel in relation to a product or service.

In short, these techniques are successful for exploring affinities because they are based on activities that people naturally do well: telling stories about their experiences in their terms and responding to stimuli presented to them.

Designing for Affinities

Once we have a deep understanding of what incites people's affinities, we can bring the emotional drivers to the fore of design thinking using a methodological approach [5]. Any approach needs to be couched in the manufacturer's goals and the designers' sensitivity and creativity, but we have seen a general method used successfully in product design. The method includes transitioning research findings about affinities into core values, which are to be supported by the design. These core values imply a character or tone (or personality) that the design should present and can be transcribed into explicit design principles to guide design activities.

Core values are the first deliverable we use to transition the results of affinity research into design action. Core values should reflect the goals, needs, and perceptions of the community of use but simultaneously offer direction to future design activities. Let's go back to our earlier example of senior citizens' expectations for emergent medical care while away from home. If the senior population's desired core value is one of authority, then we can start to think about how a design would best support that value. What would make seniors feel like they are being

[5] Most important, affinities must be addressed in all phases of development, including discovery phases when we define the offering, in design activities while we are creating concepts, during validation phases when we ensure we successfully built the correct emotional connections, and finally, in refinement activities when we iterate on solutions and focus the design more precisely.

commanded clearly and confidently by an expert? What would make the population believe in the information and instructions being offered? How can the community feel cared for? How can the design solution build trust?

After we extract and distill core values from the research, we can then think about the specific *character and tone* the design solution should have to accurately reflect the values of the community and help it actualize in the desired way. Character and tone can relate to all aspects of a solution, including industrial design, interaction design, service design, or brand design.

To continue with the same medical example, the character and tone best suited to the seniors may be one of a guardian or protector or chaperone. Discussions about the qualities to be embodied in the design are best had with an integrated team of researchers and designers so that what has been seen in the field, and how those needs might be addressed via design, can be thoroughly understood and vetted. Such collaboration also ensures team members from diverse backgrounds can start to speak the same language.

Next, we can create design principles as concrete and actionable guidelines to represent the agreed upon qualities of the design solution [6]. To be useful, the wording of these principles must ground the abstractness of "character and tone" in clear and memorable language that is both meaningful and inspirational to designers. Here are a few examples of design principles that might support the character and tone of a guardian:

- Decisiveness—The design solution should use a voice (verbal and visual) that is firm and direct, but also calming and reassuring.
- Accuracy—The design solution should provide information that is exact, consistent, and timely to build trust with users.
- Dependability—The design solution should address as many situations as possible, communicating functionality clearly and continuously to establish confidence with users.

To be successful, design principles must systematically relate to the core values of the community of use and the experience it desires with the given design. Since the wording and tone of these principles are key to their effectiveness, much iteration (and definitely collaboration) will be necessary.

The final way in which affinities are represented in design is, of course, through *design action*, which includes the traditional activities of early ideation, development, testing, and refinement. Having a record of the process that transfers core values through character and tone to design principles is important; such a record can make design decisions traceable and can reinforce design intent throughout the development process. The record can also facilitate buy-in for the design direction from both internal stakeholders like engineers, prototypers, and developers as well as external stakeholders like client executives, sales and marketing representatives, and distributers.

Conclusion

As important as affinity is in how products and services are perceived, adopted, and used, it is just one element in a design's success. Usefulness and usability (as well as novelty and price) can't be belittled or dismissed as factors in how users and consumers select products and services. However, since affinities encompass so much of what is important to us as humans (our ideals of beauty and notions of identity), the importance of affinities should always be considered in design initiatives. A design has the ability to take me back to a place, time, or experience to which I would like to return; it can allow me to be part of a community and can help define me in relation to others in a group; and it can even help me signify who I want to become. For these reasons, affinities, and a methodological research and design process to address them, are important to the designed world and those who are creating it.

[6] Ideally, design principles have universal application, whether the design solution is to be a physical product, a user interface, a service offering, or a messaging campaign. However, if the form of the proposed solution is known, it may be possible to make the design principles even more grounded, focused, and specific to the development activity. The goal is to focus and inform design but still leave ample space for inspiration, creativity, and the designers' expertise.

ABOUT THE AUTHOR

Matthew Jordan has worked in the human-centered research and design industry for 14 years and focuses on balancing user needs with business goals to deliver meaningful and creative solutions. He has worked with a range of organizations, from start-ups to midsize companies and large corporations, and enjoys the interplay of the medical, consumer, technology, and social sectors. Jordan earned a B.A. in language and literature from the University of Illinois at Urbana-Champaign and a M.A. in professional writing and communication design from Carnegie Mellon University. He has published articles in *MX* (Medtech Executive), *MD&DI* (Medical Device and Diagnostics Industry), *Visions* magazine by the Product Development Management Association (PDMA), and the annual *Journal of the Human Factors and Ergonomics Society* (HFES).

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Fluidity in Craft and Authenticity

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Increasingly, tangible interaction design is orienting itself toward craft as something distinct from design. There are efforts to translate, or reproduce, the materiality of spaces in other media; calls for a coherent approach to experience and evaluation; and NSF funding aimed at making the concepts and needs of HCI accessible to graphical and traditional crafts communities. In addition, researchers from Indiana University are teasing out a method for designing tangibles, starting with metaphors from nature. They speak of this as a designerly approach, emphasizing an "old" view of design—crafting artifacts through critical engagement with form and material, and foregrounding curiosity on the part of the designer [1]. Such intangible qualities as meaning, authenticity, commitment, engagement, and passion are becoming central to contemporary design, qualities that arguably not only characterize but also constitute craft, and which can be found discussed throughout craft literature.

With a background in Craft and working in HCI, interaction design, and tangibles, this presents an exciting opportunity. Craft is no longer being defined simplistically as handmade goods; nor are assumptions being made about the cultural status of the "C-word" in relation to Design or to Art (and to be fair, these can sometimes appear to be the only two issues exercising the craft community itself). Instead, people are putting out intelligent questions and propositions, and a hand is extending from HCI to Craft as a discipline with something important to contribute to emerging creative practices. Given this interest, I'd like to offer my thoughts on the subject and outline how craft itself is undergoing a significant shift from an activity defined by local praxis, to a form of knowledge and engagement with the world.

I Think I Know What Craft Is—Why Do You Have to Tell Me?

First of all, it is important to own up to what looks like a serious problem with craft: It doesn't seem able to define itself. You can pick up any piece of the literature and find a quote to this effect. It is possible to write almost any definitive statement about craft, and for the opposite position to simultaneously hold true:

"Craft can be a confusing word. When you use it there is a strong possibility that the other person is thinking about something quite different to you. One person imagines handmade one-off pieces while another thinks of stenciled furniture and stamps. And it doesn't get any easier when you get beyond the word craft to a specific discipline such as glass or textiles, as again everyone will imagine something different."
—Grace Cochrane [2]

Like design, craft is a value-driven activity and has undergone large ideological shifts since the mid-19th century, but in contrast to design, craft has suffered from the serious lack of a coherent historiography. Since the flurry of political theorization with the rise of the Arts and Crafts movement, there has been very little critical discussion in the field. Craft quickly became a byword for the positive values seen to be challenged by industrialization, and as a bastion of the unspoken tacit knowledge being championed by Continental philosophy and pedagogy. As late as 1997, craft's "secret knowledge" was still being jealously guarded from rational analysis and critical discourse, and it wasn't until 2004 that a series of international conferences brought together makers and thinkers to seriously question craft myths [3].

The result of this situation has been an oversimplification of the domain's shift from premodernism to modernism, placing the traditional in opposition to the new. The consequent need to retell and constantly qualify this history detracts from the

[1] TEI *Proceedings of the 4th International Conference on Tangible, Embedded and Embodied Interfaces*, Media Lab, MIT, Cambridge, MA, 2010.

[2] Cochrane, G. "What is Craft?" craftscotland. http://www.craftscotland.org/whatiscraft.html/

[3] Craft in the Twenty-First Century (2003), Edinburgh, UK; Challenging Craft (2004), Aberdeen, UK; New Craft, Future Voices (2007), Dundee, UK; NeoCraft: Modernity and the Crafts (2008), Canada; Crafticulation (2008), Helsinki, Finland.

important threads that continue to characterize craft, and from the crucial part it may play in its contemporary fluid form.

Something Old…

In the traditional view of craft, the object is predominantly handmade, and those technologies in use have been an integral part of specific techniques for hundreds of years—witness the jeweler's saw frame and workbench, found in illustrations of 16th-century workshops and earlier. A romanticized vernacular vision, this version of craft is often portrayed as somehow closer to or representative of some utopian ideal. Pugin, Ruskin, and Morris and their followers explicitly combined lifestyle with aesthetic choices that championed the medieval as an ideal. The Arts and Crafts Movement had an unprecedented global impact in its own time, but it has also handed down a legacy that has proven difficult to escape. The complexity of the movement's history and personalities is often lost in a kind of shorthand for its most renowned tenets [4]: Craft sits in opposition to industrialization; craft centers on the experience of handmaking; all beauty derives from nature; and the worker must be free for the work to be good.

Authenticity had a distinctly socialist political flavor as well as an ideological approach to form. The roots of Arts and Crafts lay in a concern for a respectful relationship between design, society, and nature, which appeared to be in danger as the Industrial Revolution progressed. Manufacturing conditions, formal attributes, and the way designs could inform engaged ownership were all important in the creation of goodness and beauty, which were in fact synonymous to the movement's leaders [4]. Integrity, holism, and authenticity were expressed in a number of ways through form: Materials were respected for their own characteristics, to be understood through hands-on engagement; the function of things was not to be disguised; and any ornament should arise from structural elements rather than through arbitrary application. Beauty could be present only in an object made by a contented worker, or could emerge from use over time. In this way, we might say communities of practice and social conditions were important to Arts and Crafts not only in the manufacture of goods, but also in the manner of their consumption.

However, there have been problems with the "revolution in manufacture" proposed by Arts and Crafts. Despite its best intentions, it has been criticized for fetishizing unthinking labor, and over time its signifier, the mark of the maker, has been seriously challenged by the ability of the machine to mimic craft's randomness. What was once a reliable expression of a particular culturally charged process is no longer connected with it in any way.

Something New…

The beliefs of the Arts and Crafts movement continued to play out through other movements such as the Jugendstil and the Bauhaus, as the economic and political forces of the 20th century began contributing to the industrialized manufacturing landscape. That is, until New Craft, as distinct from the traditional model, emerged as a paradigmatic shift in Western culture in the 1960s. "Studio craft" assiduously maintained that craft was "an artistic practice equal to all others" [5], and argued for "parity between pots and paintings" [6]. This status was, and continues to be, engineered through a number of key strategies, including framing mechanisms such as critical discourse and display cultures, a rejection of functionality and the domestic, or a rejection of material itself. Expressions of individuality took the place of craft's traditional user-centeredness and work was produced in studios by individuals, who made the explicit decision to be in control of both the conception and realization of their work (thereby implying new modernist models of authority and ownership). This individualism was also extended to the experience and consumption of craft objects, as they became exhibited in rarefied gallery environments, surrounded by white space, and bought as the ultimate statement of individual connoisseurship and identity. Craft emulated fine art's claims to authenticity through its use of these strategies and valorized the ideals of the Enlightenment: the purity of the conceptual untainted by worldly bodies or material, and the artlessness of spontaneous expression [7].

It has taken some time for craft to reflect more deeply upon its own rather messier and contingent forms of authenticity. Rather than merely defining itself in relation to art, contemporary writing in the field is

[4] Rosalind Blakesley provides an excellent overview: Blakesley, R. *The Arts and Crafts Movement*. London: Phaidon Press, 2006.

[5] Mazanti, L. "Super Objects." Ph.D thesis, Denmark's Design School/the National Academy of Fine Arts, School of Architecture, Copenhagen, 2006.

[6] Metcalf, B. "Contemporary Craft: A brief overview." In *Exploring Contemporary Craft: History, Theory and Critical Writing*, ed. J. Johnson, 13-23. Ontario: Coach House Press, 2002.

[7] A clear example would be the Shaker style furniture of the American Arts and Crafts movement, which removed ornament and promoted an austere form of honest existence.

▸ Aeolia: Stretch sensor garment, 2009. Sarah Kettley (project lead), embroidery by Tina Downes, and garment fitting by Karen Harrigan.

attempting to learn from both the traditional and the modernist views, and reflects in many ways shifts in how philosophy itself is developing a new and fluid form of authenticity.

Fluidity

The problem now is that neither of these dominant oppositional accounts of craft is able to tell the full story anymore. The more we attempt to define craft through these polarized frames, the more it slips away from us. To help, we can think of craft as something that is fluid: as a process, as an object, and as a cultural frame.

Craft has never been simply functional, even at its most traditional, nor will it ever be entirely autonomous, even at its most modern. While it is an object-focused discipline, the craft object is never an end in itself—craft objects are also means to ends. And even at their most rarefied, they retain vestiges of functionality, domesticity, and flow. They remain craft as long as there is that embodiment of humanity resulting from process, or evident in references to potential or historical functionality. Similarly, the functional craft object is never entirely transparent, nor does it intend to be. It is always available for contemplation. The crafted bowl is as available to the mantelpiece as to the kitchen cupboard, as appropriate in the gallery as in the ethnographic museum. In use it passes through moments of presence and disappearance, and also, importantly, has the ability to create an experiential space that blends these in a special kind of awareness. To take an example, Chris Knight's silver shot glasses fulfill the functional requirements for drinking tequila—their scale and form is right according to our experience—but the act of holding these spiky tumblers draws immediate attention to the danger inherent in the activity for which they are designed.

Craft objects have always had the capacity to segue between transparency and reflection, that most pressing issue for tangible interaction design. They have always occupied, even constituted, a unique place between art and life, available for the aesthetic experience, yet part of the ongoing flow of pragmatic action. They are rhythmical in their cultural configuration as well as in their internal formal organization. They retain elements of the traditional model and of the modern, combining tacit and narrative experience in a smeared simultane-

[8] For example, in the action art approach taken by influential ceramicist Peter Voulkos.

[9] Ionascu, A. "The Anatomy and Aesthetics of Use." In *Future Voices: Celebrating Diversity.* Exhibition Proceedings New Craft—Future Voices, eds. G. Folett, S. Moir and L. Valentine. Duncan of Jordnstone College of Art and Design. July 2007.

ity. Contemporary craft as it is engaged with the world around it, social, formal and political, is thus dynamically configured as its traditional romantic self, in its modern guise as art, and as experimental intervention, in a situation where none of these takes precedence.

This model of craft is exciting because it echoes so clearly the terminology and characteristics of authenticity and authentic experience. Philosophy is arguing the case for hybridity in authenticity, just as we are encountering it in the cultural sphere, and it is in the process of constructing new understandings of the relationships between the sublime and the mundane [10]. Both craft and philosophy can be seen to find authenticity in a dismantling of old dichotomies—useful/aesthetic, reflective/transparent, flow/event [11]. Craft objects provide contexts for moving in and out of experience and for a heightened awareness of somatic experience, and their contemporary fluidity encourages openness to experience and engenders processes of meaning-making rather than presenting predetermined significations.

Crafting Tangible Interfaces

This contemporary form of craft offers a promising model for the development of tangible computational products that seek to be metaphorically meaningful as well as useful, and as one of the earliest interactive art forms, offers us a unique opportunity to shape our new technologies. It allows us to rethink the nature of material itself and to explore the values we wish to embed in our emerging communities of practice.

ABOUT THE AUTHOR

Sarah Kettley is a maker and writer. She trained as a jeweler at Glasgow School of Art before becoming interested in wearable computing. She completed a Ph.D. in craft as a design methodology for wearables at Edinburgh Napier University's Center for Interaction Design in 2007 and is now a senior lecturer in the product-design subject area at Nottingham Trent University (NTU). Between May and July 2010, Kettley's digital jewelry was on display at the Bonhoga Gallery, Shetland, and Aeolia; a collaborative stretch sensing textiles project was exhibited at Create 2010, Edinburgh and at the Festival of Craft, Dundee. These projects have been generously supported by the Scottish Arts Council, the Arts & Humanities Research Council UK, The Drapers' Company, residencies at Edinburgh College of Art, Duncan of Jordanstone College of Art & Design, an Alt-w award administered by New Media Scotland, and a research sabbatical at NTU. For more information please visit www.sarahkettleydesign.co.uk.

[10] Guignon, C. *On Being Authentic.* London: Routledge, 2004.

[11] Kettley, S. "Crafts Praxis as a Design Resource." In *Crossing Design Boundaries*, eds. P. Rodgers, L. Brodhurst, and D. Hepburn. London: Taylor & Francis Group, 2005.

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The Design of Serendipity Is Not by Chance

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Technology can aid efficiency—it can prevent us from getting lost, make locating the nearest restaurant easy, help us avoid inconvenient traffic, and eliminate the wait time between physicians and patients. Yet aided by apps and served by services, we leave little up to chance. We seek out the specific. We cut out needless words. We know that less is more. And therefore, we've adopted technology to aid us.

But we know that with this efficiency may come drawbacks: People may be less exposed to chance or less inclined to try new things; behavior may be planned such that there are no discoveries or surprises. Technology may be increasing the opportunity for specificity, but is it decreasing our chances for serendipity?

Half of humanity now lives in cities, and in two decades, nearly 60 percent of the world's population will be urban dwellers [1]. Cities are not only growing in size and population, but their very interface is changing. They're being layered with information so we can search, sort, and archive data in a way that makes them endlessly exact. On the other hand, with this exactitude something may be lost.

With more people in urban places than ever before, something else has occurred: Space is a mixture of physical and digital spaces. With guides such as *Everyware*, *Shaping Things*, and *Digital Ground*, we have manifestos for moving forward in these spaces. What role will serendipity play as the layers have the ability to grow increasingly specific, while the possibilities grow with increasing disorder?

From Serendip to the Present

The term "serendipity" dates back 250 years to a somewhat storied beginning. Horace Wadpole, English writer and politician, committed the word to paper in reference to a fairy tale, "The Three Princes of Serendip." In a 1754 letter, Wadpole coined the term when he described the three princes' adventures near Serendip: "As their highnesses travelled, they were always making discoveries, by accident and sagacity, of things which they were not in quest of" [2]. Falling somewhere between accidental and sagacity, serendipity is synonymous with neither one nor the other, perhaps closest only to "chance encounters."

Chance encounters, by chance, are often present in discovery. Whether they're attributed to Columbus's discovery of America, Newton's naming of gravity, or Nobel's discovery of dynamite, in travel, medicine, science, technology, and inventions, serendipity is often cited as a key factor in the success of the new.

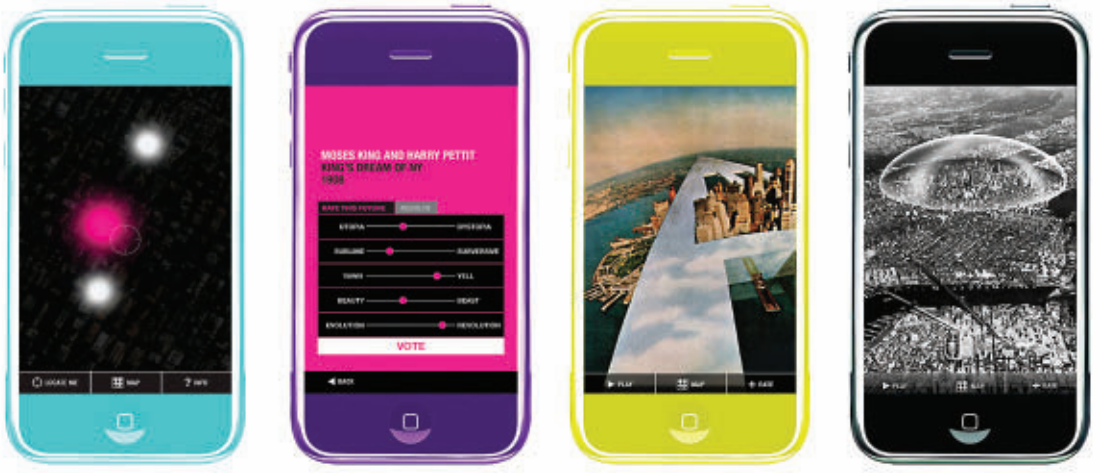
Chance leads to the possibility of new behaviors, new patterns, new ideas, and new structures. It allows people to change their behavior in response to context, in the moment, however fleeting. How might we help recapture serendipitous moments by helping coordinate chance? And what is the role of technology and interaction design? As the power that citizens have with their media grows, so must we grow opportunities for creative exploration, new ideas, and chance encounters.

By Accident

New ideas, specifically in the area of invention, are commonly inspired by chance encounters. In 1948 Swiss inventor George de Mestral, returning from a walk through the Alpine with his dog, noticed the cockleburs that were stuck to his dog's coat and his own pant legs. When he returned home to study the burs under a microscope, he found the surface contained tiny sticking mechanisms. At the time, he hadn't been consciously planning to invent such a device, but the bur construction reminded him of an alternative for fastening clothing. He had, as it happens, just recently been annoyed by a stuck zipper on his wife's dress. It took six years to work out the details, but in 1957 Velco was patented—a portmanteau of the French

[1] McGuirk, J. "The Urban Age: How Cities Became Our Greatest Design Challenge Yet." *The Guardian*. 29 March 2010; http://www.guardian.co.uk/artanddesign/2010/mar/29/urban-age-cities-design/

[2] "The Meanings of 'Serendip'"; http://serendip.brynmawr.edu/serendip/about.html/



▸ Museum of the Phantom City: OtherFutures allows users to browse visionary designs for New York City on their phones. It is a public art project designed by Cheng+Snyder with support from the Van Alen Institute New York Prize Fellowship.

words "*velour*" and "*crochet*." The former, meaning velvet, refers to the soft tape, while the latter refers to the hooks—the original inspiration for de Mestral. By the late 1950s, 60 million yards were being produced. [3]

Had de Mestral set out to take the walk in search of a "fastener solution," he would have been looking for something different. He hadn't known what he was looking for and therefore left himself open to chance. As designers, we have potential for these moments every day. "Serendipity doesn't simply mean surprise," says Adam Greenfield, who curated a showcase of urbanist iPhone apps at the inaugural FutureEverything festival in May of this year. "Strictly speaking, the word means accidentally discovering something wonderful in the course of a search for something unrelated. The genuine occurrence of serendipity necessarily implies a very powerful order of richness and texture in the world and, to my mind anyway, when you experience it in cities it's a clear indicator of a healthily functioning urban ecosystem." He selected 11 apps from EveryBlock to Foursquare to Museum of the Phantom City that best represented serendipity in their intended use [4].

Designing for Chance

If serendipity is useful, can we plan for it? Hitotoki.org (from "sketches" of everyday moments) is a website and application founded by Paul Baron, Craig Mod, and Chris Palmieri that allows its users to look for those moments of strange, serendipitous beauty throughout the day—it sharpens their eyes. It becomes not just a habit, but also a meditation in which countless otherwise overlooked events start to resonate deeply. Users become more sensitive. "Put simply: it makes you more aware," explained Mod in our email exchange.

And its use spans time. Because hitotokis are tied to geography, awareness of moments as connected with space reaches back in time. Hitotoki has caused Mod to walk the neighborhoods of his childhood, for example. Using the software, he's recoded sewer drains and houses and woods; on returning to those spots, he's realized he was carrying rows and rows of mental filing cabinets of experiences. Behaviorally, it's changed the way he's moved though life on that basic level of awareness: "It's pushed me to think deeply about the layers of experience we create living in a city for an extended period of time—how those layers fade; how they overwrite one another."

On Time

Every place has a story to tell, every neighborhood a history. Locals know not just what is there, but also what used to be there. But what of the buildings and neighborhoods that never were? Can we create a serendipitous relationship with forms that weren't there in the first place?

Cheng+Snyder, a multidisciplinary design studio in New York City, has worked to merge the hidden stories in architectural forms, the ubiquity of mobile devices, and current place to bring together something that is perhaps both familiar and strange. With iPhones and other mobile devices transforming the way we navigate city spaces, it seems somehow only logical [5].

Its iPhone application, Museum of the Phantom City: Other Futures, shows terrain using a vision from "another future" mapped against the reality of what is. Using architectural visions—from

[3] Petroski, H. *Invention by Design: How Engineers Get From Thought to Thing.* Cambridge, MA: Harvard University Press, 1996.

[4] FutureEverything Festival 2010; http://www.futureeverything.org/

[5] Cheng, I. and Snyder, B. "Museum of the Phantom City." http://urbanomnibus.net/2009/10/museum-of-the-phantom-city-2/

Buckminster Fuller's idea for a dome over Midtown Manhattan to Raymond Loewy's helicopter landing field for Bryant Park—the viewer layers their current experience with the past.

Other Futures asks more questions than it answers, and for that, it's tremendously valuable. On one hand, these juxtapositions help viewers consider the status quo. Is this the best we can do? On the other hand, viewers are provoked to think about the big ideas of the brightest minds from our past. Were they thinking big enough? Can we think bigger, and how have we progressed since? Most important, Other Futures pushes designers to consider what our other futures can be.

Hitotoki forces its users to examine similar questions with current spaces. It's forged a strange new self-relationship that spans time. Once users become aware of moment layering, according to Mod, they often bump into old selves—sometimes pleasant, sometimes awkward. "It shines a light on how much you've changed or haven't. And it makes you consider how you'd experience that same moment at that same spot now," he explains.

[6] Rhode Island School of Design Graduate Program in Graphic Design; http://gd.risd.edu/www/programs/graduate/

[7] Meyers, M. A. *Happy Accidents: Serendipity in Modern Medical Breakthroughs*. New York: Arcade Publishers, 2007.

Graduate Serendipity

How much could we design for serendipity? To test out some of these ideas, I took to the streets and recently conducted a three-day workshop at Rhode Island School of Design as part of the Graphic Design Graduate Program's Visiting Designer Lecture Series—an inventive thesis course put together by program director Bethany Johns—with the graphic-design graduate students. [6] The students' charge was to create an interactive product or service that would inspire serendipity for them and their neighbors in the city of Providence. This was their call to seek out and invite the unknown, the unplanned, the unseen. They imagined ways to craft interactions so they could intentionally influence new opportunities for discovery and creativity. In a culture steeped in exact queries, specific interactions, precise retrieval, and masterful customization, they imagined how their community could be made better through chance encounters.

To encourage students to think about chance, we held individual design reviews outside in the city. Each group did a walking-tour design review. Students were to bolster their ideas through scouting an area, observational research, interviews, and their own knowledge. Their goal was to be practical in application yet novel in idea, useful yet delightful, usable yet unparalleled, serendipitous yet approachable. The product and service were to be designed for an audience, and framing the topic were to be considered with the audience in mind.

Throughout the weekend, students were to keep evidence of their studies and observations—photos, videos, and notes—as they would present them in spot crits over the course of the two days. They not only presented their final product or service, but also touched on the process journey they took to get there.

The result of the sprint work sessions was four realizations of chance, from urban games to iPhone apps. Eliza Fitzhugh, Lynn Kiang, and Erika Tarte presented "Arcade," a system and service to bring games to the outdoor parks in Providence as a way of encouraging people to exercise. Another group, Alpkan Kirayoglu, Elise Porter, Marco Ojeda, and Salem Al-Qassimi, presented "Fuego," an iPhone app that promises to take people to new places by participating in a hotter/colder game.

Chances Are

No product or service can be entirely serendipitous. Because we choose to use a product or service in the first place, we have made a choice, thus eliminating some part of the serendipitous equation. After all, as Louis Pasteur said, "In the fields of observation, chance favors only the prepared mind" [7]. There cannot be Wadpole's intersection of sagacity and accident when choice is involved. There are, however, variations at play all the time. Smart services such as Dopplr, Foursquare, and EveryBlock have designed for chance encounters alongside of exact retrieval so users can have dual experiences. The designers have simply put forth opportunities for people to create their own pathways. It is then up to us to find chance. Chances are, we will.

