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DESIGNING GAMES
why and how

Cover Story by Sus Lundgren

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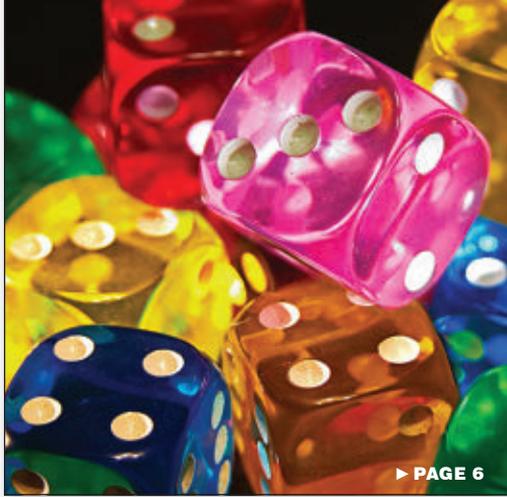
▶ PAGE 6

▶ PAGE 20

▶ PAGE 46

▶ PAGE 50

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Interactions:
Having an Impact

► Richard Anderson

► Jon Kolko

Near the end of this issue is a piece by Keith Instone and Fred Sampson that marks the passing of Randy Pausch. Jon had the good fortune of taking one of Randy's classes during his junior year at Carnegie Mellon, and while individual lectures may now be forgotten, the dramatic influence and impression of Randy's passion is forever lasting. Randy's contributions to design, entertainment, and education are phenomenal, and the personal impact he had on students and colleagues, and eventually on millions around the globe, indicates the substantive and often unpredictable influence that our ideas, creations, and pursuits can have on the world we leave behind.

This notion of influence—of leaving a mark—is one that is reflected in different ways in contributions by several authors, including Ben Bederson, who, via the International Children's Digital Library (ICDL), is returning pleasure reading to children in Mongolia and, for children elsewhere, increasing access to books from other cultures. In another article, Rich Ling describes some of the extraordinary impact mobile phones have had on our lives. But the impact of mobile phones has not been universally positive. Neither has that of email: Karen Renaud and colleagues provide an analysis of its seriously negative effects. As Brian Romanko suggests in his review of one of Ling's books, while certain forms of technology-supported communication have become indispensible, they have also become a sociological pain.

Ben and his colleagues describe how they are on the lookout for and are designing to prevent any sort of unwanted influence of the ICDL, such as the loss of meaningful engagement with books when they are accessed via the Web. Other authors offer guidance to increase the chances of the positive impact of others' work. For example, Liz Sanders presents an evolving map of design research that can help ensure that the newest approaches are considered for use along with the old. Christine Satchell provides explanation and examples of how cultural theory should influence research and design. Mike Kuniavsky discusses important guidelines for those engaged in the design of the ubiquitous computing user experience. As Don Norman puts it, "As we move from the world of stand-alone objects to social structures, complex, intelligent products, and a heavy dominance of services, then new principles are needed."

And according to Nathan Shedroff, arguably the father of "experience design," businesses need to follow new organizational and management principles as well so that they can create the proper context and culture to enable the right process for design and innovation. Nathan discusses how this relates to the focus of his upcoming book—sustainability. Bill Tomlinson describes how corporations (and individuals) can continue their natural pursuit of conspicuous consumption, but in ways that are beneficial to the environment.

However, before you get to all of that, the issue opens with our cover story by Sus Lundgren, who explores the interaction paradigms embedded in games and the moral or ethical issues they raise. The design strategies Sus advocates have further-reaching impact than one might initially think, as they are applicable to any experience or environment in which creative and abstract rule definition must occur. Games are one of these settings; business, education, and politics are others.

This issue is all about having an impact. The ability to have an impact via changing behavior is at the heart of interaction design; it's at the heart of the late Randy Pausch's career, and it's at the core of *interactions.*

—*Richard Anderson and Jon Kolko*
eic@interactions.acm.org
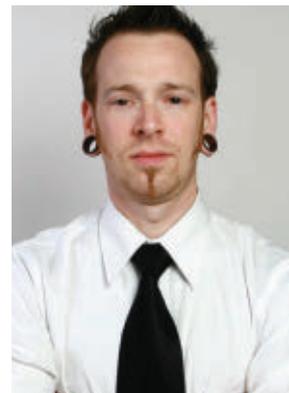
Designing Games: Why and How

Sus Lundgren

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Six different players negotiate the distribution of 11 jewels of nine different colors—in 60 seconds [1]. Teams of children are competing to get the right set of keys to open a treasure chest; is it morally right to encourage violent robbery of a wanted key? An old-fashioned dogfight game requires programmers to implement death—how does that feel? Designing a Myst-like adventure game in real life encourages the use of… grass. What is going on?