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Why "The Conversation" Isn't Necessarily a Conversation

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Most weekday mornings are fairly predictable: I make a pot of coffee; I walk the dogs with my wife, Eliza; I have a second cup of coffee while Eliza gets ready. This probably sounds familiar, as we all have our routines. But this is not where the predictability in my day ends.

I check email on my phone to find a daily handful of mass mail from various research firms and business publications. Many of the articles within these emails (especially those targeted toward marketers) will be on the topic of social media. Perhaps this, too, is a normal part of your morning. If that's the case, perhaps you have noticed the content of these emails is also a bit predictable.

You tend to see these words: engagement, metrics, conversation, ROI, community, sharing, measurement, dialogue. Ultimately, these emails regress toward some variation on "Social media is about engagement! Companies need to join the conversation!" Starting your day in this way can make you feel a little bit like Bill Murray in the movie "Groundhog Day."

I suppose there's good money to be made in periodically browbeating companies into "joining the conversation." But there are problems with this advice (that go beyond the sheer banality of it all). The biggest problem with these discussions is they tend to substitute peer pressure for insight. *You need to do this because everyone else is.* No wonder so many brands feel panicked about social media. They feel like they need to be there, but they don't know what to do or why to do it. And if they dare to question any of the conventional wisdom on social media, they're accused of "not getting it."

The more significant problem I see is the tendency to lump all social networks into one. If any differences are discussed, the conversation tends to be framed as a horse race. "Twitter is hot!" "Is Facebook getting old?" "Does YouTube make money?" But these various networks have some important structural differences. The better we understand what these differences are and how they affect behavior, the better equipped we'll be to use these networks, design for these networks, and advise clients what to do with these networks.

Architects have long understood that the structures we inhabit can influence not only the way we feel, but also the way we behave. This turns out to be true in digital environments like social networks, too. Subtle differences in the underlying structures of these networks give rise to distinct patterns of behavior.

Some of the ways in which social networks differ affect the central metaphor that we often use to describe them: "the conversation." In fact, the more time I spend in the social web, the more I'm convinced that the conversation metaphor isn't quite right. Just as one's "friends" aren't necessarily one's actual friends, "the conversation" isn't always a conversation.

Take Twitter, for example. Despite consistently being described as a medium for conversation (its tagline is even "Join the Conversation"), there are some tangible, structural reasons why Twitter can actually be quite hostile to real conversation.

Reason No. 1: Public by default

In a post on the PopMatters blog Marginal Utility, Rob Horning wrote: "Because the online space is devoid of conflict—everyone is 'friends'—it is anodyne; 'the Tyranny of Positive Energy' assures that politics is screened out of online social behavior."

This statement might hold true in an environment like Facebook, in which one's online "friends" are more likely to be one's real-world friends, and status updates are private by default. But in the Twitterverse, communication is often anything but anodyne. In fact, it can be downright incendiary, a

The structure of Twitter makes it a great platform for discovering content, finding people who share your interests, and getting connected with people to whom you wouldn't otherwise have access. It isn't, however, a great place to have a conversation.

quality that stems directly from the network's public-by-default structure. Since tweets are usually public, Twitter becomes a kind of performance space, where the purpose is to entertain, rather than discuss.

Horning also points out that social networks often "prompt us to replace the tussle of genuine connectedness with further self-display. Instead of arguing with one another, we preen." Horning equates this preening to a lack of conflict, but Twitter's preening can actually become quite aggressive. Newt Gingrich infamously labeled Sonia Sotomayor a racist on Twitter: "New racism is no better than old racism," he wrote, one presumes with a measure of self-satisfaction. It may be true that social networks don't represent "genuine connectedness," but that lack of connection often seems to escalate conflict. Just like when we're behind the wheel of a car, being somewhat disconnected from others can bring out a whole new side of ourselves.

We act differently in public spaces than we do in private. Sometimes we're funnier, sometimes we're angrier, and sometimes we're quieter. But in any case, we're very much aware of our audience. Twitter's public nature yields conversations that are often for bystanders as much as the participants, which changes both the way we behave and the content of our conversations.

Reason No. 2:
Following, not friending

Connections in Twitter are non-reciprocal (one-way) by default. I can follow you even if you don't follow me back. There is typically no approval involved—I don't request to follow you; I simply follow you. It's much more akin to "being a fan." (In fact, "Become a fan" was actually the phrase Facebook previously used to describe the one-way relationships it offered to brands.) In Facebook, on the other hand, users have reciprocal friendships (except for brands with "Pages," which allow the aforementioned "fan" relationship). I can't be friends with you if you're not friends with me. Friend requests are sent, and then the recipient approves or ignores them.

Non-reciprocal ties create a unique dynamic in Twitter. The first implication of this structure is that an individual's network on Twitter is far less likely to look like their real-world social network. In other words, followers are not the same as friends. This effect is amplified by the fact that Twitter is simply less ubiquitous than Facebook. This often means the people within one's Twitter network are less likely to know one another. Sociologists would call this a less transitive network. Low transitivity of connections may be another inhibitor to conversation in Twitter because you are less likely to have a shared context with the people reading your tweets.

The second implication of having non-reciprocal ties is that Twitter tends to take on the dynamics of a popularity contest. Followers can be amassed more easily than friends. And the more followers you have, the more influential you appear to be (whether or not that's actually the case could be debated, but surely there's a correlation). In fact, one's followers are listed right under one's name in a Twitter profile. So, almost naturally, Twitter becomes a game: Whoever gets the most followers wins.

What do people do in a public environment where they are evaluated based on the number of fans they have? They don't talk about what they had for breakfast (unless they're a celebrity). Rather, they try to be fascinating. This tendency has made Twitter a great venue for content sharing, and often a great filter for the news. But again, it doesn't mean that people are having conversations. Even if there are occasional two-way exchanges, they are quite limited.

Reason No. 3:
The 140-character limit

Twitter's 140-character limit is surely the most talked about facet of its structure. And it isn't

difficult to see why. Having a conversation 140 characters at a time is like trying to swim laps in one of those tiny hotel swimming pools. As soon as you get started, you hit a wall.

South Carolina Representative Joe Wilson infamously screamed "YOU LIE!" at Barack Obama during his healthcare speech to Congress in September 2009. Whatever else you might think about this remark, it seemed to me a sign of the times, representing the new low our public discourse has reached. And yet Wilson's outburst is exactly the type of "dialogue" one typically encounters on Twitter, particularly when one person is responding to another.

Consider Twitter's ubiquitous interjection, "FAIL." These days it seems that every one of life's letdowns gets the #fail treatment. Here's an example from @iprash on the Conan O'Brien "Tonight Show" debacle: "Not sure what Leno's angle is—my feeling is he is being pushed around too. I think this is NBC FAIL pure and simple." There's just as little intellectual content in saying that something "is fail" as there is in screaming at the president "YOU LIE!" And how is one supposed to respond to such one-dimensional criticisms? Is this even a conversation worth having?

Perhaps this is simply the byproduct of what Clay Shirky recently pointed out on edge.org, that the "shock of inclusion, where professional media gives way to participation by two billion amateurs, means that average quality of public thought has collapsed." Beyond simply giving the thoughtless a bullhorn, there is certainly also a structural reason behind Twitter's remedial discourse. Even when you have otherwise intelligent people participating, they often end up sounding one-dimensional. There's only so much you can say in 140 characters.

Conclusion

None of this is intended as a criticism of Twitter. I am a frequent (though not influential) user of Twitter and find the service to be consistently delightful, if a bit distracting. Twitter's virtues are several, and foremost among them is a refrain commonly repeated in the world of social media: It makes relationships possible that never would have occurred otherwise. Nonetheless, its virtues don't make it a business panacea, even though you might get that impression from its champions.

Companies and people who decide to give Twitter a try are often baffled by what they find. I've had several colleagues tell me over the past year, "I gave Twitter a try, but I just didn't get it." Sure enough, Twitter's usage numbers tell a similar story. (According to a recent study by Barracuda Labs cited in *The Wall Street Journal*, over a third of registered users have never even Tweeted [1].) I can't help but wonder if those silent users of Twitter were disappointed because they were expecting to find a conversation but found something entirely different.

As products become more complex, designers will need to act more like policy makers or economists, who are concerned with the effects of rules on complex systems. In the world of social networks, default settings and network structure are more than just details. The structure of a network has a profound impact on user behavior. Understanding how these structures drive behavior can help us understand and design systems more effectively. You only need to look at the growing outrage over Facebook's default settings to understand what's at stake with something as seemingly mundane as network structure.

The structure of Twitter makes it a great platform for discovering content, finding people who share your interests, and getting connected with people to whom you wouldn't otherwise have access. It isn't, however, a great place to have a conversation. But the more we use social networks and develop a shared vocabulary of how structural considerations affect behavior, the better we'll be able to design products, services, and networks that create whatever kind of conversation space we desire. Christopher Alexander gave us a pattern language of physical, architectural patterns. Now it's time to create the digital version.

In the meantime, I'll be clearing the spam out of my inbox, waiting for tomorrow's mass emails, and hoping they have something more to say.

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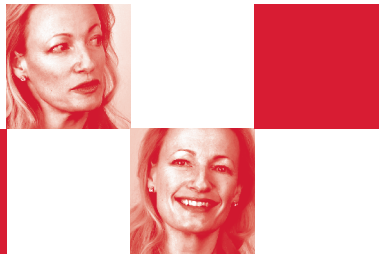
[1] Kafka, P. "Twitter's Wallflowers Get a Little Less Timid. But It's Still a Service for Watchers, Not Talkers." MediaMemo. http://mediamemo.allthingsd.com/20100310/twitters-wallflowers-get-a-little-less-timid-but-its-still-a-service-for-watchers-not-talkers/



The (Anti)Social Net

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It is time we stopped talking about social networks and started talking about people, groups, and relationships.

This is probably the fourth time this week I have said this: Social is more than the social network. It is perhaps the 500th time I have said it in the past two years. Maybe the 1,000th time if you count the past five years.

This is not news to anyone who takes a deep research interest in social networks. Rooted in insights from sociologists like Émile Durkheim, Ferdinand Tönnies, and Georg Simmel, the field as we know it emerged in the 1930s with the work of Jacob Moreno, who invented the "sociogram"—a connection diagram showing people's connections to each other. The term "social network" was coined in the 1950s by John Barnes, a British anthropologist, inspired by the work of Elizabeth Bott and her kinship studies.

These early social network researchers were primarily and fundamentally concerned with people and the social management of relationships and connections. Tacitly or explicitly there was concern for how methods could be triangulated with other data sources to foster an understanding of how people interact—these pioneers were not satisfied with the elegance of the model alone. They understood there was something to be said for looking at people as people, not simply as gates or nodes or conduits to other people. They fundamentally understood that a social network is more than a collection of nodes or dyads; and that each node has dimensions that may not be instantly or easily obvious or observable, but may be highly relevant for predicting their behavior in the network. For many early social network researchers, understanding that models of human social behavior are simplifications was an ethical as well as a scientific stance; they were interested in understanding people, and less invested in the belief they could engineer behavior. One gets the sense that some current network analysts believe their models to be more interesting and more accurate than the human activities and people on whom their abstractions are based.

While some of us intuitively know that being social as a human being involves more than what we do on a social network, once we put on our hats as designers, developers, and business entrepreneurs of social technologies, we often don't act as if we know this simple fact. This is the problem with believing your clean abstraction is the reality rather than a simplification of it. It is also a problem with our design mindset and our design processes.

Why do I say this? Let's invoke the high profile snafus in recent months with social networking technologies, in which the technically possible trumped the socially responsible—Google Buzz and Facebook's privacy settings. In both instances, the focus on what is possible (when you get enough computational power that can make connections) outstripped what was intelligent to do from a human-relations standpoint. Google opened people's profiles to reveal your contacts and whom you chat with to the rest of your network. All this proved, once again, that email contacts/=friends. In my contacts list are electricians, doctors, car mechanics, travel agents, florists, and restaurants. I have never had the urge to share my activities ("updates"), links, or personal photos with them. The labyrinthine privacy settings that Facebook implemented to enable people to retain some control over who can access them and their content was famously published by the *New York Times* [1]. Facebook's default response was everything is *public*. To retain your privacy you had to reset the permissions, but for many, the horse had already bolted the stable.

These are the kinds of mistakes that happen when you focus on the network and not the social in social networking—and when you go for what is technically easy not for

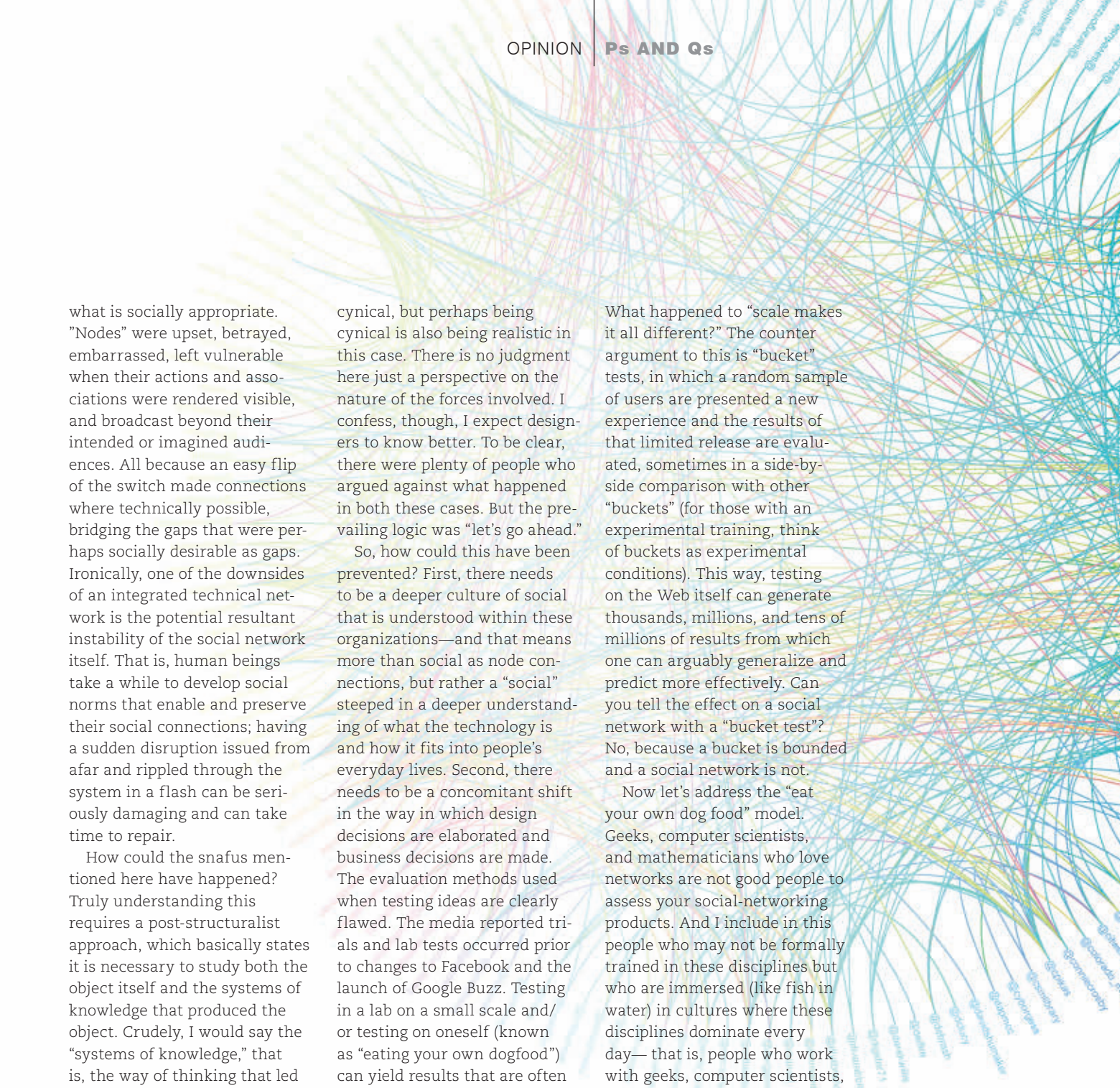
[1] Gates, G. "Facebook Privacy: A Bewildering Tangle of Options." *The New York Times*, 12 May 2010. http://www.nytimes.com/interactive/2010/05/12/business/facebook-privacy.html/

what is socially appropriate. "Nodes" were upset, betrayed, embarrassed, left vulnerable when their actions and associations were rendered visible, and broadcast beyond their intended or imagined audiences. All because an easy flip of the switch made connections where technically possible, bridging the gaps that were perhaps socially desirable as gaps. Ironically, one of the downsides of an integrated technical network is the potential resultant instability of the social network itself. That is, human beings take a while to develop social norms that enable and preserve their social connections; having a sudden disruption issued from afar and rippled through the system in a flash can be seriously damaging and can take time to repair.

How could the snafus mentioned here have happened? Truly understanding this requires a post-structuralist approach, which basically states it is necessary to study both the object itself and the systems of knowledge that produced the object. Crudely, I would say the "systems of knowledge," that is, the way of thinking that led to these errors, were ones that privileged simplified ideas and simplistic business imperatives over any concern for or understanding of human social engagement. Developers are excited about the hard technical problems but also the relatively easy control a graph (again, once we have the computational power) can give. Entrepreneurs and media strategists are goggle-eyed for the potential audience "reach" and the bucks that can be made. I realize I sound cynical, but perhaps being cynical is also being realistic in this case. There is no judgment here just a perspective on the nature of the forces involved. I confess, though, I expect designers to know better. To be clear, there were plenty of people who argued against what happened in both these cases. But the prevailing logic was "let's go ahead."

So, how could this have been prevented? First, there needs to be a deeper culture of social that is understood within these organizations—and that means more than social as node connections, but rather a "social" steeped in a deeper understanding of what the technology is and how it fits into people's everyday lives. Second, there needs to be a concomitant shift in the way in which design decisions are elaborated and business decisions are made. The evaluation methods used when testing ideas are clearly flawed. The media reported trials and lab tests occurred prior to changes to Facebook and the launch of Google Buzz. Testing in a lab on a small scale and/or testing on oneself (known as "eating your own dogfood") can yield results that are often limited and sometimes fallacious. On the first point, it has been argued we are witnessing a fundamental shift in human sociality because social networking technologies operate on a scale heretofore unseen and unimagined. But the argument can sometimes change: Prior understandings of human social relations from work on social technologies can't offer insights because of this shift in scale. But then, these technologies are tested in lab studies? What happened to "scale makes it all different?" The counter argument to this is "bucket" tests, in which a random sample of users are presented a new experience and the results of that limited release are evaluated, sometimes in a side-by-side comparison with other "buckets" (for those with an experimental training, think of buckets as experimental conditions). This way, testing on the Web itself can generate thousands, millions, and tens of millions of results from which one can arguably generalize and predict more effectively. Can you tell the effect on a social network with a "bucket test"? No, because a bucket is bounded and a social network is not.

Now let's address the "eat your own dog food" model. Geeks, computer scientists, and mathematicians who love networks are not good people to assess your social-networking products. And I include in this people who may not be formally trained in these disciplines but who are immersed (like fish in water) in cultures where these disciplines dominate every day— that is, people who work with geeks, computer scientists, and mathematicians (which would be me). Why? Because we operate simultaneously in user and evaluator mode, John Dewey, in his "Critique of Abstraction: The Intellectual Life as a Tool," makes the distinction between primary and secondary experience. Primary experience is a subjective relationship to external objects that are sensory—emotive, psychological, physical—but not reflected upon. They are experienced. Most of life is con-

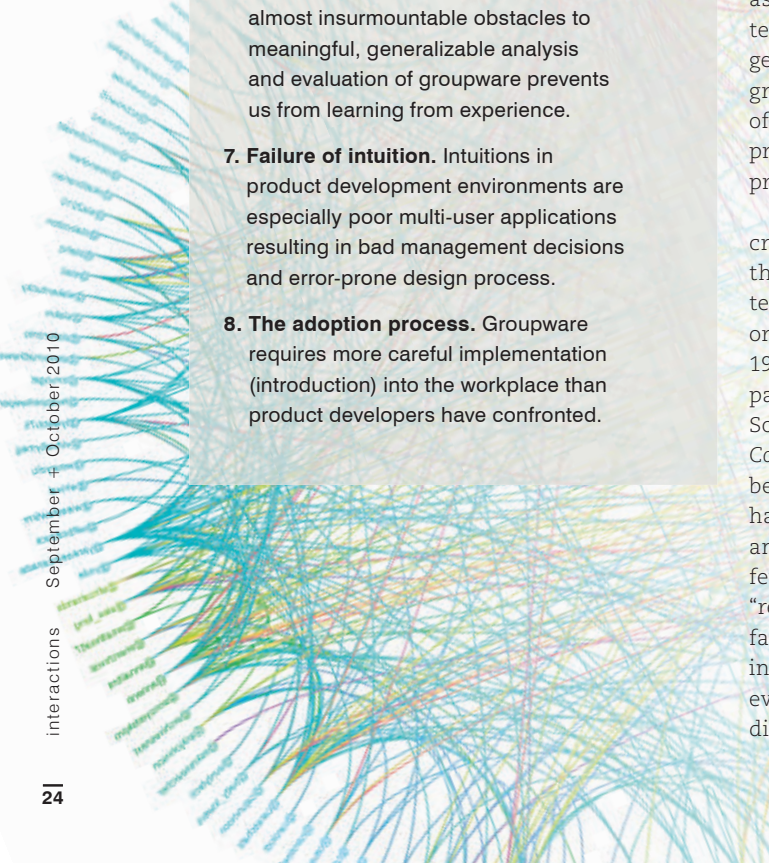


Twitter visualization by Daniel Lee

▸ A social network graph of tweet replies from October 14th to December 11th, 2009. The more lines you have, the more replies you sent to different users.

Jonathan Grudin's Eight Challenges

1. **Disparity in work and benefit.** Groupware applications often require additional work from individuals who do not perceive a direct benefit from the use of the application.
2. **Critical mass and the Prisoner's dilemma problems.** Groupware may not enlist the "critical" mass of users required to be useful, or can fail because it is never to anyone individual's advantage to use it.
3. **Disruption of social processes.** Groupware can lead to activity that violates social taboos, threatens existing political structures, or otherwise demotivates users crucial to its success.
4. **Exception handling.** Groupware may not accommodate the wide range of exception handling and improvisation that characterizes much group activity.
5. **Unobtrusive accessibility.** Features that support group processes are used relatively infrequently, requiring unobtrusive accessibility and integration with more heavily used features.
6. **Difficulty of evaluation.** The almost insurmountable obstacles to meaningful, generalizable analysis and evaluation of groupware prevents us from learning from experience.
7. **Failure of intuition.** Intuitions in product development environments are especially poor multi-user applications resulting in bad management decisions and error-prone design process.
8. **The adoption process.** Groupware requires more careful implementation (introduction) into the workplace than product developers have confronted.



ducted in this mode. Secondary experience is a rational process in every sense possible. But it should not be thought that we are even conscious of the distinction between primary and secondary experience. The transition from primary to secondary is simply a matter of coming to be conscious of, and comprehending the experience at hand. This secondary mode of existence is really just our everyday sense of what it means to think about something. People who study social networks from within—the believers of human sociality as network sociality—sometimes can't see what is really going on because they are invested in seeing things as a network. Knowing how someone socializes in your network application is knowing *only* how they socialize in your network. It is not knowing them as a social being. The view of technical designers, developers, geeks, computer scientists, and graph theorists differs from that of users. Users are primarily primary, and the technorati are primarily secondary.

The idea that we need to critically interrogate and shift the way we think about social technologies in development or emergence is not new. In 1994 Jonathan Grudin wrote a paper entitled "Groupware and Social Dynamics," published in *Communications of the ACM* [2]. It begins with, "Computer support has focused on organizations and individuals. Groups are different." Grudin goes on to say "repeated extensive groupware failures result from not meeting the challenges in design and evaluation that arise from these differences."

Here is a paraphrase of Grudin's opening lines as I think about social networking sites: *Social networking sites have focused on networks and individuals. When it comes to interacting and having relationships, people don't think in terms of the sum total of connections and inter-connections they have, they think of the individuals they know and the groups they belong to. People and groups are different from nodes and networks.*

Groups do not necessarily imply work-teams, despite the use of the term "groupware" to denote primarily enterprise team management software. Groups can also be ad hoc constellations of people who congregate around events and content, or who are affiliated by an ongoing interest. Sara Bly and I looked at these ad hoc gatherings in virtual environments, and it was Bly and Tony Salvador who coined the term "constellation" for a number of people coming together with some more or less shared interest or focus for short or long periods. Constellations form for short and long term and gather in social online spaces.

Grudin lays out "eight challenges for groupware developers" based on the insight that we need to think about groups not individuals and institutions. I wonder: Would it behoove us to move beyond individuals (user-centered design) and networks? Can a group way of thinking help us move beyond a network way of thinking? So here is my initial list entitled "Challenges for the Social Network Developers." (Grudin's full list is available in the sidebar).

1. Understand that your intuitions are likely wrong.

Remember that you, as a designer/developer, are operating in secondary mode, even if only some of the time. Most people are operating in primary mode most of the time. Given that your intuitions are likely wrong we need to conduct well-grounded evaluation and have an experimental mindset. Which brings me to my next point.

2. Broaden your ideas about evaluation. This is more than a numbers game. You don't understand social by only looking at your social network, try to understand what else your users are using. Research papers usually report data sets from one social site. Only comparative studies and studies that look at behavior across sites can give a picture of people's actual social patterns. Grand "implications" about human sociality based on data from one social site are overblown and should be taken with a pinch of salt. Start with the assumption that you are being biased and myopic, and from there drill into the data to see what you might be missing. And then go and collect more data from elsewhere.

3. Understand your constituencies. People operate in groups and communities. I find the word "community" to be almost as nebulous as the word "network." But, that being said, at least we have some idea of what draws people together in a community—that is, why they may be there. We talk about communities of circumstance, communities of interest,and communities of practice; all of these describe different factors that may draw people to one another and different needs that are perhaps being met. Thus, we can think about how these constituencies may have different needs and design features that may only be used by a few but have high value in that they deepen possibilities for collaborative engagement. So, following Grudin's point, don't only support features that are most trafficked. Give some thought to seldom used but highly valued.

4. Manage change; don't thrust it on people. Social technologies require careful introduction, and changes to social features must be carefully managed in their introduction as well as in their design. This directly relates to Grudin's point about the disruption of social processes. Social technologies sometimes (more often that you'd think) lead to activities that violate social taboos, threaten existing political structures, or otherwise demotivate the very users who are crucial to their success. Social technologies always disrupt social processes, but there are better and worse ways to handle these disruptions. So…

5. Communicate with people who use your site, and understand what they want to communicate to others and to you. Transparency is essential for conferring a sense of agency on the users of a social service. Further, make sure to understand the crucial distinction between information and data that should be surfaced for general consumption and that which should not be—think about what should be seen (or not) by whom and when and how. Your recommendations will likely differ depending on the group or community you are serving.

6. Develop a clear ethical stance. As you consider the possibilities for potential disruption of social processes you may end up with predictions that prove false. But the process of thinking through potential issues will ensure you are at least thinking of possible social (not just technical or business) slip-ups. Think beyond just what is legal to what is ethical. Moving from what is possible or good for business to what is ethical; and that may mean your design process needs to include evaluations and assessments that have a focus broader than Wall Street and your technological advantage.

The takeaway: people operate as individuals and in more or less formally organized groups, they seldom operate intentionally in their prescribed role as "nodes in a network." Sociologist Barry Wellman has been articulately pointing out for years, there is a lot more to social than the "networked individualism" of an elegant graph. There is much we can learn from looking at how people operate in groups, as the group level sits between the focus on a single person, the user, and an abstract entity that is too far from human experience—the network.

[2] Grudin, J. "Groupware and Social Dynamics: Eight Challenges for Developers." *Communications of the ACM* 37, 1 (1994): 92–105.

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Hope for the Best and Prepare for the Worst: Interaction Design and the Tipping Point

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Typical interaction designers are not climate scientists, but interaction designers can make well-informed use of climate sciences and closely related sciences. Interaction design can make scientific information, interpretations, and perspectives available in an accessible and widely distributed form so that people's consciousness is raised. Such consciousness raising is our only hope to empower individuals, groups, nations, and the international community to possibly prevent or reverse climate change and at least prepare and adapt to it in as safe and orderly a manner as possible—with the goal of securing a sustainable future for and the well-being of each and every individual person, creature, and habitat, inasmuch as it is possible to do so.

Interaction design can help bridge the gap between scientific predictions and notions of certainty and uncertainty on the one hand and public conventional wisdoms that, however well intentioned, may lead to an unsustainable future or inadequate responses to climate change on the other hand.

The possibilities concerning the imminence of global warming and climate change, or at least the arrival of a tipping point, have implications for how we think about sustainability and interaction design. We are at a crossroads where the logic that applies is the logic of hoping for the best and preparing for the worst—that is, we need to continue our efforts to develop digital interactivity to induce people and societies to engage in behavioral changes that reduce our greenhouse gas emissions. We also need to develop digital interactivity that allows us to prepare for and adapt to climate change under the possibility that we will reach a tipping point, or the possibility that we have already done so.

In what follows, we describe the present state of sustainable interaction design. We describe the potential role of interaction design in preparation for and adaptation to a post–tipping point world in terms of digital projects we may undertake for monitoring global conditions, setting public policies, and informing public behaviors, and in terms of arenas of potential effects and concern, such as water supplies, rebalancing of ecosystems, food supplies and food safety, dangers to habitations (especially coastal ones), health, and migration. We characterize computational concerns in the context of preparation and adaptation to climate change and note the similarities and differences with computational concerns targeted at inducing behavioral change to reduce greenhouse gases.

The Tipping Point

The tipping point, by definition, is the point at which any efforts to stop something from happening arrive too late. According to the 2007 Nobel Prize–winning Intergovernmental Panel on Climate Change (IPCC), we are at imminent risk of reaching a tipping point with respect to climate change and beyond the point at which even the very best case scenarios predict a certain unavoidable amount of climate change. The IPCC states:

"There is high confidence that neither adaptation nor mitigation alone can avoid all climate change impacts; however, they can complement each other and together can significantly reduce the risks of climate change. Adaptation is necessary in the short and longer

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term to address impacts resulting from the warming that would occur even for the lowest stabilization scenarios assessed. There are barriers, limits and costs, but these are not fully understood. Unmitigated climate change would, in the long term, be likely to exceed the capacity of natural, managed, and human systems to adapt. The time at which such limits could be reached will vary between sectors and regions..." [1].

The IPCC provides a historical overview of climate change research, which is compelling reading for those who want to understand the scientific basis of climate change predictions [2]. One of the scientists this report references is James Lovelock—famous for the Gaia hypothesis, considered controversial by some, that the earth is a living self-regulating system. The IPCC historical overview does not reference the Gaia hypothesis, but rather Lovelock's work from the 1970s on understanding the effects of CFCs. With respect to the Gaia hypothesis, the notion of an emergence of apparently intelligent or self-regulating behaviors from myriad autonomous agents with highly variant degrees of sentience is easily grasped by computer scientists and interaction designers who may be familiar with connectionism as understood, for example, in Minsky's *The Society of Mind* [3], Wikipedia, Web 2.0, and similar notions and systems. Lovelock provides a mathematical model called "Daisy World" to support his notion of Gaia—a model that will likely seem familiar and convincing to computer scientists and mathematically trained interaction designers [4].

A more dire prediction about climate change comes from Lovelock's latest book, *The Vanishing Face of Gaia: A Final Warning* [4]. He believes we have already passed the tipping point—the point at which positive-feedback mechanisms will induce the near certain likelihood of a period of global warming, regardless of our efforts to reform our behaviors. That is, global warming will continue even if all anthropogenic greenhouse gas production ceases. Among the implications of this prediction that Lovelock enumerates is the ominous notion that the Earth's population—now approaching 6.9 billion people—may be reduced to under a billion.

In referencing Lovelock, it is not our intention to enter any debate about scientific skill in fields that are quite different from our own, namely those connected to climate sciences. Nor are we qualified to do so. The IPCC report delimits one view of predicted effects of climate change, and we are taking Lovelock's view to delimit another view—a view that is both worst case and plausible. We could, for example, have chosen James Hansen, who also makes dire predictions about climate change, and Freeman Dyson, who has claimed climate change is nothing to worry about, to represent strikingly variant views as well [5]. In our context, these viewpoints delimit a possible design space for interaction design. The possibility that Lovelock may be correct or that the IPCC is correct or even that Dyson's refutation is correct is sufficient for the purposes of defining this space.

If Lovelock's view seems alarmist, it is sobering to note that of the six scenarios advanced by the IPCC for predicting greenhouse gas emissions over the course of the present century, only one predicts that at the end of the century, "in the absence of additional climate policies," we will be under the two-degree warming mark that pervades as a generally accepted notion of the tipping point [1].

	CONDITION *We haven't yet reached the tipping point*	**CONDITION** *We have already passed the tipping point*
Strategy: Reduce greenhouse gas emissions and hope to find successful technological solutions	**Outcome:** We're saved and we've learned how to sustain ourselves with fewer resources (possibly)	**Outcome:** We're too late (probably)
Reduce greenhouse gas emissions, hope to find successful technological solutions, and prepare for and adapt to the potential effects of global warming	We've learned how to sustain ourselves with fewer resources (possibly), but our risk of reaching the tipping point is (probably) higher than if all of our efforts had gone into reduction and technological solutions	We've prepared for the inevitable (probably), but at the expense (possibly) of using resources for ineffective efforts toward reduction and technological solutions
Prepare for and adapt to the potential effects of global warming	We will reach the tipping point (probably)	We've prepared as best we can (probably)

▸ Figure 1. Hope for the best and prepare for the worst.

[1] IPCC. "Summary for Policymakers." In: *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, edited by Parry, M.L., Canziani, O.F., Palutikof, J.P., van der Linden, P.J. and Hanson, C.E. 7–22. Cambridge: Cambridge University Press, 2007. See Figures SPM.2 and SPM.5.

[2] Le Treut, H., R. Somerville, U. Cubasch, Y. Ding, C. Mauritzen, A. Mokssit, T. Peterson and M. Prather. "Historical Overview of Climate Change." In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, edited by Solomon, S. et. al. Cambridge: Cambridge University Press, 2007. This report references: Lovelock, J.E. "Atmospheric fluorine compounds as indicators of air movements." *Nature*, 230 (1971): 379–381.

[3] Minsky, M. *The Society of Mind*. New York: Simon and Schuster, 1988.

[4] Lovelock, J. *The Vanishing Face of Gaia: A Final Warning*, 139-158. New York: Basic Books, 2009.

[5] James Hansen's and Freeman Dyson's views are at opposite sides of the debate about climate change. See Dawidoff, N. "The Civil Heretic." *New York Times Magazine*, 25 March 2009. www.nytimes.com/2009/03/29/magazine/29Dyson-t.html/.

Hope for the Best; Prepare for the Worst

How does one deal with these possibilities? It would be possible to despair on the grounds that it may be too late for efforts to reduce our greenhouse gas emissions—and to do nothing as a consequence of despair. Alternatively, the logic of Figure 1 may work—"hoping for the best and preparing for the worst." This logic is complicated in this case, because the choices we make now about how much effort to direct toward either reducing greenhouse gas emissions or preparing for and adapting to the potential effects of global warming have implications for the possible outcomes. The difficult choices this chart represents may be mitigated somewhat by the possibility that adopting lifestyles that reduce greenhouse gas emissions may overlap somewhat with preparing for and adapting to the potential effects of global warming, by helping us understand how to sustain ourselves on fewer resources in a post–tipping point world, which likely offers fewer resources.

Much of what has been written in HCI about sustainability relates to designing digital interactivity to change the behaviors that lead to unsustainable lifestyles—lifestyles that produce the greenhouse gases that almost indisputably lead to anthropogenically induced climate change. From the logic of "hope for the best and prepare for the worst," it is clear that at least some if not many of us need to also consider the degree to which some of our efforts need to be directed toward designing digital interactivity to prepare for and adapt to the potential effects of global warming and climate change. We are proposing the middle course of Figure 1; that is, we are not proposing to abandon efforts to use digital interactivity to promote behaviors that reduce greenhouse gas emissions or muster public support for technological solutions. Lovelock provides an analysis of the viability of various technological ("geoengineering") solutions [4]. We are proposing to augment efforts to include design for digital interactivity that helps prepare and adapt to the potential effects of global warming and climate change.

Sustainable Interaction Design

Much has been written about sustainable interaction design; there is much left to do and to write. In the previous issue of *interactions*, as well as in a well-received paper at CHI 2010, DiSalvo, Sengers, and Brynjarsdóttir identify several genres of work along these lines based on a thorough study of what has been written to date, raising important questions about the future paths for this work—especially questions of faith in technology as usual [6]. There are some substantial projects, too numerous to inventory here—examples include software for showing the source of constituent elements of products for small-business owners, data mining by SAP to track carbon as if it were a commodity, and software targeted at letting individuals understand and take steps to lessen their carbon footprints [7]. As a more general account of sustainable design, Tony Fry's notions of redirective practice, acts of elimination, and development of sustainment [8] are keys to understanding sustainability not just as a matter of reducing greenhouse gas emissions, but more important, as a matter of adopting lifestyles that rely on fewer and more natural uses of resources. As such, Fry's notions and the degree to which efforts in sustainable interaction design target-wise use of resources are likely as germane to a post–tipping point world as to a world at risk of reaching a tipping point.

The Potential Role of HCI in a Post–Tipping Point World

With scientific dispassion, Lovelock claims it is possible to think of the culling of the global human population as a matter of natural course, even if

[6] DiSalvo, C., Sengers, P., and Brynjarsdóttir, H. "Navigating the Terrain of Sustainable HCI." *Interactions* 17, 4 (2010): 22–25.

[7] See Bonanni, L., Hockenberry, M., Zwarg, D., Csikszentmihalyi, C., and Ishii, H. "Small Business Applications of Sourcemap: A Web Tool for Sustainable Design and Supply Chain Transparency." In *Proceedings of the 28th International Conference on Human Factors in Computing Systems* CHI '10. (2010): 937–946; as well as StepGreen (http://www.stepgreen.org/). Dan Rosenberg and Daniela Busse from SAP are building dashboards to track carbon based on the considerable scale and reach of SAP software installations [private conversation]; http://www.sap.com/usa/solutions/executiveview/sustainability/

[8] Fry T. *Design Futuring: Sustainability, Ethics, and New Practice.* Oxford: Berg Publishing, 2009.

Photograph by Eli Blevis

the catalysts to such culling occur or occurred as a result of anthropogenic activities or by some other means. Let us say unequivocally that interaction design is a science, and an art, of compassion and that saving lives above all else and incorporating sustainability whenever possible is a suitable and critical goal for our discipline—resigning to Lovelock's prediction of the potential loss of roughly six out of every seven people and many species is not an option.

The 2007 IPCC report predicts climate change will have massive implications for global food production and conditions of production, as well as for water, coastal habitations, health, and ecosystems. For the case of food production, "complex, localized negative impacts on small holders, subsistence farmers, and fishers" is virtually certain, and the latitudes at which cereal production is viable will change depending on the amount of warming. Another salient effect is the likelihood of "increased damage from floods and storms" and the possibility of coastal flooding and wetlands loss, depending on the amount of warming [1]. These two factors and others in the IPCC report have implications for the many urban areas that are located in coastal environments, not just in terms of food, but potentially in terms of habitability.

A changing climate and its associated implications in relation to this imply a need for the design of digital networking and interactive technologies that can help people at various levels—as individuals, small groups, governments, and global bodies—plan and prepare for the orderly adaptation to these effects. Such networks will need to make available data, visualizations, tracking, and predictive simulations about changing locations of food production and threats to particular urban environments. A number of interactive systems could potentially play a positive role.

In a characteristic fashion of design thinking, we offer here a design problem-setting approach—that is, we propose the need for particular concept systems targeted at preparation and adaptation to climate change and owing to insights based on the IPCC report, primarily. What follows are some speculations about the kinds of things the interaction design community can be doing.

Food production and source tracking. As an issue of both sustainable supply and food safety, interactive systems are needed that can assist various groups of people to adapt to the changing suitability of particular regions for growing particular crops and other forms of food production. Moreover, ensuring and tracking equitable food distribution to meet basic human needs under these changing conditions is a matter of certain importance.

Dashboard earth. As an issue of preparation and adaptation to changing climate, interactive systems to ensure planning and preparation for how people in particular locations can respond to changes in food and water supplies and even to threats to the habitability of coastal environments in particular and other environments in general are essential.

Orderly absorption and evacuation. We will need interactive systems that allow policy makers to provide orderly immigration to or emigration from environments in the face of the effects of climate change. Depending on the scales of particular migrations induced by climate-change events, policy makers at all levels—local, regional, national, intergovernmental—will need the information at hand to make informed decisions about orderly absorption of environmental refugees and planning for the possibility of the need for local populations under their charge to evacuate areas that have become uninhabitable.

Habitability index. Interactive systems that allow access to data about the habitability of particular regions and predictions about the future habit-

ability of particular regions will need to be in place. Such data and predictions will be critical to providing for orderly absorption and evacuation, as environments change in terms of their habitability.

Living with fewer resources. Interactive systems are required to instruct people in urban and other environments on how to live with fewer resources, either as a matter of sustainable practices or as a matter of adapting to climate change or both.

Saving life. Social mechanisms—especially those that rely on interactive technologies—can hopefully play a role in fostering relationships between people at various levels of organization in order to ensure that as many people as possible have access to safe environments, with food and drinking water, and that people are actively engaged in helping others in the face of changes that might otherwise easily induce conflicts.

Fostering public and governmental support for technological solutions. Lovelock is himself not without hope; he outlines a number of geoengineering interventions that might reverse a positive feedback loop. One example is the conversion on a large scale of agricultural waste into char and burying it in the soil or possibly on the ocean floor [4]. The strategy is effectively a form of exploiting the power of photosynthesis to capture carbon dioxide from the atmosphere in a form that can be buried so that it is no longer part of the atmosphere. Lovelock: "So far it is the only realistic proposal by which we have even a chance of restoring the Earth to the state it was in before we started using fossil fuel." Clearly, such projects require public and governmental support on a massive scale. Interaction design of social mechanisms of awareness to create such support is needed in a pervasive manner, as in the case of carbon calculators. Such systems can help inform choices about energy production; such choices likely vary from one location to another.

Fostering public understanding. Even for well-intentioned people, it's not easy to make choices that help secure our collective future. The viability and greenhouse gas emissions effects of various methods of producing energy are not commonly understood. Moreover, various forms of energy production—nuclear, wind, hydro, bio-fuels, geothermal, solar thermal, solar voltaic, gas, diesel, oil, and coal—have very different implications for greenhouse gas emissions and food supplies and other side effects of energy production [4]. The best choice can vary from one location to another. Interaction design can play a role in ensuring that such choices are informed by scientific knowledge and interpretations of our collective best interests, rather than the economic interests of private-sector enterprises.

Computing issues. With respect to sustainability, the focus of attention on computing issues has centered on issues of energy use, including individual (personal computers), corporate (servers), and very large-scale (cloud- and grid-computing) levels. One of the promises of cloud computing is the possibility of using energy more efficiently as redundancies are removed from information-storage and retrieval systems. There is a need for interaction designers to make such efficiencies transparent to individual people [9]. Nonetheless, energy savings are only a small part of what is needed. We also need to focus on building systems that can track necessary information and interactivity that can inform human preparation for and adaptation to climate change. Such systems must make this information available at scale and in forms that are suitable to a number of different constituencies, individuals, policy makers, governments, and intergovernmental organizations.

These suggestions are just the start of the discourse that we as interaction designers must have to help prepare for and adapt to climate change as a concurrent strategy with present efforts to help prevent it.

[9] Mankoff, J., Kravets, R., and Blevis, E. "Some Computer Science Issues in Creating a Sustainable World." *Computer* 41, 8 (2008): 102–105.

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Reciprocity, Deep Storage, and Letting Go: Opportunities for Designing Interactions with Inherited Digital Materials

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We are seeing a vast proliferation of self-generated content on the Internet. From ever-expanding online photo archives to mundane records of everyday life through tweets, blog posts, and status updates, new forms of digital content that people find deeply meaningful and may want to pass down one day are being created. On the one hand, digital suggests possibilities of permanence and new modes of presence and expression for these kinds of materials. On the other, it brings into question what we would want to preserve and who should make those decisions. These issues come at a time when we are moving beyond the point at which digital content is constrained to a particular generation, raising further issues about how the digital residue of a person's life could become the property of someone else and be representative of a person after they have passed on.

Despite these shifts, little is being done to consider the means by which our digital remains will persist after we are gone. For example, deceased users' social networking Web pages typically persist after their passing, often without measures in place to appropriately handle this content [1]. In general there are few mechanisms to enable people to pass digital content to loved ones, whether stored locally or in the cloud. These technological trends compel interaction designers to consider how digital possessions and archives will be handled as we begin to consider the implications of their persistence beyond the lives of the original owners.

How will we be remembered in the future? Will the digital objects we leave behind ultimately be used for reflecting on the past? Who will decide how they are treated and what forms they might take? To begin to explore these questions, we conducted interviews with people who had recently inherited physical and digital belongings from a loved one, with an eye toward key tensions that emerged in and through these exchanges. We found that people's experiences highlighted some important concerns for the design community as we collectively begin to consider designing interactions with digital materials over much longer periods of time [2].

Designing for Experiences of Reciprocity Across Exchanges

A series of complications emerged for people during the reception—and subsequent maintenance—of digital materials from the departed. One of the most pervasive problems centered on people being unable to make sense of large collections of inherited digital data. While bequeathed physical objects were generally regarded as manageable, the vast amount of unfiltered content on even a single digital device often raised troubling concerns. In some cases, participants inadvertently stumbled upon content not

[1] Recently, Facebook has included a "memorial" feature for users' homepages. Nonetheless, many problems remain, such as users being reminded to "reconnect" with deceased friends. See Ortutay. B. "Facebook to Memorialize Deceased User Profiles." *The Globe and Mail*, 27 October 2009; http://www.theglobeandmail.com/news/technology/facebook-to-memorialize-deceased-user-profiles/article1339899/

[2] For a more in-depth description of findings from our field research, see: Odom, W. Harper, R., Sellen, A., Kirk, D., and Banks, R. "Passing On and Putting to Rest: Understanding Bereavement in the Context of Interactive Technologies," 1831–1840. In *Proc. of CHI '10.* New York: ACM Press, 2010.

▸ Storing digital artifacts can go beyond flash drives and cloud computing; this archival cabinet is a manifestation of the physical and digital worlds we straddle. The dual-sided cabinet contains 16 drawers for physical objects on one side and 16 corresponding engraved patterns on the other. The pattern, which is a unique universal barcode, is linked to digital materials that are accessible when interfaced with a camera phone or computer. The digital content can be modified online, which doesn't affect the engraved pattern.

Cabinet of the Material World • Designer: Jon Stam; Producer: Danny Jooken; Technisch Instituut Heilig Hart, Hasselt, Belgium • www.commonplace.nl

intended for them when navigating through expansive, idiosyncratically structured archives. In other instances, people spoke of being in a state of paralysis, ambivalent over how to approach excavating hard-drive content that was meaningful to them and unsure of how their loved one's residual digital detritus should be handled. In all cases, participants felt a heavy obligation to deal with these digital remains, remaining burdened as they attempted to craft some sense of meaning and resolution.

While storage increasingly becomes cheaper and personal collections of digital possessions continue to grow, there seems to be value in exploring how people might pass down smaller selections of content intended for a particular audience, as opposed to handing over the entire contents of one's digital life [3]. One potential opportunity involves designing better applications across local storage and Internet services that would support people in demarcating significant digital possessions from the trivial, ultimately in

[3] This design direction is suggested by recent work critiquing the dominant view of life logging. See Sellen, A. and Whittaker, S. "Beyond Total Capture: A Constructive Critique of Lifelogging." *Communications of the ACM* 53, 5 (2010).

the service of collating meaningful digital materials over time. Another area of concern lies in designing interactive systems that can deliver this kind of content to receivers in more elegant and expressive ways. On the one hand, there are clear opportunities for designing interactive tool sets for attributing rich annotations to sentimental materials in anticipation of their inheritance. On the other, we can imagine a new space of interactions opening up for the receiver that would make sense of this kind of collection and perhaps inscribe another layer of value onto the memories and legacy it signifies. Moreover, designing an engaging space for loved ones to construct shared value from their digital inheritance might relieve the sense of burden and invoke the social relationships implicated in these materials in much more appropriate and satisfying ways.

Designing Interactions with Possessions in Deep Storage

The diverse ways in which people managed relationships with departed loved ones were often reflected in how they stored and presented physical and digital possessions in their homes. In some cases, people possessed objects that remained troubling, such as posthumously received handwritten letters or collections of digital documents and photos that the departed had arranged to be passed on after their death. Whether concealing physical objects in a desk drawer or burying digital files deep within the directory structure, great care was taken to both preserve and hide away these possessions. Despite their troubling qualities, these things remained significant, and it was crucial for owners to know their location and be assured of their safety, even though the materials were hidden out of sight. However, there was no readily accessible way for people to explicitly differentiate these digital possessions from other content within the system.

More generally, people populated their homes with physical artifacts they had been bequeathed (e.g., photo albums, clocks, various trinkets). These kinds of things could be drawn on when someone needed to reflect on the departed's life; at the same time, they could easily be put away or fade naturally into the background. The relatively unobtrusive and emergent reflective qualities of these possessions were significant in that there was a sense of honoring the departed merely by maintaining their presence in the home and at times attending to them on their own terms. Here again, digital materials were quite different in that current modes of interaction and presentation of digital content required people to make the effort to find, open up, and view materials that had been passed down, which complicated the discreet yet accessible properties of remembrance.

These instances collectively suggest several opportunities for designing richer experiences around the preservation and presence of inherited digital possessions in everyday life. Regarding modes of storage, one end of the spectrum suggests exploring opportunities around preserving the digital locally within a container, which holds formats universally accessible so long as the power supply is intact. As advances in transitive materials [4] increasingly blur the material distinction between the physical and the digital, the surfaces and form factors of these "deep storage" artifacts could be augmented to convey presence and secure the preservation of deeply sensitive content to owners in subtle yet expressive ways. As these objects transition across families and generations, there are abundant opportunities for exploring how metadata characterizing these exchanges might be captured and represented, and how the presence of the objects themselves gives rise to new narratives associated with the contents they embody.

At the other end of the spectrum, cloud-computing services offer opportunities to enable vast groups of people with access to digital archives across locations and devices.

While the transition of sensitive content online brings up issues of ownership, trust, and privacy, there nonetheless are key opportunities in designing interactive systems that could enable collective reminiscence and reflection on a person's life. In contrast to physical artifacts from the departed becoming fragmented across surviving loved one's homes, meaningful digital materials could be collated within centralized online spaces as a basis for personal or public commemoration of a person's life. There appears to be great possibility for designing interactive applications and appliances aimed at expanding how these socially constructed portraits could evolve over time with new entries to become shared, enduring records of the departed's legacy.

[4] Coelho, M. et al. 2009. "Programming Reality: From Transitive Materials to Organic User Interfaces," 4759–4762. In *Proc. of CHI '09*. New York: ACM Press, 2009.

Designing to Support Rituals of Letting Go

Maintaining ownership of possessions left behind by departed loved ones was a clear way in which legacies persisted in the present. However, we observed several cases in which letting go of key inherited materials played highly significant roles for people in terms of honoring the departed and putting core aspects of relationships with them to rest. These rituals took on diverse forms, both physical and digital. A particularly compelling example centered on a statue sculpted by a participant's late wife. While inside the widower's home, it showed significant signs of weathering and decomposition. He described the degraded nature of the statue as resulting from his choice to move it outside, where it would begin to fade away, eventually finding "its final resting place." It was clear that his choice to slowly let this possession go meaningfully reflected the shifting nature of his relationship with his departed wife.

We also encountered many instances of people retaining archives of emails or text messages received prior to a loved one's passing, which highlighted both momentous and mundane experience with the departed; in several cases they were incorporated into rituals of remembrance and letting go. For example, one participant described being in possession of several hundred email messages from his wife, which had been downloaded locally onto his desktop. He described reflecting on the emails from time to time, and eventually beginning to delete the messages as a way of honoring his wife by moving on with his own life. However, in contrast to the nuanced form of transition illustrated in the decaying statue, the digital afforded only a crude binary representation—existence or deletion.

In contrast to the increasing movement to archive all information we produce or interact with, these instances suggest opportunities for designing interactions with digital content aimed at supporting elegant forms of interment. Whether through the gradual decay or growth of tangible patina, the physical realm appeared to support more expressive ways in which rituals of "putting to rest" were recognized and enacted. This brings up several interesting questions and opportunities for interaction designers. How might the passage of time be represented in ritualized archives of digital objects? How would we design for experiences of deletion over time? What qualities and attributes might support interactions with decaying digital objects? And how could increasingly fleeting interactions with these kinds of digital materials better support rituals of remembrance and tribute?

Conclusion

As we continue to accumulate rich archives of digital possessions reflective of our lives and our loved ones, the interaction design community must begin to ask what will become of these collections in the future. This brings up issues regarding the forms in which sentimental digital possessions could be made more present in our everyday lives, the design choices that might lead to their acquiring new value over time, and how file formats and data structures will be preserved to support enduring legacies [5]. We highlighted a few of what will be many emerging opportunities for interaction designers to develop new ways in which digital materials signifying our most meaningful social relationships might persist, evolve—and perhaps fade away—alongside us, now and into the future.

[5] These directions collectively suggest clear concerns over the ethical treatment of content over time and across owners; very recently, HCI researchers have begun to articulate the imperative to approach the design of information systems with multiple life spans in mind. For example, see Friedman, B. and Nathan, L. "Multi-Lifespan Information System Design: A Research Initiative for the HCI Community," 2243–2246 In *Proc. of CHI '10*. New York: ACM Press, 2010.

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David Kirk is a lecturer of HCI in the Mixed Reality Lab at the University of Nottingham. A psychologist by background, he has researched user practices of archiving and storage of both digital and physical artifacts in the home, in particular the social practices surrounding photos. He is currently extending this research to explore the design, ethics, and human values of "technology heirlooms" designed to outlive their owners that become imbued with sentiment and reminiscent value.

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My Uncle Used to Watch Television

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In writing the latest installment of Lifelong Interactions, I knew I wanted to consider how we as human beings have come full circle from being very physical, to living an abstract life, and eventually to having a need for physicality in our golden years. It just so happened that the day before my deadline for this article, I had an interesting discussion with a colleague and close friend, Chris Krause. During the three years since I started my research on tangible interaction devices, Chris has always kept me on my toes, questioning the value that tangible user interfaces can add to the office environment. Our conversation was enlightening.

Many anthropologists regard the Cradle of Humankind, a region of the heart of South Africa, as the site of man's origins. It was during Chris's visit to this place that he realized as humans we have gradually moved from having a direct relation with the events we are responsible for, to being increasingly further removed from the consequences of our actions. After my discussion with Chris about the lifestyle of early man, I began to explore the ramifications of modern man's technology-driven detachment from direct, tactile experiences.

It's interesting to contrast current methods of subsistence with those used by early man. The hungry caveman would notice his grumbling stomach and go hunt for a meal, or dig for edible roots. Modern man gets his food indirectly.

Consider how you get food on your table. As an employee, you spend time in a workplace, possibly an office. At this office you most likely have a computer and earn some reward tokens by typing away at the keyboard. At the end of the month you are rewarded through another indirect mechanism that we call banking. Your employer sends a message to your bank stating the amount of credits to be added to your account. No physical objects are transferred. You then exchange these virtual objects for real objects at a supermarket, objects that have been prepared and packaged by a person totally unrelated to you. And so the supply chain is constituted: total strangers exchanging virtual objects for real-world objects.

My 85-year-old uncle, Charles Keegan, used to enjoy his home entertainment system, including a television set. Unfortunately, his eyes have now succumbed to macular degeneration, an age-related illness characterized by a detached retina leading to complete blindness. He has been classified as legally blind. Using the multitude of remote-control devices is becoming an acute problem for my uncle. He has many devices to keep track of, each with small buttons closely spaced, pre-programmed with multiple functions.

In general the majority of modern electronic consumer devices are packed with features with multiple functions assigned to the same control buttons on the physical interface. Manufacturers justify this overloading with the product's lower retail price.

Now envisage a remote-control system that relies on the touch and shapes of three-dimensional objects. The majority of blind people retain a sense of touch; the majority of all people has some sense of touch and have become accustomed to the feel of familiar objects.

Human aging results in unexpected changes in our bodies. My uncle never envisaged going blind. He kept physically fit and active, running his own business independently up to the age of 81, until the debilitating illness affected him. No longer an able-bodied person who can lead an independent life, he now relies on a third party for assistance.

How can technology possibly address diminished vision at an age when it's too late to learn Braille? The answer might very well be found in the way our caveman ancestors interacted with their environment. They used their sense of touch and their actions were concrete, providing a direct link between cause and effect. Direct interaction has the advantage over other means of interaction in

that varying levels of abstraction are transparent to the user and do not interfere with the understanding of the interface.

As an example of abstraction introduced in the electronic age, consider how station selection on the radio was done five decades ago, and how we do it today. In the 1960s the radio had a tuning knob and dial for selecting the receiving station. As the knob was turned, a line would move across a graduated background, providing the user with a direct correlation between the rotation of the knob and the movement of the line. The background indicated the location to which the line should be moved in order to tune to a radio station. Current radio designs present the user with a range of buttons, which can be depressed. Searching for a radio station is accomplished by depressing a specified button and listening to the audio while a circuit changes frequency. The user has little control over the rate at which the frequency changes, at least not the fine control afforded by the tuning dial. This additional abstractness has been added to numerous consumer items, supposedly in an attempt to add more functionality into an ever-decreasing volume.

A number of researchers are investigating the removal of abstraction layers by inventing new direct-manipulation mechanisms, often building on prior knowledge [1]. One group of researchers is grounding work in Tangible User Interfaces (TUIs) [2]. It is my opinion that TUIs are particularly appropriate for those who have lost their sight or have difficulty with fine motor control. For these people, manipulating large three-dimensional objects gives potential relief from the minuscule buttons of a television remote controller's two-dimensional interface.

My own interest in TUIs encompasses the development of physical systems that support the creation of simple programs by novices using physical objects. The ultimate aim is to provide a programming environment that can be operated by computer illiterates to construct very simple programs for execution on a computing device such as a desktop computer, a custom-made low-cost computer, or a computing device embedded in the world of the novice programmer. I'm motivated by the innate ability of humans to manipulate real-world objects using their hands. This is accomplished with greater ease than the manipulation of virtual objects using artificially created instruments such as the computer keyboard.

What I find of particular interest is the search for a method to introduce computer-programming principles to children living in rural communities in developing regions. I anticipate a solution requiring the integration of high-tech research with a low-tech implementation. Our laboratories at the CSIR Meraka Institute have pursued this concept for some time, initially using custom-designed and -assembled electronic circuitry to receive instruc-

[1] Norman, D. "Natural User Interfaces Are Not Natural." *interactions* 17, 3 (2010): 6-10.

[2] Ullmer, B and Ishii, H. "Emerging Frameworks for Tangible User Interfaces." *IBM Systems Journal* 39, 3-4 (2000): 915-931

tions, interpret them, and produce a result by effecting changes in the real world.

I hypothesize that through the provision of concrete inputs and concrete outputs, the abstractness of programming is reduced, and demonstrating to the novice that setting up a sequence of instructions for delayed execution is possible. If this concept is grasped by the novice programmer, then the first steps to becoming a seasoned programmer have been taken.

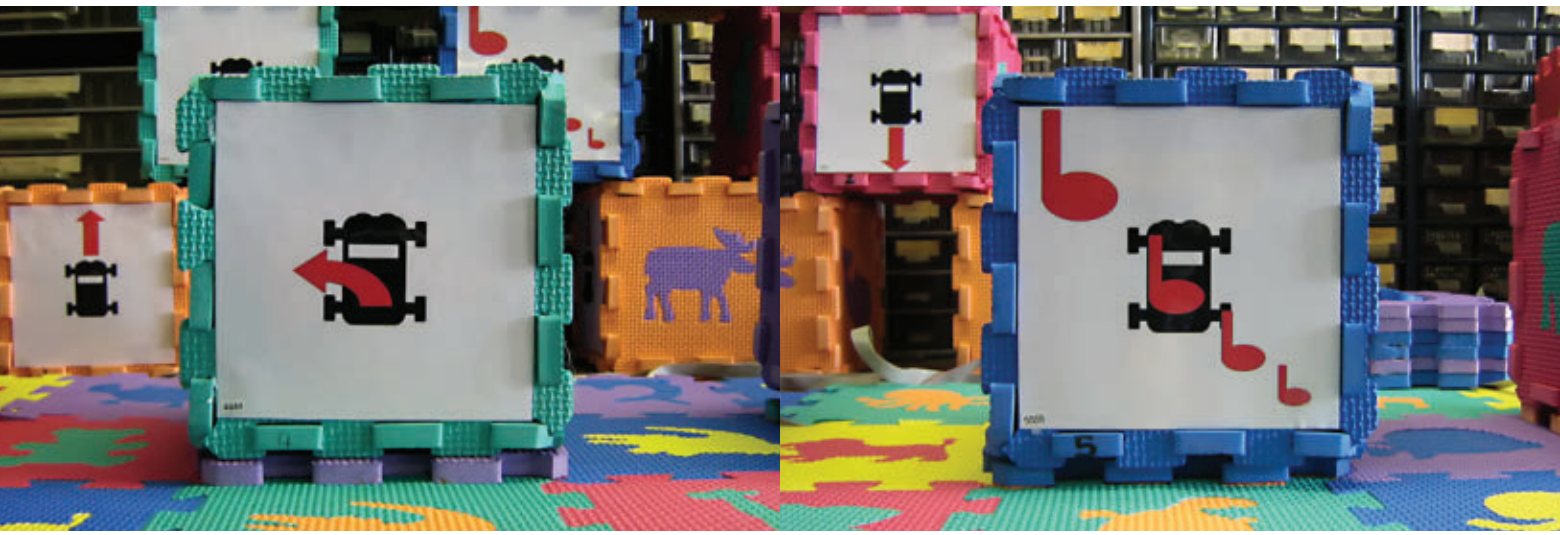
Our initial design consisted of transparent cubes, approximately 400mm square. Embedded inside the surfaces were low-cost magnets, sold in the retail sector as part of home-intruder detection systems. So-called "reed" sensors accompany the magnets, consisting of two ferro-magnetic "fingers" that make contact in the presence of a strong magnetic field. In our design the sensors were embedded in a separate sensing surface. By varying the combinations of the magnets, the sensing surface detects which cubes have been placed at predetermined positions. Attached is a low-cost computing device that receives the combinations, interprets them, and sends commands to a toy robot.

Since our initial design, we have progressed through a number of iterations. The second design incorporated colorful foam blocks, and in the third design we investigated the use of natural materials, shaping soft rock using hand tools. The fourth design investigated the use of recycled materials such as discarded CDs and lengths of abandoned electrical wiring.

I ponder whether modern man is abstracting life too much. I recall having read that one of the effects modern technology has on humans is that of isolation [3]. I, too, have succumbed to technology, sending email messages to students who are in a lab just down the hall from me.

Will humankind be able to recover from a disastrous event if all our current electronic technology has been destroyed and we have to revert to manual processes and actually speak to other people face-to-face? And what about my uncle? Our culture's dependence on technology has arguably complicated his experience of blindness—can we turn that around and use all that we've learned to make technology more accessible to those with a disability? On second thought, where is that power switch…

[3] Bell, G., Blythe, M. and Sengers, P. "Making by Making Strange: Defamiliarization and the design of domestic technologies." *ACM Transactions on Computer-Human Interaction* 12, 2 (2005):149–173.



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Six Speaking Chairs (not directly) for People Who Cannot Speak

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There are some commonly held assumptions about the future of speech technology, and our interactions with it, that we wish to challenge. Our goal with "Six Speaking Chairs" is to explore alternative perspectives rather than to converge on solutions at this first stage. We would therefore describe this activity as design research, even though it involves our practice as interaction designers.

We have built a collection of objects, each of which embodies a different way of thinking about tone of voice. It is better to view the chairs as provocations than as prototypes in the conventional sense, because their most important role is to spark discussion rather than to test proposals. The chairs are not to be taken literally. It's not about chairs at all—they are really just illustrations of principles, more so even than sketches of user interfaces. Each illustrates what might otherwise be a rather esoteric mental model, making it accessible to experts and non-experts alike and engaging both in conversation and reflection [1].

[1] Pullin, G. and Cook, A. "Six Speaking Chairs." August 2008. http://www.imd.dundee.ac.uk/sixspeaking-chairs/

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Speech Technology with Subtle Tones of Voice

This is a project about more expressive interactions with speech technology, specifically interacting with the tone of voice of synthesized speech. We hesitate to use the term "emotional" speech synthesis because, as we will explain, we are far more interested in the complex nuances of everyday speech than basic emotions such as sadness and fear.

As interaction designers, our focus is not on how to produce different tones of voice with speech technology itself. (We know there are more expert researchers looking into this, and we are collaborating with a world-leading research center on another project). Instead, we are exploring the implications for a user interface: How might someone who is not a speech technologist conceive of tone of voice in the first place, and therefore select or control it? This is a challenging question.

A Story in Six Chairs

Without any further preamble, we will unfold the story of the project through the objects themselves, introducing the background, rationale, and inspiration along the way...

Chair No.1. The Exclaiming/Questioning Chair, the first chair in the collection, is a reclaimed wooden kitchen chair; a plain charcoal-gray box that extends to one side has been fitted beneath the seat. Set into the top surface of this box are three keys from a computer keyboard, marked with a period (full stop), an exclamation point, and a question mark. An old-fashioned metal horn loudspeaker projects from the front edge of the box. While sitting in the chair, if you press the period key, the loudspeaker emits the word "yes" in a level tone. Press the "?" key and "yes" is delivered with a rising, questioning intonation. Pressing the exclamation-point key elicits a louder, more emphatic delivery.

... and the limitations of Text-to-Speech

These three ways to say "yes" represent the common flexibility of everyday Text-to-Speech (TTS) technology. Yet in our own speech, we employ much greater and more subtle variation in our tone of voice. In any sentence—but in particular in the short interjections at the heart of informal conversation—it is not just what we say, but how we say it, that counts. Whereas in writing, "yes" is usually affirmative, in speech its meaning can be more complex, more layered, and more sophisticated. With the right tone of voice, we can either say "yes" to agree, to reassure, to bide for time, or even to undermine (without being so blunt as to actually say "no") [2].

[2] Crystal, D. *The English Tone of Voice: Essays in Intonation, Prosody and Paralanguage.* London: Edward Arnold, 1975.

All photographs by Graham Pullin and Andrew Cook

▸ Stills from a video of three completed speaking chairs in action. See more at the Six Speaking Chairs website; http://imd.dundee.ac.uk/sixspeakingchairs/video.html/

TTS is found in the screen-reading software used by many visually impaired people, in other eyes-free interfaces (such as Apple's iPod Shuffle), and in automated telephone answering services. But its most profound application is in communication devices used by people who cannot speak. And it is here that the limitations of TTS can be most disabling, because a lack of variation in tone of voice can never be neutral. A lack of expressiveness can itself send out a false message that the person is emotionally impaired as well as speech-impaired, or perhaps socially unsophisticated. Writing and speaking are fundamentally different ways of conveying language, and yet TTS treats them as if they were equivalent.

Chair No. 2. The Happy/Sad Chair, illustrates an alternative approach. On a reclaimed wooden dining chair, a tuning dial (from a 1950s Bush radio) has been relabeled, the international radio stations replaced by a two-dimensional mapping of emotions, taken from psychological research [3]. Inside the box a potentiometer registers the rotation of the tuning dial, and a separate slider controls the degree of emotion. These inputs drive a parametric model of prosody, using granular synthesis and formant resynthesis in Max/MSP—a flexible "experience prototype" standing in for more sophisticated state-of-the-art speech technology [4]. (Our speech technology, while flexible and capable of a high level of nuance and real-time control, sounds far from realistically human. Besides their iconic visual representation of spoken announcements, the low-fidelity sound from the metal horn speakers accentuates the highly artificial sound of the speech. The emphasis is not on its realism, but its expressiveness.)

... and so-called emotional speech

Of course the limitations of TTS have not escaped the developers of speech technology. There are many research projects (and have been for some time) investing synthetic speech with different emotions [5]. The standard approach remains to create the most extreme emotions—usually defined as joy, sadness, anger and fear—and to interpolate any other emotion between these four and a neutral tone of voice. The Happy/Sad Chair illustrates just this approach.

Manufacturers of AAC (augmentative and alternative communication) devices are expecting speech technology to support this kind of emotional speech in the future. So a more conventional assistive technology project might have taken this emotional model as a given and designed in more detail how this might be translated into a usable interface (even if some assistive technology researchers predict that emotion could be sensed automatically with biosensors, supposedly obviating the need for a conscious user interface at all). But our intent is to challenge these assumptions—we (and other

[3] Schlosberg, H. "Three Dimensions of Emotion." *The Psychological Review* 61, 2 (1954): 81–88.

[4] Buchenau, M. and Fulton Suri, J. "Experience Prototyping." Paper presented at the *3rd International Conference on Designing Interactive Systems*, August 17–19, New York (2000): 424–433.

[5] Murray, I. and Arnott, J. "Implementation and Testing of a System for Producing Emotion-by-rule in Synthetic Speech." *Speech Communication* 16 (1995): 369–390.

researchers, as the subsequent chairs show) believe that expression of emotion is only one aspect of tone of voice. Not to even mention the moral implications of providing someone with a device that uncontrollably broadcasts their emotional state through tone of voice.

We believe that designers can play a valuable role in disability-related design, not only in refining clinically and technically driven solutions, but also in provoking discussion about the very role of assistive technology, a theme explored in *Design Meets Disability* [6]. So Chair No. 2 is not the end of the story.

Chair No. 3. The Offering/Seeking Chair goes beyond emotions. We have reservations about using the phrases "emotional speech" and "expressive speech" interchangeably. Our emotions are just one of the things that we express through tone of voice, and even then, the situation is more complicated: when we try to suppress our emotions but they are still discernable, when we feign an emotion, or when two emotions are combined or even in conflict.

Chair No. 3, the Offering/Seeking Chair, is based not just on the emotions of the speaker, but also around the relationship they have with their conversational partner, the social context in which they find themselves, and their conversational intent. It is built on the work of Nick Campbell, a speech corpora researcher [7]. The chair's interface is a series of six toggle switches: two to register the social relationship between conversational partners; two to reflect the conversational intent of any individual utterance. This leaves two switches to register a total of just four emotional states.

... and challenging existing paradigms

We are interested in understanding more about the relative strengths and weaknesses of this approach when compared with the emotional model. The overall number of tones of voice, and therefore the cognitive overhead, is not too dissimilar. But we are gaining complementary sensitivity at the expense of fine emotional control.

Our interactive prototypes allow each to be deployed within a conversational context to assess their effectiveness—not only their clarity or ambiguity, but also the conversational influence and creative expression that they afford. These contexts have to be carefully crafted, given that the chairs are limited to just four words for prototyping reasons. There is a secondary control on the other side of the seat, selecting "no," "really," or "hello" in favor of the default "yes," all four chosen for the importance of tone of voice in their meaning and for their role in engaging and sustaining conversation. This is not without precedent in the study of AAC: Some people with aphasia lose their vocabulary yet nonetheless manage to influence and direct a conversation [8].

Chair No. 4. The Rising/Falling Chair dispenses with intermediate parameters and gives direct control of the speech sounds: The user traces the desired pitch contour on a flat surface (the touchscreen of a Nintendo DS embedded in the chair) and the intonation and timing of the synthesised speech follows this in real time. This is based on intonation diagrams that phoneticians use to record speech tones [9], turned around to define rather than transcribe. We have been surprised by how intuitive this can prove even for people not trained in phonetics. An exercise in hand-ear coordination that yields ever greater levels of control and nuance with practice, it is akin to learning a musical instrument.

... and curating design collections

This manipulation of the voice builds on Pullin's "Speaking Mobile," in which the intonation of synthesised speech was controlled with a thumb joystick (itself inspired by Kempelen's Speaking Machine" [10]). This radical mobile phone allowed expressive telephone conversation to be silently and discreetly held in public places, without disturbing other people. It was one of five concepts in "Social Mobiles," a collaboration between IDEO and Crispin Jones led by Jones and Pullin [11]. This critical design project provoked discussion about the anger and frustration caused by other people's mobile phones [12].

"Social Mobiles" inspired the format of the "Six Speaking Chairs" as a design collection. A design collection, by which we mean a series of designs conceived to be considered collectively, can provoke more divergent discussion than more conventional design concepts. The allusion to museum collections is appropriate: The six chairs each represent a way of thinking about speech encountered on our interdisciplinary travels and brought back home. Our mental models, like the physical controls and the chairs themselves, are all found objects, reappropriated. Their physical form—the anonymous chairs, the plain gray

[6] Pullin, G. *Design Meets Disability.* Cambridge: The MIT Press, 2009.

[7] Campbell, Nick. "Getting to the Heart of the Matter: Speech as the Expression of Affect, Rather Than Just Text or Language." *Language Resources and Evaluation* 39, 1 (2005): 109–118.

[8] Goodwin, C. "A Competent Speaker Who Can't Speak: The Social Life of Aphasia." *Journal of Linguistic Anthropology* 14, 2 (2004): 151–170.

[9] Jones, D. *English Phonetics*. Cambridge (U.K.): W.H. Heffer, 1936.

[10] Kempelen, Wolfgang von. *Mechanismus der menschlichen Sprache nebst Beschreibung einer sprechenden Maschine*. Vienna: JB Degen, 1791.

[11] IDEO. "Social Mobiles." 2002. http://www.ideo.com/work/item/social-mobiles/

[12] Standage, T. "Think Before You Talk." *The Economist*, January 16, 2003.

boxes, and the familiar controls out of contex—is designed to reflect this, designed to look not designed as much as displayed. The project is as much an exercise in curation as creation [13].

Chair No. 5. The Reassuring/Undermining Chair offers more abstract control. The user hits a drum pad, and the way in which it is hit and the material with which it is hit determine the timbre and intonation of the utterance. Confident hitting will trigger "yes" and "no" responses in different tones of voice; lighter tapping will produce the type of paralinguistic sounds (for instance, "uh-huh" and "ye-yeah") that lubricate conversation, encouraging or undermining the other person while they are speaking without interrupting them, yet which are not even part of current TTS systems.

As with any musical instrument, practice would be required to explore this relationship between action and sound. We are interested in how accessible, rewarding, and expressive this might be for people with differing musical abilities. This approach has been informed and inspired by Cook's "Tactophonics", an exploration of intuitive interaction with computer music underpinned by the concepts of affordance and expressive performance through objects as varied and unexpected as tree branches and baseball bats [14].

... and materiality in interaction design

This has also led us to consider a role for physical materials as part of the user interface. How might the qualities of materials translate into voice quality? Waxy, woolly, glassy, porcelain, dark chocolate, even "rich fruitcake" might all bring to mind a particular voice quality. Here, as elsewhere in interaction design, material qualities offer underexplored opportunities for associations that are familiar and intuitive, yet abstract and open to interpretation.

Chair No. 6. Lastly, the Terse/Roaring Chair has 17 doorbells, each of which offers a different description of tone of voice, from coaxing to coyly, from whimpering to whispering. These descriptors are taken from stage directions by the playwright George Bernard Shaw [15].

In communication devices, a selection rather than a manipulation may be more appropriate after all, since speech impairment is so often associated with other physical impairments. But 17 choices are many more than existing AAC devices. The "Tango!" by Blink Twice [16], in many ways the state of the art, allows a child to speak, shout, whisper, and whine (note that none of these are emotions). This is wonderfully expressive for a young child, but for adults, tone of voice is richer still and more finely nuanced—and more personal.

... and 17 ways to say yes

Alongside the doorbells is a recess containing a white pencil with the simple instruction: "please customize," which hints that we intend people to choose their own 17 ways. We have asked AAC users and other experts which tones they would choose, were they to be limited to just (just!) 17.

Shaw's descriptions are more heterogeneous than any of the mental models we have borrowed from academic sources. The unified model of the academic is eschewed in favor of the pragmatism of the practitioner, whose goal after all is practical, rather than theoretical. This of course is also the motivation of our future users, and we are not surprised to see this degree of heterogeneity in their responses, too. They showed a level of diversity—both between people and within individuals' 17 choices—that starts to show that any single mental model may never be sufficient.

Following the Chairs

We believe the challenge ahead, on the project that is already following this [17], is to embrace this complexity of coexisting models while maintaining simplicity of interaction. It does sound very challenging—but at the same time, it is an appropriate contribution for interaction designers to make to this fascinating interdisciplinary area.

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[13] Pullin, G. "Curating and Creating Design Collections, from Social Mobiles to the Museum of Lost Interactions and Six Speaking Chairs." *Design and Culture* 2, 1 (2010).

[14] Cook, A. "Your Favourite Thing Would Like to Sing." Presented at *NIME*, New York (2008).

[15] These descriptors are taken from a George Bernard Shaw's stage directions. Shaw, G. B. *Pygmalion*. London: Penguin Classics, 2003.

[16] DynaVox. Tango! 2009. http://www.dynavoxtech.com/products/tango/

[17] Speaking Unit. "Speech Hedge." July 2010. http://speakingunit.co.uk/speech-hedge/

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Looking at Accessibility as a Design Problem

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Nearly everyone on the planet will be at least temporarily, minimally disabled at some point in their lives. It may be a broken bone or a major illness. And if you live long enough, you will experience age-related impairments such as limitations of sight, hearing, dexterity, and mobility. Those who are born with severe medical conditions, however, have to accept their disabilities and live with them every day. In *Design Meets Disability*, Graham Pullin looks at design for disability through the principles that drive design in the able world. By doing so, Pullin helped me realize that most of us who work on accessibility have been thinking about this all wrong.

So much of design for disability has been about basic engineering and problem solving, making it possible to overcome certain limitations. For example, the creation of accessible voting systems was a watershed moment for people with varied disabilities. Since about 2004 disabled persons who are able to access a polling place can independently cast their vote. This is no small thing. I've witnessed people with disabilities shed tears of joy and relief as they recount their experiences of voting independently for the first time. However, voting is still extremely difficult if you have disabilities. Most existing voting systems were retrofitted rather than designed for accessibility. There's nothing elegant about them. They're slow. They're awkward. They're different from the voting systems that non-disabled voters use.

If you don't have a disability, it is easy to look at designing for limitations as accommodating exceptions. But for people who have impairments, limitations, or disabilities, working around them or through them is a way of life.

Pullin, a medical engineer by training, works on projects to embed assistance in everyday objects, such as a "speaking chair" to help people who can't verbally communicate. In *Design Meets*

Design Meets Disability
Graham Pullin
MIT Press, 2009
$29.95

Disability, he gives us an inspiring book about disability that talks to the art school-trained designer. The book has two parts. In the first, he contemplates what it would be like if designers rather than engineers designed hearing aids, limb prostheses, and wheelchairs. Or rather, what it would be like if an interdisciplinary team of designers and engineers developed designs for disabilities that took into account context and experience.

To frame the discussion, Pullin looks at the tension between sets of design principles. From the opening pages, the tension between discretion and fashion is introduced as a short and welcome history lesson on the design and engineering of medical devices. The classic approach has been to try to make the disability invisible, a thing that has never been done particularly well. The materials aren't right, the assumptions aren't right, and the technology isn't good enough. But what if design could be used to destigmatize disability, as in the case of eyeglasses?

Pullin also contemplates the tension between universal design and simplicity. Making a device that will work for nearly everyone often means adding complexity by layering on affordances for differently abled people. Not only is there a visual layer, but also a tactile layer and an auditory layer, which is a direct conflict with the principle of simplicity in design: taking things away until only what is needed is present. Pullin closes this topic by giving examples of designs that did strip away nearly every feature that might be considered helpful to universal design, but in doing so actually delivered the best possible experience for the widest audience.

In his discussion of ability and identity, Pullin presents the World Health Organization's definitions of disability, which are broad and assertive. WHO states every person will experience disability at some point, recognizing, as Pullin says, "disability as a complex interaction between the features of a person's body and the features of the environment and society in which the person lives." Adding context to the picture of disability stretches the design possibilities and removes limitations, disabilities, and handicaps from the medical realm and inserts them into the everyday lives of us all. The discussion no longer centers on a binary classification of disabled versus able.

As a researcher and evaluator more so than a designer, I identified most strongly with the tension between testing (or clinical trials) and feeling. In a discussion about prototyping beyond the object to get at fitness of use, Pullin discusses experience prototyping—engagement, experience, and emotion—as it relates to the first prototypes of digital cameras. It was curious to me that those designers seemed to think of a prototype as something to show rather than something to interact with.

In the world of user interface design, we've been working with interactive prototypes for a long time. However, Pullin implies designers might not see the importance of testing, especially in very formative stages of design. I found it fascinating that his audience might not have thought about getting people to try designs, and I'm pleased to see the idea of testing design for disability included in this book. Pullin does the idea justice in his description of testing prototypes using the "Wizard of Oz" method—an evaluation technique commonly used in technology user interface design.

One of the most helpful accounts in the book highlights design testing for people who have dementia. Researchers found that testing early, rough prototypes was disorienting and disturbing to people with dementia. Instead Pullin recommends first doing this testing with the people who care for those with dementia. Only after the prototype can look, feel, and behave realistically, then is it the time to do necessary testing with people with dementia.

Pullin goes on to briefly explain the differences between formative and summative testing, concluding that testing in the home over time is the best way to learn of a design's flaws and successes. Intriguingly, he rarely uses the word "usability," except to describe an attribute of a design. I liked that.

In the second half of the book, he imagines what would happen if high-profile designers took on specific design challenges in designing for disabilities. Though he has spoken with many of the designers he writes about, this section of the book is more of a museum. If Pullin could curate a show of all the great designers and their works, this would be the catalog for the show. It is compelling, but to me, ultimately dissatisfying because the imagined designs are never made, only contemplated, talked about, or storyboarded. (I found the few storyboards included to be some of the most engaging artifacts in the book—potential examples for design students to examine and perhaps emulate.)

What is instructional and useful, though disconnected from the first part of the book, is how Pullin gives us glimpses of how different designers approach design. We get a peek at where they start, how they think, and what their processes are. Though the process may not be open to introspection by an individual designer, looking across the chapters, we can see a wide range of philosophies and approaches in use.

Overall this is a beautiful and thoughtful book full of ideas and aspirations that lives in a world between textbook and coffee-table book. The purpose of this book is to help designers remember, as Pullin says:

"In the context of an environment or society that takes little or no account of impairment, people's activities can be limited and their social participation restricted. People are therefore disabled by the society they live in, not directly by their impairment."

It's a call to action against an old way of thinking, in which design for disability is solving a medical engineering problem rather than meeting a cultural, societal challenge. As Jared Spool has said, "Too often, we choose a design because it's doable, not because it's the best we could do." I'd love to see what Pullin could do with voting systems.

ABOUT THE AUTHOR Dana Chisnell has helped hundreds of people learn how to make better design decisions by giving them the skills they need to gain knowledge about users—especially voters and older adults. She is an independent researcher and consultant who founded UsabilityWorks. Chisnell has observed hundreds of study participants for dozens of clients to learn about design issues in software, hardware, websites, online services, games, and ballots. She has helped companies like Yahoo!, Intuit, AARP, Wells Fargo, E*TRADE, Sun Microsystems, and RLG (now OCLC) perform usability tests and other user research to inform and improve the designs of their products and services. Chisnell is a fellow of the Society for Technical Communication and a longtime member of the Usability Professional's Association and ACM's SIGCHI, IEEE, and AIGA. She's the co-author, with Jeff Rubin, of *Handbook of Usability Testing*, second edition (Wiley, 2008).

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Gestural Interfaces: A Step Backward In Usability

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One step forward, two steps back.

Once again, the usability crisis is upon us. We suspect most of you thought it was over. After all, HCI certainly understands how to make things usable, so the emphasis has shifted to more engaging topics, such as new applications, new technological developments, and the challenges of social networks and ubiquitous connection and communication. Well, you were wrong.

In a recent column for *interactions*, Norman pointed out that in the rush to develop gestural (or "natural") interfaces, well-tested and understood standards of interaction design were being overthrown, ignored, and violated [1]. Yes, new technologies require new methods, but the refusal to follow well-established principles leads to usability disaster.

Recently, Raluca Budui and Hoa Loranger from the Nielsen Norman Group performed usability tests on Apple's iPad, reaching much the same conclusion. The new applications for gestural control in smart cell phones (notably the iPhone and Android devices) and the coming arrival of larger screen devices built upon gestural operating systems (starting with Apple's iPad) promise even more opportunities for well-intended developers to screw things up. Nielsen put it this way: "The first crop of iPad apps revived memories of Web designs from 1993, when Mosaic first introduced the image map that made it possible for any part of any picture to become a UI element. As a result, graphic designers went wild: Anything they could draw could be a UI, whether it made sense or not. It's the same with iPad apps: Anything you can show and touch can be a UI on this device. There are no standards and no expectations." [2]

Why are we having trouble? Several reasons:

- The lack of established guidelines for gestural control
- The misguided insistence by companies (e.g., Apple and Google) to ignore established conventions and establish ill-conceived new ones.
- The developer community's apparent ignorance of the long history and many findings of HCI research, which results in their feeling empowered to unleash untested and unproven creative efforts upon the unwitting public.

In response to Nielsen's article about the iPad usability studies, some critics claimed it is reasonable to experiment with radically new interaction techniques when given a new platform. We agree. But the place for such experimentation is in the lab. After all, most new ideas fail, and the more radically they depart from previous best practices, the more likely they are to fail. Sometimes a radical idea turns out to be a brilliant radical breakthrough. Those designs should indeed ship, but it's important to realize radical breakthroughs are extremely rare in any discipline. Most progress is made through small and sustained incremental steps. Bold explorations should remain inside the company and university research laboratories and not be inflicted on any customers until those recruited to participate in user research have validated the approach.

There are several fundamental principles of interaction design that are completely independent of technology:

- Visibility (also called perceived affordances or signifiers)
- Feedback
- Consistency (also known as standards)
- Non-destructive operations (hence the importance of undo)
- Discoverability: All operations can be discovered by systematic exploration of menus.
- Scalability: The operation should work on all screen sizes, small and large.

[1] Norman, D. A. "Natural User Interfaces Are Not Natural." *interactions* 17, 3, (2010); http://interactions.acm.org/content/?p=1355/

[2] Nielsen, J. "iPad Usability: First Findings from User Testing." Jakob Nielsen's Alertbox, 26 April 2010. http://www.useit.com/alertbox/ipad.html/

• Reliability: Operations should work. Period. And events should not happen randomly.

All of these principles are rapidly disappearing from designers' tool kits, aided, we must emphasize, by the weird design guidelines issued by Apple, Google, and Microsoft.

What are we talking about? Let us explain.

Visibility

Nonexistent signifiers. To delete an unread message in Mail on the iPhone, swipe right across the unopened mail and a dialog appears, allowing you to delete the item. Open the email and the same operation has no result. In the Calendar, the operation does not work. How is anyone to know, first, that this magical gesture exists, and second, in which settings it operates?

With the Android, pressing and holding on an unopened email brings up a menu that allows, among other items, deletion. Open the email and the same operation has no result. In the Google calendar, the same operation has no result. How is anyone to know, first, that this magical gesture exists, and second, in which settings it operates?

Whenever we discuss these examples with others, we invariably get two reactions. One is "Gee, I didn't know that." The other is, "Did you know that if you do this [followed by some exotic swipe, multifingered tap, or prolonged touch] that [the following] happens?" Usually it is then our turn to look surprised and say, "No, we didn't know that." This is no way to have people learn how to use a system.

Misleading signifiers. For Android phones, there are four permanent controls at the bottom of the screen: back, menu, home, and search. They are always visible, suggesting they are always operative. True for three out of the four—not for the menu button. This visible menu button implies there is a menu available, but no, many applications (and places within applications) don't have menus, and even those that do don't always have them everywhere. There is no way to tell without pushing the button and discovering that nothing happens. (Actually, it means multiple pushes because the lack of a response the first time may reflect the unreliability of the technology.)

Worse, when on the home screen, pushing the menu will occasionally bring up the on-screen keyboard. Usually a second push of the same key undoes the action done by the first, but sometimes, the second push brings up a menu that floats above the material being displayed (The keyboard does not always appear. Despite much experimentation, we are unable to come up with the rules that govern when this will or will not occur.)

Feedback

Both Apple and Google recommend multiple ways to return to a previous screen. Unfortunately, for any given implementation, the method seems to depend upon the designer's whim. Sometimes one can swipe the screen to the right or downward. Generally, one uses the back button. On the iPhone, if you are lucky, there is a labeled button. (If not, try swiping in all directions and pushing everything visible on the screen.) With the Android, the permanently visible back button provides one method, but sometimes the task is accomplished by sliding the screen to the right. The back button has a major flaw, however. Push the back button to go to the previous page, then again, and then again: Oops, suddenly you are out of the application, never having been warned that the next button-push exits instead of simply going back. (The same flaw exists on the Blackberry.) The back button moves the user through the "activity stack," which always includes the originating activity: home.

This programming decision should not be allowed to affect the user experience: Falling off the cliff of the application to the home screen is not good usability practice. (Note too that the stack on the Android does not include all the elements the user model would include: It explicitly leaves out views, windows, menus, and dialogs.) Yes, provide a back button—or perhaps call it a dismiss button—but make it follow the user's model of "going back," not the programmer's model that is incorporated into the activity stack of the operating system. Among other things, it should have a hard stop at the top level of the application. The forced exit from the application is wrong.

Consistency and Standards

Whatever happened to the distinction between radio buttons and checkboxes? Radio buttons meant selection of only one out of all the possibilities: Selecting one precluded the selection of others. Check boxes, however, allow one to select multiple alternatives. Now, with these new systems, check boxes can work any

When users think they did one thing but actually did something else, they lose their sense of controlling the system because they don't understand the connection between actions and results.

way the developer chooses, often to the distress of the poor person trying to use the system.

Some applications allow pinching to change image scale; others use plus and minus boxes. Some allow you to flip screens up, some down, some to the right, some to the left, and some not at all. Touching an image can enlarge it, hyperlink from it, flip it over, unlock it so it can be moved, or whatever the developer and his whim decided.

The different operating-system developers have provided detailed interface guidelines for their products. Unfortunately, the guidelines differ from one another, in part because different companies wish to protect their intellectual property by not allowing other companies to follow their methods. But whatever the reason, proprietary standards make life more difficult for everyone. For sure, they undermine the main way in which users learn from each other.

Discoverability

The true advantage of the Graphical User Interface (GUI) was that commands no longer had to be memorized. Instead, every possible action in the interface could be discovered through systematic exploration of the menus. Discoverability is another important principle that has now disappeared. Apple specifically recommends against the use of menus. The Android UI team takes the opposite position, even providing a dedicated menu key, but does not require that it always be active. Moreover, swipes and gestures cannot readily be incorporated in menus: So far, nobody has figured out how to inform the person using the app what the alternatives are.

Scalability

Home computers, whether laptop or desktop, always came with a wide variety of screen sizes. Now that computer operating systems are starting to support multitouch technology, this means gestures must work on large screens as well as small. There is a plethora of screen sizes for cell phones, including the emergence of an in-between form; we now have midsize screens. Eventually, screens will range from tiny to huge, conceivably wall-size (or at least, whiteboard-size). However, gestures that work well for small screens fail for large ones, and vice versa. Small little checkboxes and other targets that work well with mouse and stylus are inappropriate for fingers. Larger screens have their own problems with control sizes. Are the new controls to be used while held in the hand, laid flat upon a surface, or tilted at an angle? All varieties now exist.

Sensitive screens give many opportunities for accidental selection and the triggering of actions. This happens on small screens because the target items might be small and close together. This happens on large screens because the same hands necessary to hold and stabilize the device can accidentally touch the screen.

Reliability

Accidental activation is common in gestural interfaces, as users happen to touch something they didn't mean to touch. Conversely, users frequently intend to touch a control or issue a gestural command, but nothing happens because their touch or gesture was a little bit off. Traditional GUIs do have similar problems: for example, when the mouse is clicked one pixel outside the icon a user intended to activate. But at least the mouse pointer is visible on the screen so that the user can see it's slightly off.

Since gestures are invisible, users often don't know that they made such mistakes. Also, a basic foundation of usability is that errors are not the user's fault; they are the system's (or designer's) fault for making it too easy to commit the error. When users think they did one thing but actually did something else, they lose their sense of controlling the system because they don't understand the connection between actions and results. The user experience feels random and definitely not empowering.

Some reliability issues can be alleviated by following usability guidelines such as using larger objects and surrounding

them with generous click zones. Others are inherent in any new technology that will have its bugs—that much more reason to enhance user empowerment by designing according to the other interaction principles we have listed in this article.

Lack of undo. Undo! One of the most brilliant inventions of usable computer interfaces seems mostly to have been forgotten. It is very difficult to recover from accidental selections or checking of boxes. First, the result often takes you to a new location. Second, it may not even be obvious what action got you there. For example, if a finger accidentally scrapes an active region, triggering an action, there is almost no way to know why the resulting action took place because the trigger was unintentional.

Novel Interaction Methods

Gestural systems do require novel interaction methods. Indeed, this is one of their virtues. We can tilt and shake, rotate and touch, poke and probe. The results can be extremely effective while also conveying a sense of fun and pleasure. But these interaction styles are still in their infancy, so it is only natural to expect that a great deal of exploration and study still needs to be done.

Shaking has become a standard way of requesting another choice, a choice that seems to have been discovered accidentally, but that also feels natural. Note, however, that although it is easy and fun to shake a small cell phone, shaking a large pad is neither easy nor much fun. Scrolling through long lists can now be done by rapid swiping of the fingers, providing some visual excitement, but we still need to work out the display dynamics, allowing the items to gather speed, to keep going through a form of "momentum," yet to make it possible to see where one is in the list while it whizzes past, and to enable rapid stopping once the desired location seems near.

Although pinching and spreading seem like natural ways of zooming an object out and in, when the dynamics are badly set, the movements are difficult to control. Different applications today use different rules, which end up confusing people. Moreover, even if they could, not all places allow this: another source of confusion.

Rotation and tilting the device are also often used to change the display, although for some applications, such as reading, it has been found necessary to provide a lock to prevent the otherwise natural rotation of the displayed image that would prevent easy reading.

The Promise of Gestural Interfaces

The new interfaces can be a pleasure to use and a pleasure to see. They also offer the possibility of scaling back the sometimes heavy-handed visual language of traditional GUIs that were designed back when nobody had seen a scrollbar. In the early 1980s, usability demanded GUI elements that fairly screamed "click me."

Desktop GUIs are already less neon than Windows 3.0, and we can afford to dial back the visual prominence a bit more on tablets, which will further enhance their aesthetics. But dialed back doesn't mean invisible.

The new displays promise to revolutionize media: News and opinion pieces can be dynamic, with short video instead of still photographs and adjustable figures that can be manipulated instead of static diagrams. *Consumer Reports* could publish its rating tables with reader-controlled weights, so each viewer would have a tailored set of recommendations based upon standardized test results.

The new devices are also fun to use: Gestures add a welcome feeling of activity to the otherwise joyless ones of pointing and clicking.

But the lack of consistency and inability to discover operations, coupled with the ease of accidentally triggering actions from which there is no recovery, threatens the viability of these systems.

We urgently need to return to our basics, developing usability guidelines for these systems that are based upon solid principles of interaction design, not on the whims of the company-interface guidelines and arbitrary ideas of developers.

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Not Your Average Farmer: Designing for Lead Users in ICT4D Research

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Information and Communication Technologies for Development (ICT4D) research has a history of making mistakes that, in hindsight, seem obvious. For example, many working in the field have a favorite story of a project gone wrong because of techno-centrism. Mine is the LINCOS telecenter project, intended to provide computing and internet access to a Costa Rican village via a high-tech shipping container, which was described as "an alien spaceship dropping from the sky" [1]. It closed after two years—the community began using a new cyber cafe, and the container was vandalized.

This and other early ICT4D projects conflated the goal of diffusing technology with meeting the real needs of a community. Richard Heeks called this "ICT4D 1.0" [2]. Fortunately, we are now moving into Heeks's ICT4D 2.0: Most of the ICT4D papers at CHI 2010 deeply integrated needs-finding and community involvement into the design and development of the technology intervention.

But with this step forward come new pitfalls of which ICT4D researchers should be mindful. Before designers may have made the mistake of designing without a deep understanding of the community and its needs; now that real needs are being addressed, a potential trap is thinking the identified needs are shared by *everyone*. There are a few signs this is starting to happen. First, when describing whose needs are being addressed, ICT4D research (mine included) rarely gets more specific than "farmers," "community health workers," "slum dwellers," or even "low-literacy users."

Second, as others have noted, ICT4D research is often premature in presuming a local solution is generalizable and can, or should be, scaled up [3]. This is partly driven by technologists' bias toward a large-scale perspective, but it's also driven by external expectations. Caught up in a drive to develop scalable solutions, designers tend to be imprecise about who specific solutions will work for. It is probable that novel technology interventions in particular will see significant uptake with only a subsegment of the larger potential user community. My view is that rather than feeling disappointed about this, we should embrace it!

In the 1980s, Eric Von Hippel introduced the term "lead users" to identify those users who face needs that everyone else will face sometime in the future, and who stand to benefit greatly from solutions to those needs [4]. Through my own work, I have found that designing explicitly for lead users is an effective approach for an ICT4D intervention.

My collaborators and I have designed and developed Avaaj Otalo (literally "voice stoop"), a service for farmers in Gujarat, India, to access and share agricultural information using mobile phones [5]. Farmers dial a phone number and listen to automated prompts to navigate a voice message board, where they can post questions, listen to the questions and answers of other farmers, and post answers to the questions themselves. Avaaj Otalo was designed and launched in collaboration with Development Support Center (DSC), an NGO in Gujarat, and IBM Research India.

In the design and development phase, we incorporated input from DSC and farmers. One of those farmers, Babubhai Thakur, was particularly remarkable. Babubhai belongs to a nomadic community that lives in a remote part of Gujarat. When I met him, he was 17, having left school in the eighth grade to work full time as a farmer.

[1] Brand, P. and Schwittay, A. "The Missing Piece: Human-Driven Design and Research in ICT and Development." In Proceedings of the *IEEE Conference on Information and Communication Technologies and Development* (2006): 2–10.

[2] Heeks, R. "ICT4D 2.0: The Next Phase of Applying ICT for International Development." *Computer* 41, 6 (2008): 26–33.

[3] Burrell, J. and Toyama, K. "What Constitutes Good ICTD Research?" *Information Technologies and International Development* 5, 3 (2009): 82–94.

[4] Von Hippel, E. "Lead Users: A Source of Novel Product Concepts." *Management Science* 32 (1986): 791–805.

[5] Patel, N., Chittamuru, D., Jain, A., Dave, P., and Parikh, T. S. "Avaaj Otalo: A Field Study of an Interactive Voice Forum for Small Farmers in Rural India." In *Proceedings of ACM Conference on Human Factors in Computing Systems* (2010): 733–742.

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But despite his youth, Babubhai was recognized as an expert farmer in his community. Even the eldest farmers with decades of experience would come to him to consult about agricultural issues. He was a voracious learner and had an experimental nature, always looking to try out new techniques to improve his productivity. He was also a renowned inventor; on our field visit he showed off his latest, a wooden contraption on which he hung a lightbulb and natural materials that attract and then trap a pest that was common in the area. Babubhai told us that he wished to share the device with all of the farmers of Gujarat, so they could reap its benefits.

It was thus no surprise that Avaaj Otalo immediately appealed to Babubhai; he became one of its biggest proponents during our design process. He was eager to get access to an on-demand information system where he could share his experiences with other farmers.

But I quickly learned that not all farmers saw it the same way. In fact, it was a member of my own family who taught me that lesson.

Running a research project in Gujarat, I have the unique benefit of working in a place where I have family—many of my uncles and cousins are farmers. Shortly after we had deployed Avaaj Otalo, I showed it to my uncle Kishore Patel, whose family has been farming cotton and sugarcane for generations. When I explained Avaaj Otalo to him and had him listen to some of the questions and answers that were on the message board, he tried to suppress his laughter. "This is not new information; I already get all the information I need from TV," he said. Some of his farmer friends mocked the system, saying that it was useless to them because they already know what to do—it's the same thing they did the season before and the season before that. What's the use of new information? To my uncle and his friends, farming was a business activity, not a craft. They bought the same seeds, fertilizer, and pesticides every year, applied them the same way, harvested and sold to the same buyers. They saw changing their farming practice as a headache, not as a need.

Through these and other encounters I got a sense for the spectrum of Gujarat farmers, in terms of motivations, willingness to change, and openness to new ideas. On one end, there is Babubhai, a lead user: a progressive early-adopter,

Photograph courtesy of CIMMYT

a thought-leader. Near the other extreme is Uncle Kishore: conservative, resistant to change, skeptical. In evolving Avaaj Otalo in terms of its capabilities and value proposition, I realized I should no longer think about what "farmers" need. I decided to design specifically for Babubhai.

There are at least two advantages in designing for lead users. The first has to do with motivation. I am not going to easily convince farmers like my uncle that they should use Avaaj Otalo, but Babubhai hardly needs any convincing at all—he is already motivated. While many farmers may need Avaaj Otalo, Babubhai also *wants it*. At CHI'10, Tom Smyth and his colleagues at MSR India highlighted the distinction between needs and desires in their study of mobile video sharing in Bangalore, India [6]. They pointed out that while many ICT4D projects are developing mobile services for health or education, users are highly motivated to be entertained. They routinely overcome a slew of obstacles (cost, time, legality, even the complexity of the computing device itself) to meet this desire. To attract use of a new service or practice, addressing a clear need isn't enough; users should have a genuine willingness.

Smyth and his colleagues also suggested ICT4D projects may be overlooking the importance of generating demand for a service while focusing on making that service more easily accessible for scalability purposes [6]. But catering the technology intervention to a lead user's wants and needs can drive both demand and scaling up. By focusing on delighting the Babubhais of the world, we shift the focus from diffusion at scale to serving a small but dedicated user community.

Ultimately I predict nurturing this community can indirectly meet the scale challenge. In Indian villages, where the social fabric is very dense, lead users like Babubhai hold a lot of sway as thought leaders. Diffusing Avaaj Otalo through the empowerment of lead users decentralizes the process, and the word-of-mouth approach may help the message stick more effectively than when the technology is pushed by outsiders. As a researcher, I come from another culture, have no social capital in the local community, and my personality is not necessarily the most persuasive. Thought leaders like Babubhai win on all of those counts.

I have seen the power of the persuasive farmer firsthand during my time in India. During the summer of 2007, I worked on a project with Jatan Trust, a pioneering NGO for the organic-farming movement in Gujarat. We worked on developing an innovative organic certification system in which we co-designed the standards for certification (the very definition of what it meant to farm organically in Gujarat) with local farmers. Through the project, I came into contact with many of Gujarat's most advanced organic farmers. A question I began routinely asking was, "How did you get started farming organically?" Almost invariably, I would get the same one-word answer: "Sarvadamanbhai." Sarvadaman Patel is an organic farmer in Gujarat, running a 40-acre marvel outside the city of Anand. Sarvadaman came from an upper-class family and received a Western education. He studied agronomy and settled back in Gujarat to experiment with farming practices he learned from reading the likes of Sir Albert Howard and Masanobu Fukuoka. Over the course of decades he mastered many aspects of organic agriculture, and other farmers took notice. Soon he was spending much of his time giving tours to farmers who would travel great distances to see his operation. Many of today's committed organic farmers in Gujarat got their start from an inspirational visit to Sarvadaman's farm.

After I first met Babubhai, I gushed to the staff of DSC about how impressed I was by him, how I thought he was a rare diamond in the rough. One of the staffers responded by saying, "He is impressive, but not rare. All over Gujarat, there are thousands of Babubhais." It is my belief that leveraging the Sarvadamans and Babubhais is the key to sustainable and impactful ICT4D interventions. Supporting lead users with the appropriate tools to amplify their natural intent, capabilities, and influence is what will drive diffusion and ultimately development—economically or otherwise.

[6] Smyth, T., Kumar, S., Medhi, I., and Toyama, K. "Where There's a Will There's a Way: Mobile Media Sharing in Urban India." In *Proceedings of ACM Conference on Human Factors in Computing Systems* (2010): 753–762.

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John Leslie King's interest in history was evident at the first CSCW conference in 1986. His review of 15 years of research with technology to support real-time collocated interaction, then called Group Decision Support Systems, revealed that we sometimes learn more slowly from experience than we could. In this article, he describes the little-known system that pioneered real-time human-computer interaction in the 1950s, created the computing profession, and trained hundreds of its earliest practitioners.—Jonathan Grudin

Project SAGE, a Half-Century On

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In 1959 a Project SAGE Sector Direction Center went live in Syracuse, NY. It was the first of more than two dozen such centers built in the U.S. and Canada. They were part of NORAD, the North American Air Defense Command, headquartered in the bowels of Cheyenne Mountain in the Colorado Rockies. Project SAGE cost more than the Manhattan Project (between $20 billion and $60 billion in today's dollars, depending on how one counts), yet few people have heard of it. It never saw a single instance of what it was built to detect—an attack by Cold War adversary the Soviet Union—but deterrence would have been its greatest victory. Yet it launched the modern computer age in the U.S. As its peculiar name suggests, SAGE (Semi-Automatic Ground Environment) was by design a human-computer system.

In 1945 the U.S. tested the first atomic bomb in New Mexico, dropped atomic bombs on Hiroshima and Nagasaki in Japan, and ended World War II in the Pacific. The Yalta Conference that year raised British and American fears about Soviet ambitions following the war; the Berlin crisis of 1948 confirmed those fears. In 1949 the Soviet Union tested its first atomic bomb and unveiled the TU-4, its first long-range bomber capable of carrying nuclear weapons. That same year, the Western allies created NATO to counter Soviet expansion: a Soviet attack on any NATO member would be an attack on all. The Cold War was on.

NATO leaders anticipated Soviet attacks on the ground from the east into Western Europe, by sea from the west into the Pacific, and by air from the north over Canada to the U.S. Project SAGE was a response to the third scenario. In 1947 Canada began erecting the Pine Tree Line, a set of radar stations just north of major Canadian population centers, connected by telephone to Canadian air-defense centers. The risk rose as jet aircraft flying low and fast could use the curvature of the Earth to mask an attack until it was too late for air defenses to respond. The answer? Move the radar stations closer to the enemy. The Mid-Canada Line, begun in 1952, moved detection several hundred miles north. The U.S. joined the Canadian effort in 1955, helping to build the Distant Early Warning (DEW) Line across Alaska and the Northwest Territories near the Arctic Ocean in 1958.

In 1948 two MIT researchers, Robert Valley and Jay Forrester, noted that air defense was actually an air-traffic-control problem, and that computers, such as the Whirlwind built at MIT under Forrester's direction, could help monitor airspace. The U.S. Air Force bought the idea in 1949, launching Project SAGE in 1950 with Jay Forrester as its director. Project SAGE offered the solution to a vexing problem facing the systems being built in Canada: to determine whether the enemy was attacking with a surgical strike or in force across a wide frontier. By linking radar to computers via human operators, Project SAGE enabled rapid calculation of the situation and appropriate provisioning of air-defense response using interceptor aircraft and/or anti-aircraft missiles. The entire set of assets—radar stations, command centers, and air-defense positions—would be connected through a data-communication network and modern computers operating 24/7.

Project SAGE protected North American airspace by detecting incoming enemy aircraft from

▸ A late 1950s SAGE console with "light gun" used to select radar tracks for display on central "summary board" (not shown). The operator accesses information and directs action using sliders, switches, buttons, and dials. Courtesy IBM Archives.

the north, integrating that information with other incoming information and known conditions, calculating the appropriate air-defense response, and launching counter-measures. Nothing like this had ever been tried before. Cooperation between the Canadian and American governments had to be established within NATO parameters, and a mix of military, public, and private organizations had to be brought together to work as a collaborative whole. MIT's Lincoln Laboratories spun the Whirlwind computer off to the IBM Corporation as the IBM A/N FSQ7. The computer had 32-bit word length, four index registers, a real-time clock, magnetic (ferrite) core memory, and 60,000 vacuum tubes. It weighed half a million pounds and consumed three megawatts of power. Two A/N FSQ7s were built for each center, one of which would be in operation and the other of which would be in hot standby mode at any given time. MIT also spun off a new nonprofit organization called the MITRE Corporation to do systems integration. Other partners included the strategic-defense think tank RAND Corporation, which, with IBM, set up the Systems Development Corporation to do programming. AT&T Long Lines built the long-distance communications; AT&T Western Electric built the control centers; and Burroughs Corporation solved analog/digital conversion by building modems.

The cost of Project SAGE was enormous. In addition to the expense of R&D and the deployment of infrastructure, each Sector Direction Center operated four shifts per day of more than 100 people per shift. Additional thousands were employed in the command centers, the radar stations, the interceptor aircraft wings, and the missile batteries.

Was Project SAGE worth what it cost from a defense perspective? It is difficult to know. The ideal outcome was not air defense but deterrence: making the risk of defeat in an attack so high that the enemy would never attack. It is impossible to know what role Project SAGE played in the Cold War, but there never was an attack from the north. Project SAGE ran for two decades and never saw a bogie, much less a bandit. Moreover, the intercontinental ballistic missile (ICBM) introduced in the late 1950s made traditional air defense moot: ICBMs flew so fast there was little warning time before they struck, and they were almost impossible to shoot down. Project SAGE was kept in operation to protect against attack by manned bombers. It was surely targeted by Soviet ICBMs, but nuclear war was avoided and Project SAGE never faced the ultimate test.

Leaving aside the defense outcomes of Project SAGE, it is fair to say the enormous investment in the effort paid off in the creation of a unique U.S. computer and communications industry that has generated hundreds of billions of dollars in value over the past half-century. Two SAGE contributions were directly related to HCI: interactive CRT displays and light-pen I/O devices that foreshadowed the creation of the mouse. In addition, SAGE introduced a number of important technical innovations: ferrite core memory used in computers from 1953 until the mid-1970s; analog/digital and digital/analog conversion through the modem; multiprocessing; real-time database management; distributed processing; time-sharing; marginal checking for component failure (arguably the beginning of intelligent devices); memory cycle-stealing (LISP machines subsequently made this popular); buffered I/O; the COMPOOL (shared memory for subroutines that reappeared in COBOL); and large-scale system executives (the SAGE real-time executive had more than 500,000 lines of code). The

IBM System 360, the most successful mainframe computer in history, with more than $100 billion in sales, was a major beneficiary of SAGE. So too was the MIT TX2, the precursor to Digital Equipment Corporation's PDP-10, the first truly successful computer for artificial intelligence research.

Project SAGE led to broader development of the computing field and new applications of information technology. SAGE was the direct precursor to the Ballistic Missile Early Warning System, BMEWS. It also created modern air-traffic control; in fact, for many years ATC terminals looked exactly like SAGE terminals. Tracking for manned space vehicles was built on knowledge gained from SAGE. The Semi-Automatic Business Research Environment, or SABRE, came from SAGE and was used to create one of the first successful computerized airline-reservation systems. The System Development Corporation and IBM Corporation, working on Project SAGE, arguably invented the profession of computer programming. And the entire constellation of high-tech defense programs, including Project SAGE, proved to be an incubator of systems management and the concept of human organizations as systems that profoundly affected engineering and management education for decades.

Project SAGE touched thousands of people who shaped the future of U.S. information technology. One of these was Vinton Cerf, a co-creator of the Internet, whose first experience with computers was in 1958 at a Project SAGE facility at the System Development Corporation in Santa Monica. He was fascinated by the experience, took all the computer science courses he could find in college, and then began his career at IBM. Project SAGE proved beyond doubt that it is possible to build very large, integrated systems linking geographically remote (including offshore) sites with real-time computation to maintain 24/7 engagement with a highly complicated task. This proof was instrumental in many areas of large-scale socio-technical endeavor, not the least of which was the U.S. Space Program that successfully landed a human on the moon within a decade of President John F. Kennedy's famous challenge of May 1961. Project SAGE never received the fame of the space program. The program was kept quiet, and most citizens living near the Sector Direction Centers never knew what they were. Project SAGE was phased out in 1983, made obsolete by other technologies and strategic strategies. It disappeared without a whimper.

Many lessons can be drawn from Project SAGE, but three stand out. One is that enough smart people and enough resources can make remarkable things happen—the old adage that you cannot solve anything by throwing money at it simply is not true. It is difficult to tell whether the Cold War would have turned out any differently without Project SAGE, but the Computer Age of the U.S. would almost certainly have been different—and less spectacular—without Project SAGE. Another is that bold initiatives draw naysayers who, for reasons that seem perfectly sensible at the time, doubt that anything good will come from such initiatives. In the late 1950s, computers were for calculation. Who better to ask for an opinion than mathematicians? Distinguished mathematicians reviewing the proposal said Valley and Forrester were not sufficiently sophisticated in mathematics to create such a complicated system. Fortunately, risk-takers won the day, but only because confidence in peer review was relaxed in the face of pressing national need. Finally, the "multiplier" effect of Moore's Law had a profound effect on the consequences of Project SAGE. Gordon Moore described the law in 1965, well after SAGE was launched. Few could imagine in 1950 that a revolution in materials, design, and manufacturing would produce a multidecade era of increasingly powerful and inexpensive computers that were far more versatile and reliable than Whirlwind. Project SAGE advanced technical aspects of computer-building, but perhaps the greatest effect of the project was to show that large-scale, computer-assisted systems could be built and operated successfully as essential infrastructure. When SAGE went live in the early 1960s, this was unknown; when SAGE was finally shut down in the early 1980s, that knowledge was commonplace. Project SAGE constructed a new reality.

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Recommended Reading

Edwards, P. N. *The Closed World: Computers and the Politics of Discourse in Cold War America.* Cambridge: MIT Press, 1996.

Green, T. *Bright Boys.* Natick, Massachusetts: A K Peters Ltd., 2010.

Hughes, T. *Rescuing Prometheus: Four Monumental Projects that Changed the Modern World.* New York: Pantheon Books, 1998.

MITRE Corporation; http://www.mitre.org/about/sage.html/

Moore, G. E. "Cramming More Components onto Integrated Circuits." *Electronics*, April 19, 1965, 114–117.

Wikipedia; http://en.wikipedia.org/wiki/Semi_Automatic_Ground_Environment/

YouTube; "SAGE - Semi Automatic Ground Environment ; Parts 1 and 2" http://www.youtube.com/watch?v=vzf88oM9egk&feature=related/ http://www.youtube.com/watch?v=aGEv7hlptRY&feature=related/

Interacting with Policy in a Political World: Reflections from the Voices from the Rwanda Tribunal Project

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"What does policy have to do with me?" That was the essence of the question Jonathan Lazar put on the table in his inaugural article for *interactions*. We agree with him that the answer is "a lot." Our recent efforts to work with the United Nations International Criminal Tribunal for Rwanda, officials from the Rwandan government, Rwandan NGOs, institutional review boards, and our own diverse project team continue to be an intense lesson in how different levels of policy exert influence on the design of interactive information systems [1].

Earlier articles have discussed large-scale public policies that can influence design decisions on a national or even international level (e.g., Web-accessibility legislation and voting-machine standards). In this article we consider the difficulties that arise when these large-scale policies are in tension with smaller-scale policies (e.g., institutional, organizational, or even project-based). We suspect these tensions are becoming more prevalent as HCI researchers and designers undertake increasingly complex projects in domains such as sustainability, health, government, and justice. The interactive systems that result from these endeavors can cross numerous boundaries among legislation, regulations, principles, standards, and norms (i.e., written and unwritten policies). These boundaries are often amorphous, and, more often than not, more than one level of policy is at play in any given set of design decisions. For purposes of this discussion, we conceptualize the term "policy" quite broadly and find it to be closely linked with social values. Pragmatic in structure, policies help HCI researchers and designers to identify and choose among alternative courses of action according to a specified set of goals or values.

[1] For more information, please see http://www.tribunalvoices.org/.

[2] Access to Justice Technology Principles; http://atjweb.org/frontpage/

[3] European Commission Justice and Home Affairs–Data Protection; http://ec.europa.eu/justice_home/fsj/privacy/index_en.htm/

At Least Five Levels of Policy

First, a quick look at five levels of policy that HCI researchers and designers may encounter in their work:

Domestic (government) policy. Instituted by national, state/provincial, and perhaps city governing bodies, these are the principles, rules, regulations, and laws that typically come to mind when considering public policy. The Access to Justice Technology Principles developed in the state of Washington provide one useful example [2]. Written to guide court administration, these principles articulate how courts can use information technology to give all Washingtonians fair access to the state's justice system.

International policy. In some arenas, national governments have come together to create treaties, pacts, and even international laws that transcend national boundaries. For example, the data-protection principles and policies established by the European Commission govern the flow of personal information among the 27 EU member states and three EEA (European Economic Area) member countries (Norway, Liechtenstein, and Iceland) with third-party countries [3].

Organizational/institutional policy. Though not public policy per se, the organizations and insti-

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tutions with which HCI researchers and designers work to develop interactive systems may have their own policies that impact system design. Many organizations, for example, have explicit policies that provide guidelines for "appropriate" employee Internet and email usage.

Working-group norms and expectations. Again, though not public policy and perhaps not even explicitly stated, the specific groups of individuals who will be using the technology and perhaps even participating as co-designers may have tacit but strongly held norms and expectations relevant to a technology under development. These norms and expectations may function as if they were explicitly agreed upon policies; to the extent they do, they may need to be accounted for in the design process and eventual system deployment [4].

HCI researcher and designer principles, policies, norms, and expectations. Finally, HCI research and design teams have their own explicit or tacit commitments similar to the working-group norms and expectations that can function as if they were policies, guiding acceptable design practices and outcomes. For example, project team policies might guide the breadth and depth of user studies, the minimal extent to which co-design must occur, and explicitly supported values for a given project. Seen in this light, Bidwell and Winschiers-Theophilus advocate project team policies that encourage Western researchers and designers to engage in co-design with Africans within an African context [5].

Encountering Policy in the World

To help explicate the ways in which various levels of policy can interact within a single research and design project, we draw from one of our current projects. Our work with video interviews from the United Nations International Criminal Tribunal for Rwanda (UN-ICTR) begins where the official tribunal records end: the collection of 49 in-depth video interviews with a diverse group of tribunal personnel—prosecutors, defense counsel, judges, investigators, interpreters, court administrators, and others—on the experience of participating in the tribunal. We refer to this project as the "Voices from the Rwanda Tribunal" (or "Tribunal Voices") [6]. The original goals were to provide widespread public access to the interviews for access and reuse while protecting against revisionist histories.

Bounding Discourse: Rwandan National Law and Information Centre Principles

To enhance the "Tribunal Voices" material on a local area network, we explored the development of a commenting system. The goal of the online commenting system was to provide visitors to information centers (managed by United Nations employees, many from Rwanda) in Kigali and roughly a dozen Rwandan provinces with the opportunity to contribute their reflections and analyses about specific clips and the tribunal in general. The ability to weigh in might scaffold open discourse in a country reaching for democracy, in turn supporting UN policies of international human rights and development [7]. In the words of one of our African colleagues: "This website can help people to reconciliation.... You want people to talk. To get rid of the hatred inside them." Yet in early discussions about the specifics of the commenting system, strong concerns arose. The information-center employees worried that some comments might be perceived as violating Rwanda's 2008 Genocide Ideology Law (e.g., comments that deny the genocide). Violators of this law face harsh penalties (fines and/or incarceration), and the site would likely be blocked in Rwanda.

This concern for national policy led our colleagues to urge for a "moderated" forum in which all posts would be reviewed prior to posting. If the online forum on the local area network were moderated and anti-government messages removed, would this system be supporting open, democratic discourse? Together with our co-designers we decided to set up a moderated forum for the near term; we plan to revisit this choice as the political climate in Rwanda continues to evolve.

Interacting with Participants: Institutional Review Board and UN-ICTR Culture

Conducting research in a post-conflict situation poses unique challenges for protecting human subjects. In particular, prior to being in the field, it is difficult if not impossible to understand communication norms and the conditions that would be perceived as safe by potential participants. During our first attempt to recruit UN-ICTR personnel to participate in our project, our Institutional Review Board (IRB) required that we extend at most two invitations to each

[4] Orlikowski, W. J. "Using Technology and Constituting Structures: A Practice Lens for Studying Technology in Organizations." *Organization Science* 11, 4 (2000): 404–428.

[5] Bidwell, N. J., and Winschiers-Theophius, H. "Beyond the Benjamins: Toward an African Interaction Design." *interactions* 17, 1 (2010): 32–35.

[6] Friedman, B., Nathan, L. P., Grey, N. C., Lake, M., Nilsen, T., Utter, E., Utter, R. F., Ring, M., and Kahn. Z. "Multi-lifespan Information System Design in Post-conflict Societies: An Evolving Project in Rwanda." *Extended Abstracts of CHI 2010* (2010): 2833–2842.

[7] United Nations' Office of the High Commission for Human Rights; http://www.ohchr.org/EN/Pages/WelcomePage.aspx/

▸ François Bembatoum, chief interpreter

potential participant. We soon learned that this "at most two invites" policy contradicted tacit understandings within the UN-ICTR culture. As one participant explained: "If you really want me to participate, you need to tug on my arm, so I know that you are truly interested in what I have to say." The actions determined by the two-invites policy were perceived in the UN-ICTR culture as polite politic—interest that was likely feigned. We realized we were losing tribunal personnel who wanted to participate by following a policy created in the American context to protect participants working in an international culture. Upon returning to our home university, we discussed with the IRB the implications of overly prescriptive recruitment policies when working internationally. Swayed by our experience, the IRB has allowed more adaptable policies for our future work in Rwanda.

Underspecified Priorities: Project Team Principles

In contrast to the two situations here that concerned interactions with policies from outside the project team, our last example highlights a policy tension that arose from within. Alerted by prior work to the usefulness of articulating explicitly supported project values [8], early on the project team established a list of eight "Guiding Principles," one of which was the principle of access. While presumably in agreement, the team discovered in the thick of making design decisions that members had different understandings about what constitutes meaningful access and for whom.

In particular, the team debated whether to release the video interviews in the languages in which they had been conducted (primarily English) or to wait until translations and subtitles in the native language for Rwanda (Kinyarwanda) could be obtained, which could take up to two years. At stake was who would be able to access the video interviews and when—not only technically but also linguistically. Some team members strongly favored releasing the videos as soon as possible, without Kinyarwandan subtitles, prioritizing access to the international legal community for important, time-critical work. Other team members were just as much in favor of waiting to release videos until a Kinyarwandan translation was available, interpreting "supporting access" in a robust sense to include the broader Rwandan populace. We delayed making a decision until a follow-up trip to Rwanda enabled us to engage diverse Rwandan communities in the decision-making process. The response from the Rwandans we spoke with was surprisingly unified: It was better to post in English sooner rather than wait for translation into Kinyarwanda. At the same time, many underscored the importance of eventual translation to enable Rwandans in rural areas greater access to the material. Key to this discussion: While the project team had articulated guiding principles, the team had not adequately defined those principles or put in place a process for setting priorities when tensions inevitably would arise.

The Evolution of Society: The Evolution of Policy

In the midst of designing a particular system, it can be difficult to hold on to the reality that policy conditions will shift. As our experiences working on "Tribunal Voices" highlight, govern-

[8]. Borning, A., Friedman, B., Davis, J., and Lin, P. "Informing Public Deliberation: Value Sensitive Design of Indicators for a Large-scale Urban Simulation." *Proceedings of ECSCW 2005* (2005): 449–468.

▸ The ambitious "Voices from the Rwanda Tribunal" project includes a collection of 49 video interviews with tribunal personnel. The videos are viewable at http://www.tribunalvoices.org/videos.html. All are subtitled in Kinyarwanda.

▸ Hassan Jallow, prosecutor

ments will change, policies will be reworked, and a project team's ability to work with policies will evolve. Thus, a further challenge for HCI designers and researchers entails working with and building multi-lifespan information systems that can be responsive to and take advantage of those shifts when they do occur [9].

This article has explored policy tensions through a politically sensitive international case study. We expect interaction designers and researchers in other contexts to face analogous challenges as different levels of policy bump up against each other. In response to the policy tensions discussed above, we remain faithful to our original goals of widespread public access and reuse of the "Tribunal Voices" materials, albeit within the confines of existing public-security and domestic law. We welcome insight on how other researchers and designers have approached similar challenges.

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[9] Friedman, B., and Nathan, L. P. "Multi-lifespan Information System Design: A Research Initiative for the HCI community." *Proceedings of CHI 2010* (2010): 2243–2246.

▸ Mandiaye Niang, senior legal advisor

All Look Same? A Comparison of Experience Design and Service Design

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I've come to a disarming realization: Everything old is new again. Lady Gaga is the new Madonna, the Tea Party movement mimics the protests of the 1970s—except the left is now the right—and the interest in how to design for service seems much like the interest in how to design for experience that emerged in the mid-1990s.

The comparison of experience design (or UX, as it has been labeled) and service design seems to be a topic of interest in the interaction design community. Recently, Jeff Howard took to his service-design blog to argue that while service designers embrace participatory values, UX designers do not [1]. This opened up a huge can of worms, spurring arguments about the character and nature of service and UX designs among current leading practitioners in the field.

One question that comes to mind is whether it is even important to make a distinction between these two subdisciplines of interaction design, or if the difference is purely semantic. While I think it is good to have foundational definitions to help further the field, I also believe these starting points can quickly become points of departure. Asking these questions prompts the interaction design community to consider the similarities and differences between service design and experience design, and to reflect on whether service design and experience design, and for that matter, interaction design, are really all the same. Can we and should we articulate differences among these fields? Can the methods and knowledge of one successfully transfer to another?

Founding Definitions

A good place to start is with founding definitions of both service design and experience design. Service design has been defined as an overall transactional journey, constructed of smaller encounters between employees and customers, customers and technology, and technology and employees [2]. A service design is produced at the time it is consumed; it may have few to no tangible properties.

Experience design has been defined as the practice of designing products, services, events, and environments with a focus on the quality of the user experience and culturally relevant solutions, rather than a focus on increasing and improving functionality of the design [3].

In the 1980s, early practitioners were inspired by the field of operations research to define the field of service design and articulate how service designs might be represented, or blueprinted [4]. How to design to support user experience became of interest to the design community just a decade later. Interest grew on both sides of the Atlantic, resulting in user-centered, product-centered, and interaction-centered frameworks that drew from literature on art, aesthetics, and cognitive psychology to explain the phenomena of experience and to guide designers in how to design [for an overview, see 5].

All Look Same

At first inspection, experience design and service design have many similarities. Historically, both have drawn from other fields to develop sensitizing constructs for their fields. Service design traditionally drew from operations management research; interaction design continues to draw from consumer and cognitive psy-

[1] Howard, J. "Rock Stars Need Not Apply." Design for Service. http://designforservice.wordpress.com/2010/03/28/rock-stars-need-not-apply/

[2] Gutierriez, C. (2010). "Service Design: A Systematic Approach." Master's thesis in interaction design, Carnegie Mellon University.

[3] Wikipedia definition of service design; http://en.wikipedia.org/wiki/Experience_design/

[4] Bitner, M.J., Ostrom, A., and Morgan, F. "Service Blueprinting: A Practical Technique for Service Innovation." *California Management Review* 50,3 (2008): 66–94.

[5] Forlizzi, J. and Zimmerman, J. "Building a Unified Framework for the Practice of Experience Design." *Extended Abstracts of CHI09*, 4803–4806. New York: ACM Press, 2009.

chology to develop ideas about how customers frame and evaluate their interactions with a service and recover when they fail. Experience design has drawn from disciplines ranging from art to marketing to develop frames for how people experience products. In the past 30 years, both service design and experience design have advanced from the application of qualitative, user-centered design methods to understand the problems that we are designing for. Experience design led to new methods such as experience prototyping, or acting out the social and intangible aspects of product use [6]; service design has become fascinated with participatory methods, probably because services are co-created by businesses and consumers at the time of their consumption [1].

Designing both for experience and for the completion of a service is approached improvisationally and holistically. Instead of designing a concrete experience or service transaction, designers create resources or levers for establishing an experience or enacting a service, with the understanding that people's subjective perceptions, attitudes, actions, and beliefs will ultimately shape the outcomes. While a service blueprint—a process diagram for orchestrating all of the components of a service—is indigenous to service design, other interaction design methods such as user enactments, storytelling, mapping, and modeling are useful both in experience design and service design. Additionally, the interaction design community is evolving the service-design blueprint, to attempt to combine blueprinting with personas and use cases [7], customer-centered views of service design [8], improvisation in art, dance, and drama [9], the emotional state of a customer [10], and changes in services and customers as information about customer preferences is gathered over time [11].

But Then, Again

Upon deeper consideration, one can argue there are some substantial differences between experience design and service design. One of the biggest differences is that a service is transactional, helping a customer to achieve a goal. Experience, however, encompasses a much larger set of conditions: our everyday, moment-to-moment experience, understanding the world by comparing it with what we find familiar, and understanding changes in people and contexts of product use over longer periods of time—even a lifetime. Experience has been described as one person or a group of people using a product; service design is framed as a journey with touchpoints. Experience designers represent aspects of experience design through description, frameworks, and models, while service designers create a service blueprint as a process diagram to represent all of the aspects of a service design [4].

"Difference" as a Concept

Perhaps it is superfluous to reignite an old discussion in the interaction design community. Rather than waging turf wars to articulate the differences between experience design and service design, designers should instead spend time working on how to more

[6] Buchenau, M. and Fulton Suri, J. "Experience Prototyping." *Proceedings of DIS00*, 424–433. New York: ACM Press, 2000.

[7] Morelli, N. "Designing Product/Service Systems: A Methodological Exploration." *Design Issues* 18 (2002): 3–17.

[8] Pinhanez, C. "Service as Customer-intensive Systems." *Design Issues* 25,2 (2009): 3–13.

[9] Mager, B. and Evenson, S. "The Art of Service: Drawing on the Arts to Inform Service Design and Specification." In *Service Science: Research and Innovations in the Service Economy*, eds. Hefley, B. and Murphy, W. London: Springer, 2008.

[10] Spraragen, S. and Chan, C. (2008). "Service Blueprinting: When Customer Satisfaction Numbers Are Not Enough." International DMI Education Conference. Design Thinking: New Challenges for Designers, Managers and Organizations, available on CD-rom.

[11] Lee, M.K. and Forlizzi, J. "Designing Adaptive Robotic Services." *Proceedings of IASDR09*. New York, NY: ACM Press, 2009.

	SERVICE DESIGN	EXPERIENCE DESIGN
Influences	Consumer and cognitive psychology; some studies of organizations	Art, philosophy, rhetoric, marketing, participatory design
Methods	Qualitative, user-centered design methods; simulation and modeling, (inspired by operations management); storytelling, blueprinting, mapping, and modeling	Qualitative, user-centered design methods; storytelling; modeling
Approaches	Focused mainly on transactions	Understanding how people use products, and the experience that results
Key concepts	Serving, character of service, co-production, co-experience	Values, experience, an experience, co-experience

▸ Summary of key factors in a comparison of service design and experience design.

richly frame research and design for experience and service. What's interesting for the future of service design is the notion of serving, which is different from helping or fixing, in designing a holistic service [12]. Rather than developing a static blueprint, the design community can explore how to express the ways in which people experience services emotionally and socially, and how services might adapt as people use them over time [11]. Similarly, we can support what people value by looking at which symbols, elements, and constructs bring about the best services and experiences. Finally, we can uphold the goal of systemically and holistically designing services and experiences, understanding the relationships among component parts and the emergent qualities of the whole.

Yesterday's hot concepts may be today's classics, but as the field of interaction design continues to evolve, it is inevitable that service design and experience design will develop both individually and collectively as domains within design. It is our job to advance these fields in ethical, pragmatic, and purposeful ways.

[12] Remen, R.N. "In the Service of Life." Rachel Naomi Remen. http://www.rachelremen.com/service.html/

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Building a User Observatory: From Ethnographic Insights to Effective Recommendations

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It has been nine years since I last heard a statement like this: "Users' opinions don't matter. They don't know what they want, anyway. Let's just throw the technology on the market and check the reaction." The tone at Swisscom now is radically different, and our User Observatory method is considered a competitive tool. We have grown and evolved significantly during this time. This article will retrace part of the User Observatory journey and share some of the tricks we have learned along the way about how to set up and manage an observatory within a large corporation.

Sowing the Seeds—Get Attention

With a degree in business administration, I worked for 10 years in finance, eventually writing business plans in Swisscom's R&D department. The revenue curves always tended to look the same: They had to rocket upward. Our market analysis always fit nicely into value chains, and user needs were always aligned into tables. A user segment would get a full moon when their needs were fulfilled. If the segment couldn't be satisfied, they would just get a crescent. When three half-moons aligned, our analysis was on the mark. Although it was a stylish, organized, rational flow of argumentation on how to tackle a market, doubts started to emerge. At that time Swisscom did not conduct systematic user research, apart from conventional market research, some usability testing, and interviews. Field observations were almost non-existent. And personally, I didn't know much about them.

I began my "conversion" by interviewing users. Based on these positive experiences, and after reading some literature on the subject, I convinced three managers in my department to tackle this subject more professionally and systematically. We decided to hire an expert to give us the impetus needed to explore and benefit from this new field. In hindsight I now realize that my naivety and lack of knowledge were actually assets: I was able to be pragmatic, cut corners, and talk about user research with business words (my "native language") to managers.

The takeaway: Mix backgrounds in your team. People without a social science background can add considerable value to a user research group (e.g., business specialists or engineers), but only if they are truly interested in, ready to delve into, and eager to invest in learning about users and user research approaches.

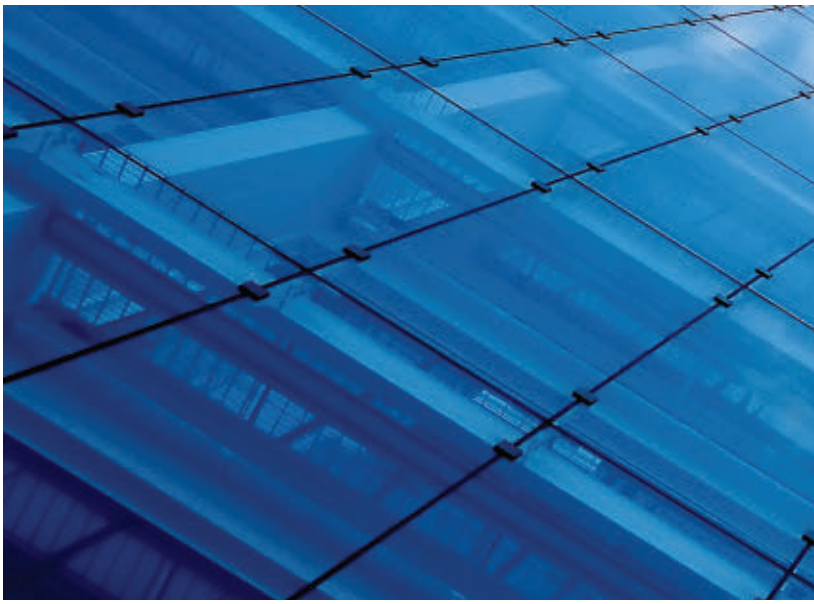
Setting the Scene—Surprise

Starting in 2004, we acquired as many user research projects as we possibly could and left the lab for the field to conduct interviews and observations, creating a "wow effect." Swisscom realized it was receiving reliable information that reflected real user behavior and explained our customers' actions. Moreover, the information was useful. In other words, we could translate the findings we made into concrete innovation suggestions with immediate impact on products and services. As the former head of strategy put it, "No more garbage! Let's get rid of these generalities about users that reassure our industry. Finally, relevant and actionable answers for our business. Good sense!"

As a direct consequence of these positive experiences, we managed to get approval from management to start a longitudinal study on the communication and entertainment habits of residential customers. This breakthrough became the beginning of what we now call the User Observatory. The scene was set. We had a top producer and many enthusias-

tic and dedicated actors. The rehearsals were over. The real performance could begin.

The takeaway: Hiring a top researcher with an established reputation can help establish a new field and achieve recognition faster. Don't be afraid of hiring people who are more experienced than you. The strategy of investing in a field, not just in personal careers, pays off: One automatically develops with the field.



Impact. Differentiate. Feed the Buzz

Expectations were high. We had to keep proving we were making a difference to the company. Our longitudinal study was unique and became the flagship of our research activities. It was a very ambitious project, as it was designed to understand the adoption processes of all telecom services (from communication to entertainment) by tracking real user behavior over a period of time within 60 households across Switzerland. The amount of data collected was massive, ranging from timelines, flat plans, and diaries of communication to social maps, interviews, and observations.

To create a buzz, we spent a lot of time advertising the results of our studies. It was also necessary to advertise results inside the company in order to influence decision-making processes. As both the User Observatory and our approach were still very new at the time, it was important to do several presentations in person and at different hierarchical levels. What helped us most was to publish an article in *The Economist* [1], write stories in various Swiss newspapers and specialized magazines [2], and conduct interviews on the radio.

By this time, our group had not only been able to develop a good reputation inside and outside the company, but had also created an increased awareness and acceptance of the ethnographic approach as a key method for understanding user needs.

The takeaway: External publicity creates internal recognition. When you publish or are present in the media, people inside your company not only become aware of your existence, they also realize your expertise is respected externally.

Managing the User Observatory—Maintaining Competitive Advantage

In today's increasingly challenging economic environment, especially in the telecommunications sector, the role of our User Observatory is more important than ever. But we cannot rest on the laurels of previous achievements and are therefore constantly adapting our goals and methods to heightened management demands such as "monetize," "industrialize," "create impact," "differentiate," "be a competitive advantage."

If we want to go on satisfying management, we must demonstrate we have a remarkable impact that no one else in the company can contribute. We must deliver unique user insights that enable the company to answer current strategic questions and support the launch of strategic products and initiatives. This implies not only do we need a unique, profound, and holistic understanding of user behavior today, but we should also provide a compelling vision for tomorrow.

In order to achieve this objective, we have four main challenges to confront:

- How to maintain a line of research over a timeline of several years, even though the budgetary focus and the objectives of our whole department (R&D) continue to evolve;

[1] Giussani, B. "Home Truths About Telecom." *The Economist* Technology Quarterly, June 7, 2007.

[2] Broadbent, S. and Bauwens, V. "Understanding Convergence." *interactions* 15, 1 (2008).

Photograph by Yago Veith

▸ The Swisscom high-rise tower in Zurich. With 3,500 employees in 35 locations, Swisscom is Switzerland's leading telecommunications provider.

• How to involve Swisscom staff outside our group to gain other insights (e.g., technical, design) so we can move beyond pure user research (e.g., creating new product ideas) and address specific questions within the product lifecycle;

• How to keep the link with the operational units and their management to stay tuned about what matters strategically to the company and, consequently, to identify where our research should be heading; and

• How to keep differentiating from other user research units within our company, given the growing pressure on costs.

How to Achieve These Objectives?

Here are 10 basic management rules of the User Observatory. Note it is not a static rule set, as we are always fine-tuning our approach and seeking inspiration from the experiences of others [3]. Input is welcome anytime.

1. Stick to your core belief in order to differentiate. Ethnography is our core belief and differentiator. Over the years, we have developed a methodology that enables us to bring unique insights to our management in a more efficient and systematic way.

The takeaway: The heart of any User Observatory should be field research: observe and interview people in their daily contexts. This creates realistic insights to which managers can immediately relate.

2. Find ways to create recurring discussion areas with management in order to focus on what is strategically relevant. We try to find lasting or recurring topics of discussion with the management of the operational units for example about results of our longitudinal study, or "products portfolio roadmaps." We are also experimenting with a new format of interaction: the position paper. This short report provides an opinion on a strategically relevant topic and is distributed all over the company.

The takeaway: A longitudinal study is a differentiator for a user research unit. It is a great way to remain continuously connected with the rest of the company. It reveals trends. It is, however, a large investment that needs to be managed carefully in order to keep stakeholders interested. Therefore, pamper and maintain your sample, but do not hesitate to stop tracking some behaviors for a while if you find developments are too slow. If this is the case, focus instead on the tracking of other new, exciting phenomena.

3. Involve others in your research, and share methods to increase the potential of your impact. We are increasingly trying to involve people outside the User Observatory in our research. This widens the breadth of our research insights, as these are no longer based on just the opinions of user researchers. It also allows non–user specialists to truly dive into and integrate user insights. We learn about market perspec-

[3] Jordan, B., Dalal, B. "Persuasive Encounters: Ethnography in the Corporation," *Field Methods* 18, 4, (2006): 1–24.

tives and about our company's products from them. Finally, it enables us to establish longer-lasting relationships outside the Observatory.

This is achievable by requiring each internal customer to commit some of his own workforce to participate in the field research. (We offer an introduction course to ethnography to allow that to happen.) We also discuss our findings more frequently with our internal customers. Instead of simply handing out a report at the end, we send the customer short observation extracts at regular intervals throughout the research project.

The takeaway: Share your user research methods with others. By empowering others to do field research, you convey the message that field research is normal, or even a must. You position yourself as the specialist to consult, while at the same time helping others to increase the quality of their decisions. Finally, it removes pressure from you in terms of work volume, as you delegate some fieldwork. However, there is a drawback: One loses some control over the quality of the field research.

4. Keep your outputs simple. At the end of a project, we sit on a mountain of ethnographic insights, excited about sharing them with the rest of the company. Yet internal customers are not interested in the details of our findings. They want only short reports that provide overviews, actionable answers, and tools. We have learned over time to really have two types of outputs from our research: a detailed report just for ourselves and more simplified deliveries for our internal customers. These deliveries contain brief, pointed messages and actionable measures, and use business language and artifacts like value chains, adoption curves, etc. They are always backed up by rich, vivid ethnographic insights.

The takeaway: To convince managers, dare cutting corners; don't look for perfect deep user insights, which don't interest managers anyway; and use business language and artifacts.

5. Spread insights inside the company to increase your visibility and influence opinions. We are constantly trying to find new ways to advertise our insights. While we are still spending a lot of time preparing nice PowerPoints and presenting our results in person, we are also developing other, more efficient methods to increase our visibility within the company, including one-pagers sent to a customer-insights distribution list. Our findings are also available on shared project drives and in a wiki. But people barely consult them. To change that, we are now experimenting with video podcasts and social-media websites with tools such as alerts and comments.

6. Spread insights outside the company to gain competitive advantage. As previously mentioned, publishing outside our company creates publicity. Not to mention that media presence doesn't help only the Observatory, but the company as a whole. It enables us to differentiate ourselves from other operators. Customers have reported to our top management, "Wow, we never expected that from Swisscom. They don't just sell us technology!"

7. Balance the project portfolio to provide immediate answers, but also anticipate demand. Creating the right balance in a project portfolio means finding equilibrium between extremes. Should we work on projects that tackle current issues or instead on projects more future-oriented or transformational? Should we work on product-related projects, on segments, or on more general topics (e.g., situation-related, like mobility)? Should these projects support our own research department or the operational units, and to what degree? Such balancing doesn't take place in a vacuum. After all, we have to get approval from management on every single project we start; we have to make sure the project is focusing on something nobody else does in the company and that it has enough strategic relevance to achieve meaningful impact now and in the future.

8. Consolidate knowledge across projects in order to build continuity. We have to be careful as a research unit not to spend all our time rushing from project to project. It is crucial to aggregate knowledge and link findings from various studies in order to identify trends.

This can be done in several ways. First, we use the same methods across projects, and there are certain sets of data we try to systematically collect. Second, some projects focus specifically on consolidating knowledge. For instance, our longitudinal study serves as the glue between all the various themes we have to master and provides us with an overview and a profound understanding of the whole ecosystem of communication and entertainment

behavior. Other more general and future-oriented projects (e.g., on the future of the workplace) also force us to gain an overview on a wide range of topics.

9. Aggregate knowledge within the team to ensure strong results. Our team is our capital. We have taken care to gather a mix of disciplines in social sciences (sociology, psychology, ethnography), and have been lucky enough over the past years to have little staff turnover. Team management has used various methods to foster knowledge building. People began to specialize by themes (e.g., television usage, instant messaging usage) and market segment (the residential observatory and the business observatory). We have also organized our project work in three levels: the field researcher, the project leader, and someone with the overview of all different projects. Finally, we strongly believe it is essential to conduct most of our field research ourselves, and not to outsource it. By delegating and outsourcing field research, we would have risked losing access to the depth of data, as well as the real feeling for the user.

10. Aggregate knowledge from outside the team to gain fresh insights. As mentioned earlier, it is crucial to learn from others within the company who have different views about users and customers (account managers, field agents, etc.). We are experimenting with a new internal exchange platform to meet such stakeholders (e.g., customer-insights lunch). We also believe it is fundamental to work with external partners. We have therefore signed a first partnership with a research unit in a local university [4] with expertise in anthropotechnology. This enables us both to have a foot in the academic and industrial worlds, while working on joint projects.

The takeaway: Developing external partnerships takes time. You need to identify the right partner, to know them and to identify recurring topics around which one can cooperate. It really pays off when joint activities are started so that knowledge can truly be exchanged.

Conclusion

Building a User Observatory has been a long journey. Ethnography has revolutionized our way of thinking about our customers. We now have the impression to have "the right cards in our hands to play a winning game."

If you have a vision for your department and/or your company, try to turn it into reality, even if you don't think you already have all the knowledge or financial means to achieve it on your own. You may think bigger than just improving a process here or repairing another there. Sow the seeds in the right heads, in the right places, and at the right time. Learn and grow with your vision, as it can become a reality you can only imagine today.

Acknowledgments

Closing this article can be done only by thanking everyone who has made this adventure possible. First of all, I would like to pay tribute to Kilian Kämpfen, my manager who provided me with continuous and unconditional support, when I had only faint ideas of what I wanted to build. I would also like to thank two "protecting hands," Daniel Ledermann, former research-program manager, who early on understood the importance of the user, and Walter Steinlin, former head of Swisscom R&D. A very special mention to Stefana Broadbent, my user research mentor. Finally, I want to pay tribute to our team, the Residential and Business User Observatories, starting with Petra Hutter, a.k.a. Mrs. LOTUS (LOngiTudinal Study head), head of the Residential User Observatory who is supported by Caroline Hirt, Veronica Pagnamenta, Géraldine Bröker, Cora Pauli, Silvia Büchi, and Ursula Ulrich; and continuing with all the members of the Business User Observatory: Daniel Boos, Myriam Fournier, Laure Kloetzer, Sandra Moscatelli-Steiner, Thomas Robinson, Susanne Schlegel, and Samuel Tikou.

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Valérie Bauwens is head of the Business User Observatory of Swisscom's Research and Development (R&D) department. The Swisscom User Observatory is a group of about 15 social scientists working in R&D at Swisscom, the leading telecom operator in Switzerland. Its main goal is to understand the adoption processes and usage of TIME (telecom, information technology, media, entertainment) in order to identify future user behavior and anticipate potential new services. The main approach is ethnographic, interviewing and observing users in their homes, on the move, and at their workplaces. For the past nine years, Bauwens has focused on building and establishing user research as a core center of competence within her department, which has led to the creation of what is known today as the Residential User Observatory. In 2008 she founded the Business User Observatory, leading and doing field research in large and small companies. She has 17 years of varied telecom experience, ranging from finance and business development to user research. Her original academic background is business administration, and she will be finishing a university degree in psychology later this year.

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Relying on Failures in Design Research

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Sitting next to the automatic door between train coaches in Switzerland provides a fantastic opportunity to observe the range of behaviors when people interact with a very basic instance of ubiquitous computing. Interestingly, most Swiss trains have sensors located in the upper part of the doorway. Experienced travelers know they have to wait for their presence to be detected, while nervous commuters wave their hand at the sensor to open the door. However, a longer period of observation reveals plenty of less-than-fluid usage: Elderly travelers try to find an (absent) handle; some people in a rush bang their head against the door because the sensor did not have time to detect them; angry knowledge workers (who know how the sensor works) wave their arm, but the door fails to open because of some momentary flaw with the sensor. Meanwhile, kids, luggage, or even the combination of both lead to even more complex situations.

Observing frustration with the automatic door is an example of how the investigation of accidents within a larger process can be inspiring from a design viewpoint. Surfacing people's problematic reactions when confronted with invisible pieces of technologies highlights their mental model and eventually has implications for design. In the case of an automatic door opening, these observations show that previous encounters with non-automatic doors shape our expectations of what a door is and how it should work. Noticing these problems can also lead to understanding how the sensor calibration should be tuned or that the presence of the sensors should be made apparent in a more visible way.

From Observing Failures to Provoking Them

I am interested in how users appropriate technology, especially product failures and prototype flops. As a user experience researcher, failures of all sorts intrigue me. User mistakes, errors, and accidents (as in the example above) are pertinent because of their design implications.

Curiously, as pointed out by various authors [1, 2], there is little field research about design flops and failures. This is surprising, given that design has a long-time interest in avoiding or fixing failures, as in Herbert Simon's famous quote: "Everyone designs who devises courses of action aimed at changing existing situations into preferred ones" [3]. To some extent, we can consider that preferring one solution over another is a matter of preventing accidents and mistakes.

Furthermore, the idea that design can be inspired and fueled by people's practices is now more common with the establishment of approaches such as user-centered design. We observe users and investigate their needs and interests or we try to understand consumers' motivations to do something and then turn them into insights and design concepts. But as we saw in the automatic-door example, failures and mistakes are important too because they are implicit signs of a need or problem that requires a solution. The examination of failures reveals what is commonly referred to in HCI as the "gulf of execution," i.e., the difference between the user's expected actions to achieve a goal and the actual required actions [4].

However, my quirky mind-set left me wondering about the role of failure in design research: If problems and mistakes are so interesting and insightful, why not be a bit more bold and enlist them as a design tactic? I am suggesting the conscious design of "questionable" prototypes to investigate user experience. Drawing on the "probe" metaphor [5], the approach here is to use "anti-probes"—a failed embodiment of technology that can be shown to people in order to engage them in open-ended ways.

[1] Latour, B. *Aramis, or the Love of Technology.* Cambridge: Harvard University Press, 1996.

[2] Gaver, W., Bowers, J., Kerridge, T., Boucher, A. and Jarvis, N. "Anatomy of a Failure: How We Knew When our Design Went Wrong, and What We Learned From It." In: *Proceedings of ACM CHI 2009* Conference on Human Factors in Computing Systems. 2213–2222.

[3] Simon, H.A. *The Sciences of the Artificial.* Cambridge: MIT Press, 1969.

[4] Norman, D. and Draper, S. eds. User Centered System Design: *New Perspectives on Human-computer Interaction.* Hillsdale, New Jersey: Lawrence Erlbaum Associates, 1986.

[5] Gaver, B., Dunne, T. and Pacenti, E. "Cultural Probes." *interactions* 6, 1 (1999): 21–29.

In doing so, what kind of insights can be derived from leading people in the wrong direction?

Wrong Positioning

The first example of this approach stems from research I conducted with my colleague Fabien Girardin when we worked at the Swiss Institute of Technology in Lausanne. We designed a location-based game called CatchBob! to run geolocation field studies. We were interested in the user experience of positioning technologies: how people react when they see their own location and how they react to awareness of their contacts' locations.

An interesting example of provoking failures in the context of location-based services is to locate people in wrong locations (close to the proper location, a bit farther away, much farther, etc.) and observe their reactions. Incorrectly positioning the user and locating a friend in the wrong place on the display enabled us to test different "acceptable" accuracies of positioning. This helps the researcher to understand the radius of the area in which people are comfortable being located (for self and for others). Evaluating users' reactions to wrong location is a proxy to understand the mental model: Should positioning be accurate? What is an acceptable uncertainty? Could this be an iterated process to define a "comfort zone" in the context of location-based services?

Wii Superpower

In another project I examined failures in console games. Games are especially interesting when exploring failures because difficulties and hurdles can be playful and intriguing from the players' standpoint. Unlike with business applications, designing a game is not necessarily a matter of making everything as easy as possible. Failure is indeed acceptable when framed as play simply because it is a prominent component of the game's mechanics. Therefore, we thought video games could be an interesting platform to explore failures in the context of interaction design.

In this project, we looked at the Nintendo Wiimote and the sensitivity calibration of its accelerometers. When preparing the software that used the Wiimote (and Nunchuk) sensors, programmers intentionally coded the effects of the gestures to be highly sensitive to motion. Small movements made by players had an extra-large influence on the character's movements in the virtual environment. At first, this was done to gain an understanding of how people would react to sensitivity so we could fine-tune it properly. But play tests revealed that players liked this utterly wrong calibration because it gave them a sort of superpower. We observed children gesturing and shouting dramatically: The on-screen reaction was more compelling than what they had experienced before. In this example, provoking failures was a way to disrupt the way game designers thought about players' interests.

So What?

Failures result from the incompatibilities between the way technical objects are designed and the way people actually perceive those objects, think, and act. Provoking and observing failures can be an insightful tactic in design research. However, this approach nevertheless calls into question the kind of failures that can or should be provoked. Choosing what problems can be tested on users is obviously conditioned by social, technical, and ethical constraints.

In doing so, user experience researchers can start a different kind of dialog with users that highlights inspirational data about how people would behave (and adjust their behavior or solve problems). Knowing how users react to problems can lead to insights about how to prevent these failures from happening, how to communicate malfunctions (i.e., error messages), or simply find solutions so users are not too bothered. In addition, the use of fieldwork in the context of misuse (or flawed use) can be a way to shed some light on original design possibilities and questions.

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Solving Complex Problems Through Design

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What is it about design that makes it so well suited to solving complex problems? Why is design thinking such a promising avenue for business and government tackling seemingly intractable problems?

Design is a broad arena of activity with a rich history, developed theory, and passionate practitioners. It encompasses a myriad of techniques, tools, philosophies, and craft. At least in part, design can be seen as an approach to solving problems and in that guise has several fundamental qualities—as a practice and as a mindset—that make it effective in the face of complicated issues. Better suited, in fact, than analytical approaches grounded in a scientific mode of observe, hypothesize, test, iterate. While analytical approaches are excellent at driving operational improvements in efficiency and effectiveness—reducing waste, optimizing processes, and the like—they are poorly suited to bridging the chasms that open up in the face of disruptive technological, social, and political change.

A complex problem is typically characterized by a system of causal relationships wherein the effect of a change in one part of the system may have long-term and difficult-to-predict consequences. Such problems are often "chaotic" in the sense that small changes can have large impacts, and large changes may have little or no impact at all.

Complex problems can also arrive suddenly: the collapse of a currency; the global financial crisis; soaring oil prices; a natural disaster requiring urgent, coordinated action. A complex problem often involves ambiguity and requires a model as an approximation to the problem space. Unknowns are common, and the boundaries of the problem space are often ill defined. While "wicked problems" [1] are inherently complex, not all complex problems would be considered wicked.

The design of a manufacturing supply chain can be considered a complex problem influencing, and being influenced by, product design on the one hand; logistics and the drive for efficiency on the other. Similarly, the design of a freshwater solution for developing nations and remote communities is also complex.

What, then, characterizes design as an effective method for identifying, defining, and potentially solving such problems? These are:

1. A deconstructionist perspective to the problem;
2. Abductive thinking and synthesis beyond the problem's definition;
3. Handling ambiguity through multiplicity and the suspension of judgment;
4. Critique; and
5. Empathy.

Deconstructionism

Design is most notably associated with abductive thinking and synthesis—the leap of insight that pulls together two seemingly disconnected ideas and demonstrates a powerful connection. But equally valuable is the ability to look at the components of a problem space—the physical, financial, social, or systemic constraints—in isolation and critically examine them.

This quality is at the heart of the designer's ability to set aside constraints, to think beyond the problem as it has been defined, and open up avenues for discovery and exploration that would otherwise remain closed. (Taking advantage of those avenues relies on the abductive thinking and synthesis skills we will discuss here.)

Deconstruction provides the framework for asking "what might be?" by isolating the components that make up what is. It is, in part, a process of asking whether something must necessarily be. It is the vehicle through which design challenges assumptions and tacit

[1] http://en.wikipedia.org/wiki/Wicked_problem/; See also Buchanan, R. http://research.informatics.buffalo.edu/Faculty/Scott/INF420/downloads/Readings/2-What%20is%20HCI/Wicked%20Problems_excerpt.pdf/

[2] Kolko, J. *Method of Design Synthesis.* Oxford University Press, in press. http://www.methodsofsynthesis.com/

beliefs. And, in so doing, it lays the foundation for truly insightful synthesis to take place.

This form of thinking allows us to challenge the sacred cows of an industry. Should shareholder value trump worker rights in business? What would happen if all foreign debts were forgiven? Is the user always right, or are they sometimes selfish and misguided, and is this one of those times?

Deconstruction helps us to ask better research questions, thereby allowing us to learn things that may never have come to light. Knowing that an assumption is really an assumption provides for an opportunity to learn something critical.

Abduction and Synthesis

Of all the qualities of design, abductive thinking and synthesis are perhaps the most critical.

In synthesis we see the epitome of the breakthrough idea, the ability to pull together disconnected ideas and arrive at something new and meaningful: the folding bicycle, the bamboo computer case, public bike sharing, Zipcar.

Methods for encouraging and facilitating abductive thinking and synthesis are not well explored, but they do exist [2]. They include the need for immersion in the problem space—through research, observation, and reflection—and a willingness to deliberately play with seemingly absurd connections.

To return to an earlier example, what if shareholders were viewed as capital service providers for workers? What if the enterprise were viewed as a collective endeavor with capital rated as one input with no greater importance than the knowledge and expertise of the workforce? How would that new conceptualization play out in areas like dividends and ownership, intellectual property, and organizational longevity?

By looking at a car with square wheels, engineers were forced to reinvent automobile suspension systems. The connection of absurd (on the surface) concepts led to breakthrough thinking in a problem space considered largely solved and resigned to incremental improvement, at best, by previous design teams.

And this is one of the most valuable applications of abductive thinking—to break new ground in areas thought previously to have been well and truly tapped out. For businesses this is a thoroughly intriguing idea: Instead of trying to expand and broaden their products and markets, the most profitable route is often to reconceive the problem.

Abductive thinking does not happen in isolation. Nor can it be turned on like a tap. When engaging in this activity, a lifetime of observation and experience is brought to bear. The designer practiced in this mode of thought may be capable of making such leaps of insight quickly and unconsciously, but there is no possible timetable for such activities.

Having seen my fill of project plans with "Synthesis: 2pm–5pm" on them, I remain convinced that this remains a poorly understood, but no less critical, quality of design.

Photograph by Ron Tamondong

Multiplicity

Like all problem-solving ideologies, design attempts to ultimately arrive at a single solution. But design is inherently exploratory, baking in phases of generative, dispersive activities aimed at deriving a large set of possible solution paths followed by phases of reflection, critique, and testing to narrow and refine.

At each of the refinement phases, the aim is not to select a single "best bet," but instead to choose the several most promising avenues of inquiry for further exploration. When designers are attempting to solve complex problems, the constant multiplicity of the design process helps them to avoid dead ends and anchoring—the psychological bias that can lead to purely derivative, rather than truly creative solutions.

Exploring a multiplicity of ideas in parallel helps the team to embrace ambiguity, work with assumptions and what-if scenarios, and make progress while further information is sought. Since complex problems are never completely well known, the ability to work with ambiguity and multiple, concurrent streams of ideas are a crucial quality in attempting to design a solution.

Critique

Hand in hand with the ability to reserve judgment and retain multiplicity is the need to critically review and assess concepts in a group environment.

In the face of complex problems, individuals or small teams will often break off during the generative phases to come up with ideas separately. The team will later reconvene to review and critique each idea.

Critique is one of the foundation skills of the design studio. It involves a number of different skills: setting aside ego, thinking critically, and offering language-neutral evaluation and feedback.

The aim of critique is to build up an idea, not shoot it down. Each concept represents a form of going out on a limb (or at least, it should) and good critiques will encourage innovative and disruptive thinking. Negativity, criticism, and "yes, but..." thinking serve only to reinforce safe ideas and lead to incrementalism in the concepts presented.

Design encourages disruptive thinking—wild leaps of insight—through critique. As a team, individuals are able to safely explore ideas in the absence of ego and criticism.

An equally essential skill in critique is the ability to receive feedback and remain open, to avoid becoming defensive or taking the feedback personally. Learning and practicing critique early and often is one of the most valuable and unique qualities of design—and designers.

Without critique—without a process of openly and honestly giving and receiving feedback—the problem-solving process is more likely to degenerate in politics, overinvestment in bad ideas, and siloed thinking.

Empathy

There is a growing trend in business to understand customers. And in many respects, good marketing has, for the better part of 50 years, been aimed at gaining a better understanding of the people who will ultimately use the products and services that a business or organization chooses to offer. This understanding is typically a projection outward from the organization, looking at motivations, behaviors, and needs as an influence to purchasing.

Design, by comparison, attempts to gain understanding of the customer from the perspective of the customer. Design aims to look back at the organization, its products and services, through the eyes of the people for whom those products and services are being designed.

This understanding, or empathy, is important for several reasons, but most notably: It allows for the design of products and services that are truly meaningful, and it affords the organization an opportunity to see itself as others see it, allowing—should it choose—for a critical reflection on its own role and value in the lives of its customers to take place.

Empathy enriches the solution with an understanding of the context of a problem, the setting in which it occurs—the distractions, the disruptions, technology, importance, and place within the broader setting of the person's life. In so doing, empathy enables the problem to be more broadly defined, which in turn provides opportunity for the problem itself to be reframed.

What's Missing?

Let me touch on two common characteristics of design that do not appear in the above list: observation, or research more broadly; and iteration.

Design is underpinned by the designer's ability to not only look, but also to see. To look at a group of adults talking in a bar and see an opportunity to change behaviors; to look at a child engrossed in a game and see "flow." The act of observation is not unique to design or design thinking, and design research is not the sole domain of the designer. It is in the seeing, in the sense-making, and in the questioning of what is observed that design sets itself apart.

Researchers, academics, marketers, and engineers all look around themselves to gather information. They measure, study, and observe. The distinguishing quality of design lies not in this act of looking but in the perspective gained—a perspective firmly rooted in the shoes of the customer. And the answer to understanding that distinction lies not in the observation, but in the first two qualities noted above— deconstruction and synthesis.

The second missing characteristic is iteration. Whether sketching or prototyping, design processes are inherently iterative. But iteration is a fundamental component of most generative and creative endeavors. An engineer designing a bridge or a ship will iterate through many, many revisions. A scientist will test and revise his or her hypothesis; a management consultant will explore iterations of a business model.

A lifetime ago, as a consultant statistician, I remember developing, testing, and discarding dozens of models for how a new transit option in Sydney would affect ticket sales on public transport.

Iteration is everywhere. It is in the parallel exploration of a multiplicity of ideas—and the resultant power of that exploration—that design lends itself to solving complex problems.

Conclusion

Design is, at heart, an approach to solving problems. In particular, design is well suited to the solution of problems for which there is no incremental, step-wise path. Complex problems require an approach that decries constraints and linear improvement, looking instead to make intuitive leaps and arrive at breakthrough solutions.

The qualities of design described here allow for these intuitive leaps to take place through the application of synthesis and abductive thinking. They allow for constraints to be tested and discarded through the application of deconstruction. They allow for ambiguity to be embraced and explored through a process that inherently supports multiplicity, and also through critique. And they allow for an understanding of the end recipient of the products and services under design to provide opportunities to reframe, broaden, and define the problem in ways that lead to more meaningful solutions for those recipients.

Caveat

These qualities—deconstructionism, abduction and synthesis, multiplicity, critique, and empathy—are not the sum total of design. At the same time, there is also a designer to take into consideration. So while these qualities of design make it well suited to solving particular types of problems, the depth and extent to which these qualities reside in the designer also form a critical factor in the success or failure of a project.

But in the same way that the existence of good and bad engineers does not stop engineering from being an excellent approach to solving particular types of problems, the existence of good and bad designers does not stop these qualities of design from being particularly relevant in the solution of complex issues.

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The Space of Design

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Models of the process of design are relatively common. I have found approximately 150 such models, many of which are presented in "How Do You Design?" (http://www.dubberly.com/articles/how-do-you-design.html/).

Each describes a sequence of steps required to design something—or at least the steps that designers recommend. Models of the design process are common because designers often need to explain what they do (or want to do) so that clients, colleagues, and students can understand.

Less common are models of the domain of design—models describing the scope or nature of practice, research, or teaching. (I have found only about a dozen such models.) Such models may be useful for locating individual processes, projects, or approaches and comparing them to others; and also help clients, colleagues, and students understand alternatives and agree on where they are (or want to be) within a space of possibilities.

Typically models of a domain are of three types:

1. Timelines
   - Lists of events from the domain's history
   - Links between events suggesting influences
2. Taxonomies
   - Lists of sub-domains
   - Trees branching into categories and subcategories and so on
3. Spaces
   - Venn diagrams indicating overlapping categories
   - Matrices defining the dimensions of a space of possibilities or area of potential

Among the very few spatial models of the domain of design is Jay Doblin's 2 x 3 "Matrix of Design." The rows are performance and appearance; the columns are products, unisystems, and multisystems.

Doblin explains, "A continuum exists between pure performance and pure appearance. Some products, such as crowbars or paper clips, are clearly performance products. Others, such as Christmas ornaments, medals, and trophies… are purely appearance products. Still others, like automobiles, cups, and chairs, are combinations of both. The essential point is most products (and messages) can be conceived as primarily performance or appearance oriented."

"Products, the simplest kind of design, are tangible objects, which can be touched, photographed, and comprehended. Objects such as cars, chairs and spoons and messages such as brochures, signs, or ads are all included."

"Unisystems are comprised of sets of coordinated products and the people who operate them. They are more complex in design, perform more complex operations, and are not as readily discernible as products alone. A kitchen, an airline, a factory, and a corporation are all types of unisystems… .The important concept in unisystems design is… the relationships and interactions between the items involved."

"Multisystems are comprised of sets of competing unisytems. The retailing field or the office equipment market are types of multisystems…. Sears goes against JCPenny, K-Mart, department stores, and hardware stores… . IBM, Xerox, Digital, Wang, Apple, and Canon are all pitted against each other" [1].

In Doblin's model, multiplying the columns and rows yields "six types of design problems that are fundamentally different."

1. *Performance Product Design.* The realm of product engineering, where "performance is quantitative."
2. *Appearance Product Design.* The realm of product "styling" and style, "not easily quantified."
3. *Performance Unisystems Design.* The realm of technical planning and methods, often associated with infrastructure, government, or military projects. (The Design Methods Movement grew out of this type of project.)
4. *Appearance Unisystems Design.* "Environments that…deliver a satisfying experience… usually designed by impresarios with an holistic approach. Projects begin with an overall vision of what the consumer's experience should be,

[1] Doblin, J. "A Short, Grandiose Theory of Design," *STA Journal*, Chicago, 1987.

[2] Morris, C. *Foundations of the Theory of Signs.* Chicago: University of Chicago Press, 1938.

[3] Ockerse, T. Conversations with the author when he was a student and from time to time since then.

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then the details of the experience are painstakingly worked out." Doblin cites as examples restaurants, worlds fairs, the South Street Seaport, and Disneyland. (Doblin's emphasis on experience prefigures discussions of experience design and service design by several years.)

5. *Performance Multisystems Design.* Groups of competing unisystems. Doblin gives no examples of performance multisystems.

6. *Appearance Multisystems Design.* Also groups of competing unisystems, and again Doblin gives no examples, nor does he distinguish performance multisystems from appearance multisystems. In fact he says, "design approaches for these two types of multisystems are similar." This comment is odd given that one of Doblin's goals for the model is to present "how design methods and design specialists can be matched to the problems." He notes, "Just as there are six distinguishable types of design, there are six different kinds of designers. It is a rare designer who is competent in more than one design type. The capability and experience required in one arena may actually obstruct a designer's competence in another."

Yet, Doblin himself questions the distinction between performance and appearance, "Unfortunately, the threshold separating performance products from appearance products can be fugitive, and is sometimes confused when the designer has one goal, the user another." Of course, no product or system is all about form or all about function; all products and all systems have formal and functional aspects—and other aspects, too.

Perhaps we need to reconsider Doblin's y-axis.

I propose substituting Charles Morris's model of "sign function," which he describes as having three levels—syntactic, semantic, and pragmatic [2]—and incorporating Thomas Ockerse's argument that the result of any design process is a sign (in the semiotic sense). That is, anything that has been designed acts as a sign—loosely, it stands for something [3]. (Rhetoricians might say anything that has been designed makes an argument or arguments, including arguments *for* itself.)

If the result of the design process is a sign, then we may apply Morris's model of sign function to things that have been designed—or more broadly to the space of things that can be designed.

1. Pragmatic—The context (from which an artifact emerges and in which it will be used) or need (which it will meet). *Why* does this matter? *Why*

Matrix of Design + Examples

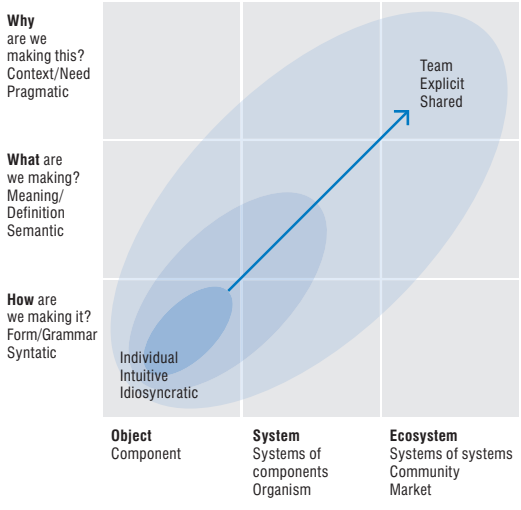
after Jay Doblin

	Products Messages	**Unisystems**	**Multisystems**
Appearance	Christmas ornament Medal Trophy	Restaurant Worlds fair South Street Seaport Disneyland	Market
Performance	Crowbar Paper clip	Infrastructure Government Military project	Market

Space of Design + Examples

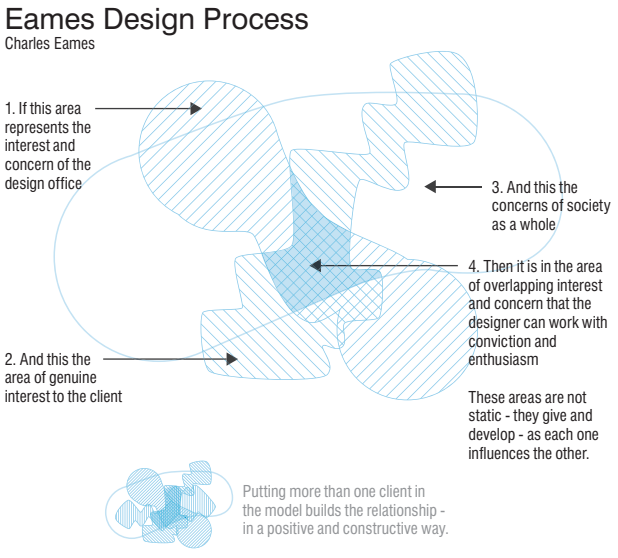
	Object Component	**System** Systems of components Organism	**Ecosystem** Systems of systems Community Market
Why are we making this? Context/Need Pragmatic	Event + methods of attracting an audience	Website business/user/ technology models	Developer community and its drivers
What are we making? Meaning/ Definition Semantic	Poster headline + imagery	Website information architecture + content + CMS	APIs—rules for communicating between systems
How are we making it? Form/Grammar Syntatic	Poster typography + layout	Website style sheet (CSS)	Cross media coordination of identity system

Direction of Change in Design Practice



Areas of Interest and Concern of the Design Office, the Client, and Society

Among the models of the domain of design, perhaps most well known is Charles Eames' diagram of the overlap between the areas of "interest and concern" of the design office, the client, and society. Eames's model is sometimes erroneously described as "a diagram of the design process." While Eames notes that the "areas are not static—they grow and develop as each one influences the others," his model does not describe how design is (or should be) practiced; it describes where "designers can work with conviction and enthusiasm" [5].



are we making it? Who will use it and for what purpose? In Morris's terms, "the relation of signs to interpreters."

2. Semantic—The meaning or definition of the artifact. *What* is this? *What* art we making? *What* does it do? In Morris's terms, "the relation of signs to the objects to which the signs are applicable."

3. Syntactic—The form or grammar of the artifact. *How* will this be? *How* are we making it? In Morris's terms, "the formal relation of signs to one another."

In a rational design process we might begin by trying to understand why something is needed—who will use it, where, and to what end; which then might help define what is designed—the structure and features that make it meaningful; and lastly the definition of what's needed might help drive how the artifact looks and even how it's made.

Of course the process is rarely so neat or linear. Discussion about what may also change the way we understand why, and prototypes of how very often affect the way we understand what and even why. Still we seek not just coherence within each level, but also between levels. The structure of form must map to the structure of meaning, and the structure of meaning must map to the structure of the context. These mappings do not flow in just one direction; they are reciprocal. The design process involves iteration, adjusting structures at each level to achieve coherence throughout.

In the late 1970s, Ockerse explicitly organized RISD's graphic design curriculum around Morris's model:

- The first year introduced students to form-giving exercises.
- The second year added greater attention to meaning.
- The third year added practical considerations.

Meredith Davis has criticized this approach to design education, arguing the distinctions are artificial. She has proposed a curriculum that engages students in issues of form-giving, meaning-making, and context-negotiating simultaneously. In practice, however, the distinctions often correspond to commonly found responsibilities or "degrees of freedom" of operation.

Young designers typically find themselves working within a team structure where senior designers, managers, and clients have already negotiated many of the practical business issues. The problem at hand is "simple" in Horst Rittel's terms, well understood—and already agreed—by the constituents. What remains is the working out of the solution within the established framework.

Also likely is that the message or feature set—the content, the information architecture, or the interaction sequences—have already been decided by others. Our young designer's role is to make it "look good" or "professional" or "appealing" or even "sexy." Doing so requires skill and benefits from training.

And this is where most design schools start (and quite a few stop). A typical problem in a graphic design class asks students to design a poster. The teacher provides the context—perhaps a poster promoting a concert for the Boston Pops. The teacher also provides much of the message—the copy to be included. The teacher may even specify the size, particular colors, and typeface. All that's left is for the student to arrange the elements. Each student should produce half a dozen or more variations.

A class of 25 students produces 150 variations, which provide the basis for a critique—a discussion about the student's proposed form and perhaps its relation to the given message. Through prototyping and discussing, students come to understand the space of possible solutions—the degrees of freedom open to them—and the tradeoffs between various factors.

Projects like designing the form of a concert poster remain the reality of most graphic design classes at the undergraduate level today—and quite a few at the graduate level. Such formal projects are also the reality of much of practice. Not just for graphic design, but also product design, interaction design, and architecture.

As young designers gain experience, they may get opportunities to affect the way projects are defined. At first, that may mean simply having visibility into new projects and being able to express interest. Later, they may sit in on planning meetings and then client meetings. Eventually, they may take on responsibility for "running" a client engagement. In function, if not name, they become managers. Here they can affect at least how a design team organizes a project.

However clients still constrain the level of engagement. Figuring out what product to build or which markets to serve are pragmatic business issues—the third level of the matrix—typically decided by the CEO or other "C-level" officers. Such issues are almost always outside the hands of even the product manager—and the designer.

It's always good to remember at the beginning of each project to explicitly confirm the level of engagement:

- Is the focus here making icons and skinning this interface?
- Or do you want us to look at the interaction as well?
- Who's writing the copy? Developing the content?
- Is the product positioning "locked and loaded"?
- Do you have user research to share? Would you like us to talk to users?
- How will the product be distributed?
- Where is value added? How does the product pay for itself?

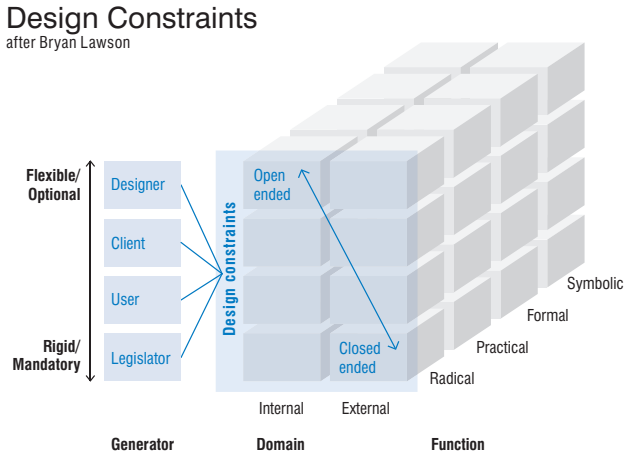
Mimicking this growth path with design class exercises is difficult. Critiquing formal issues is easier—simply less time consuming—than critiqu-

Space of Design Constraints

Brian Lawson has proposed a model of the space of design constraints, defined by three dimensions:

1. The generators of constraints: designers themselves, clients, users, and legislators. On this continuum, designer-generated constraints are the most flexible; client- and user-generated constraints less so; and legislator-generated constraints are the least flexible.
2. The domain of constraints, which may be internal to the thing being designed or imposed from outside.
3. The type of constraint, which he bases on function:
   - Symbolic: related to meaning
   - Formal: color, texture, shape, etc.
   - Practical: related to production
   - Radical: fundamental, related to the main purpose

Lawson reminds us that many constraints are self-imposed and their flexibility varies considerably. His matrix provides a framework for cataloging a project's constraints, a useful starting point [6].



The Matrix of Inquiry

Richard Buchanan has proposed a model of the space of design research, "The Matrix of Inquiry" [7]. Rick Robinson summarizes it nicely:

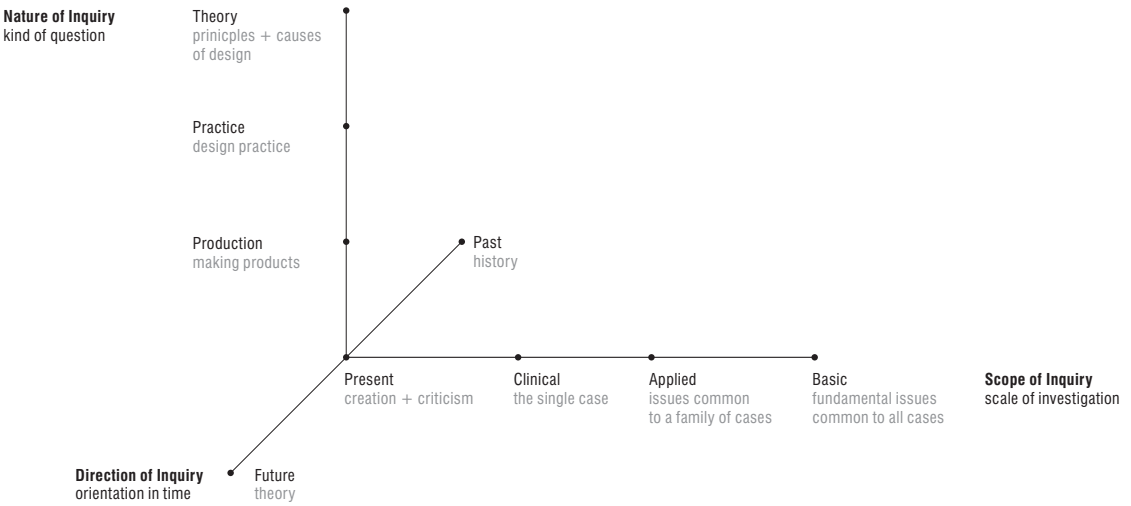
"The vertical axis… is asking what drives a particular inquiry—from the immediate needs of production, through questions of (design) practice out to questions generated by theory. [Most research skews toward the bottom.]

The horizontal or 'scope of inquiry' dimension presses a slightly different question upon us. By 'clinical' Buchanan refers to work primarily based on case studies. Again, were we to plot relevant work in the field, 'skew' would be a barely adequate description of the result. A single case study is often a powerful thing. But theory cannot be built on cases alone, especially when one case is rarely connected to the next. It is, as Buchanan's diagram implies, a limited 'scope of inquiry.' If case studies are the only fodder for the conversation, there is no extension, little reach beyond the immediate, and no larger patterns or emergent issues for theory to make sense of...

But I think the single most important thing to draw from this model is found on his z-axis: past, present, and future as the 'direction' of inquiry. Future has this little paren after it: 'theory).' What does that mean? Obviously, it could be prediction, in the sense of extending our understanding of the current situation into likely sequelae in the future. But there is also a much more potent way to understand it: that in this space—the 'here'…—theory of the future also develops the future, conditions the future.

In the gap between what is (now) and what might be, theory is action. This is especially true of the representations of theory we develop and deploy. Because we are in this conversation with the people and organizations who will populate the future with artifacts, affordances, tools, and ways of thinking, we are actively engaged in shaping the future. We are not simply observers, describers, or contemplators of it" [8].

Matrix of Inquiry for Design Research
after Richard Buchanan



ing semantic issues. Asking design students to create content means asking them to write. That means the teacher needs to read and review what the students write. It's difficult to imagine teachers like Armin Hoffman or Wolfgang Weingart commenting on student writing. Even Paul Rand, who seems to have written rather well, never gave assignments that required students to write.

Still, why not extend our Boston Pops-poster assignment? Shouldn't students discuss the copy as well as the typography? Shouldn't students discuss what makes an effective poster? Or whether a poster is the best way to attract people to a concert? Or perhaps even what the role of the Pops might be in Boston, in New England, in the U.S., or the broader music community—today and 10 years from now? Rather than ask students to redesign (reskin or even reorganize) the Pops website, wouldn't it make more sense to ask how the Internet will affect the Pops' long-term future?

That's some of what moving from the bottom row up to the top row might mean.

Let's come back to Doblin's x-axis: product, unisystem, multisystem.

I propose replacing "product" with "object", because product may suggest a thing to be sold, while the result of a design process need not be sold. "Object" also seems to be in the same family as system.

"Unisystem" and "multisystem" are terms of Doblin's devising. While diligent readers may be able to decipher them, they are not immediately accessible. "System" seems clearer than "unisystem." Likewise "ecology" (or Meredith Davis's term, "community of systems") seems clearer than"multisystem." "Ecology" also suggests the dynamic, even living, quality of a system of systems. In sum: Ecologies are composed of systems, and systems are composed of objects.

The examples Doblin gives of multisystems are all competitive spaces or markets, but as Pytor Kropotkin noted, cooperation may be as important as competition in evolution [4]. Multisystems or ecologies need not be seen only as markets. Many large organizations (e.g, conglomerates, universities, and governments) are themselves multisystems or ecologies. And even some product offerings are multisystems or ecologies, (e.g, the Univers family of typefaces is a system of systems; so are integrated systems of hardware, software, networked applications, and human services, such as Apple's iTunes and iPhone environments).

Traditionally, designers have focused on the lower left corner—crafting the form of objects. Such work can be direct and largely unmediated. Individuals work material in highly intuitive even idiosyncratic ways.

In the past 20 or 30 years, practice and theory have evolved. Ethnography and research about users and use are regularly incorporated in design processes. We might represent this change as expanding focus from the lower right and moving up the y-axis. At the same time, many designers have become involved in the design of systems and ecologies (or designing conditions in which ecologies may arise and thrive). We might represent this change as expanding focus from the lower right and moving across the x-axis. Such work is often indirect and mediated by models or maps. Teams collaborate, often by sharing explicitly defined processes.

Doblin noted, "For years, most design problems could be solved by using a combination of design training, experience, and applied intuition. But as the world and its design problems have become more complex, traditional approaches have become less effective."

Differentiation and value may be created more easily by expanding beyond form to meaning and context, and by expanding beyond objects to systems and ecologies—moving up and to the right. This shift reflects interest in design thinking and emergence of cross- or trans-disciplinary practices and educational initiatives.

Still, none of this diminishes the value of good form. Designers who love to make things look good should feel no compunction to expand their practice. We still need beauty.

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[4] Kropotkin, P. *Mutual Aid: A Factor of Evolution.* New York: McLure Phillips & Co., 1902.

[5] Neuhart, J., Neuhart, M., and Eames, R. *Eames Design: The Work of the Office of Charles and Ray Eames*. New York: Abrams, 1989.

[6] Lawson, B. *How Designers Think: The Design Process Demystified*. Oxford, UK: Butterworth Architecture, 1990.

[7] Buchanan, R. "Design as Inquiry: The Common, Future and Current Ground of Design," address to the Design Research Society, Annual Meeting, 2005.

[8] Robinson, R. E. "Let's Have a Conversation." In Anderson, Ken & Lovejoy, Tracey (editors) *Proceedings of EPIC 2005*, American Anthropological Association, January, 2006.

On Academic Knowledge Production

It's no longer astute to point out how design has the potential to shape society and contribute to solving some of the catastrophic issues facing our world. Yet the conversation of addressing these problems is often divided into two groups. One, with a competency in building products, uses language like "social innovation" and "social entrepreneurship"—utilizing standard business activities, with goals of both a karmic and financial return on investment. I find myself in this group, and our conversations commonly describe the ability to scale up, to capitalize, to drive adoption, and to provide triple-bottom-line value.

There's another group holding heated discussions about the role of design in this brave new world. These conversations are happening at universities, and the language is likely foreign to practicing designers. I refer, of course, to the academy, where the conversation is one of co-creation, knowledge generation, "design with versus design for," and the design of social services. These are experts in cognitive and social psychology, urban planning, and anthropology. And in these circles, while the direness is as apparent and the conversation as heated, relatively absent is the discussion of money. Instead, the tone and content of the discourse are focused on people (often described not as users or consumers, but as citizens, voters, or "the populus"). I find myself participating in these conversations, too, albeit mostly as a guest.

This divide between practitioners and the academy has seemingly existed for as long as there have been either practitioners or academics, with the practitioners describing the academics as lacking realism, urgency, and practicality. The academics are a bit less judgmental in return, yet there is still a pejorative undertone to the description of "the corporate model" or "the agency approach."

But now, as design enjoys the corporate credibility of "design thinking" and with the social problems confronting the world growing increasingly intractable, the need for bridging the gap between the groups is more important than ever. The academics are generally driven by the generation or discovery of knowledge and are pushed to disseminate this material to the world. It is in these groups that I've heard over and over that *we already have the data to address the big corporate and social problems*. And I tend to agree; buried in obscure academic journals and presented at conferences by tenure-seeking professors is a beautiful array of data related to human motivation, the human brain, the nature of cities, and the patterns of digital culture. Yet following this claim of knowledge is a telling phrase that I've heard repeatedly: *"We already have the data to address the big corporate and social problems—but the practitioners don't listen!"*

Indeed, the practitioners don't listen. The mechanics of a design consultancy celebrate speed of execution, not reflection. The business of the corporation is one of quarterly profits and a constant refrain of strategic imperatives and brand positioning. We read the books that translate the academic language into a consumable context; some of the best sellers of the past decade consist of academic cognitive psychology translated into a size and context we can supposedly "handle" (usually with single-verb titles, such as *Switch*, *Drive*, and *Blink*). But the latest Gladwell book isn't going to stop oil from leaking into the ocean. The pop-culture approach to bringing scientific and designerly knowledge to the masses scrapes only the surface, and it is in the depth and in the details that we can find the relevant knowledge necessary for practicing designers to do what they do best: to design, to execute, and to do so quickly.

This must be a larger and more public conversation, and the answer is not yet another conference with proceedings that few will read. My call to action is one of mutual dialogue, and the challenge is direct: We must find a way to move the knowledge from one group to another.

—Jon Kolko

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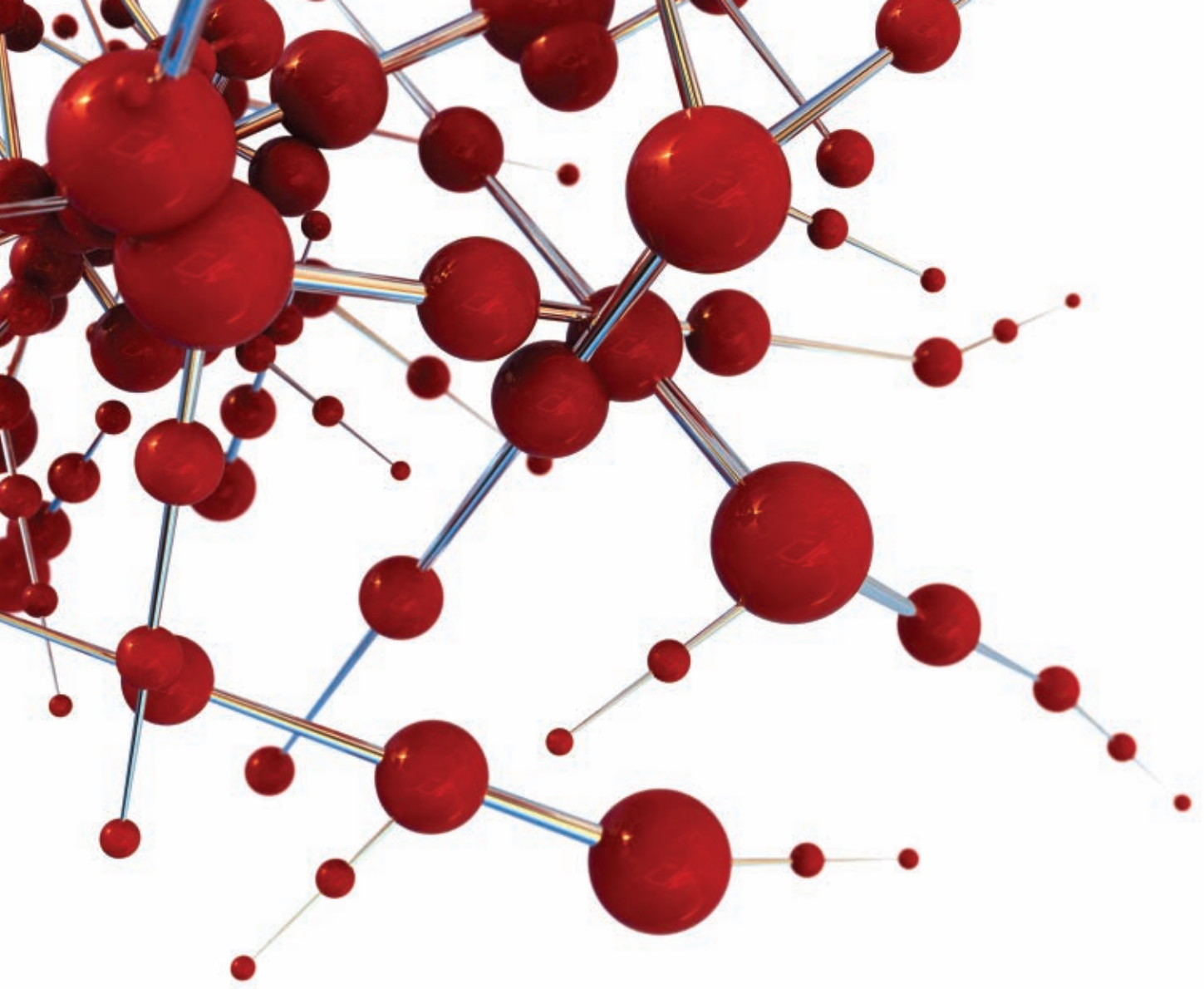

The Human Factor

"Before we design the robot we have to really understand the end-user."

–Melissa Ledoux, *Bentley MSHFID; Systems Engineer, iRobot, Inc.*

Bentley graduate Melissa Ledoux designs robots for the battlefield. Here she answers questions about her job and her MS in Human Factors in Information Design (MSHFID) from McCallum Graduate School of Business at Bentley University.

How did a psychology major get into military robotics? Actually, psychology is a great background for understanding the "human factors" in design engineering. My job merges technology with the science of human behavior—before we build the robot we have to understand the needs of the end-user, in our case, the soldier.

Why did you decide to get your MS in Human Factors in Information Design? I was working in the defense industry in a "human factors" role and felt I needed more background in the usability field. Bentley's program had the technology focus I was looking for, plus the business perspective—and I could earn my degree while working full time.

What made Bentley's MSHFID program a good fit? It was practical and hands-on. We learned usability testing in the Design and Usability Center—it wasn't just theoretical. Plus, the professors all had real-world credentials. I came out with the expertise I needed to succeed. Finally, the "business twist" has been a critical asset in my career.

You seem to have a passion for sending "cool robots" on dangerous missions. What excites you most about this field? Saving lives, making a difference. When we get feedback from a soldier that one of our robots has saved a life, I know I'm in the right field.

Attend a webinar on Thursday, October 7, from 7:30-8:30 p.m. EST to learn more about the MSHFID program. Visit bentley.edu/mshfid to register.

The MSHFID is now online. Learn **MORE** *at* ***bentley.edu/mshfid***

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