The examples above all come from my life as an interaction/gameplay designer or teacher of these subjects, and to me it just proves that gameplay design is in fact interaction design. Why? Because gameplay design is design of the core game, i.e., the rules of the game. And the rules in turn affect not only how the game is played, but also how players interact with each other via the game and thus in turn how they experience it. For instance a game like Yahtzee, with its luck-based and non-interactive gameplay, will result in a totally different game experience than a negotiation-intense game, where you have to actively interact with others in order to succeed. Hence, every single design decision matters when writing the rules. Imagine for instance a poker game where all cards are open; this simple decision reduces the game to an exercise in counting the odds. This, the immediate impact of a design change, is what makes gameplay design so interesting and so instructive.

In addition, the freer realm of games opens up for interesting challenges when it comes to interaction design. Let's take the first example above, with negotiation: How often do you get to design that in a normal GUI? How would you go about transforming such an immediate, body-language-dependent process to an online environment? I've given this task to 180 students in 39 groups, and there seems to be at least three and a half solutions—can you figure them out?

Games are full of these unusual interaction issues, never before solved. In addition, they often provide moral or ethical issues, as in the examples above. In the children's game, the solution was to introduce stun guns into the game; the children could shoot and stun each other, and whoever was stunned had to give up his or her key and stand still for a minute. As for the dogfight game, the students programming it wrote this in their report: "On the other hand it was interesting to face one's feelings when one implements status = STATUS DEAD. It is not uncomplicated at all, and maybe it does not just numb but also starts thoughts on why?" Another group of students set out to make a live version of an old-fashioned computer game in the adventure genre, but as they couldn't make the entire game, they designed a small room in what should have appeared as a cottage. To create the feeling of a mystery, they worked hard with effects like a filmed face projected upon a dummy, saying mysterious things, secret writings on the wall that appeared only in ultraviolet light, a buzzing radio that was in fact controlling interior sounds, a diary, etc. The room was part of an exhibition, and despite the fact that it was dark and the outer sounds were muffled, the room did not really get its own character until the students bravely rolled out a piece of real lawn in what was to be "outside." The musty smell of grass changed the experience completely, and it exemplifies how games open up new aesthetic dimensions and questions. Actually, any non-abstract game is full of aesthetic issues, the most important ones being how the theme should "carry" the rules and make them logical: "No, you can't move across that square, because that's water and you don't have a boat." And so on.

So, that's why you should try gameplay design if you have

[2]"I have no words and I must design" was originally published in a British roleplaying journal, and features Greg's definition of a game as well as a list of different game-related things. It's still available online at: http://www.costik.com/nowords.html
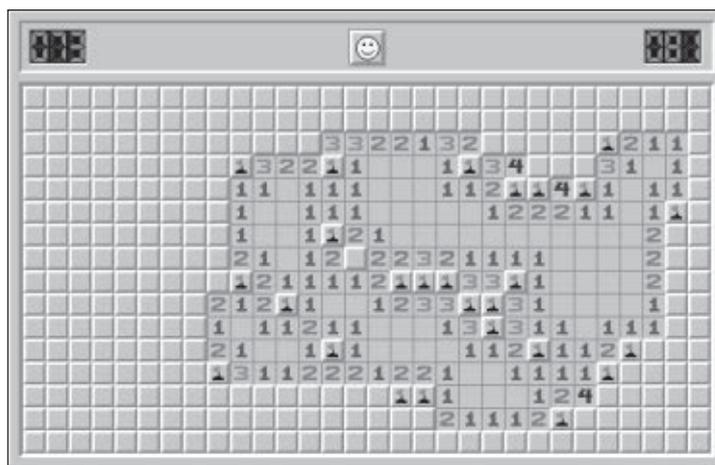
[3] See for instance Salen and Zimmerman's *Rules of Play: Game Design Fundamentals*, MIT Press, 2003; or Fullerton et al *Game Design Workshop: Designing, Prototyping, and Playtesting Games*, CMP Books, 2004; or C. Crawford's *Chris Crawford on Game Design,* New Riders Games, 2003. Even I myself have proposed a method for multidisciplinary game design: S. Lundgren, "Facets of Fun: The design of Computer Augmented Entertainment Artifacts," Master's thesis, Chalmers University of Technology and Göteborg University, 2006, 159-186. <http://www.cs.chalmers.se/~lundsus/publications.html>

[4] Yes, of course there is such a game, called Bluff or Liar's Dice, designed by Richard Borg in 1974 and published by very many, e.g. FX Schmid, Piatnik, Milton Bradley.
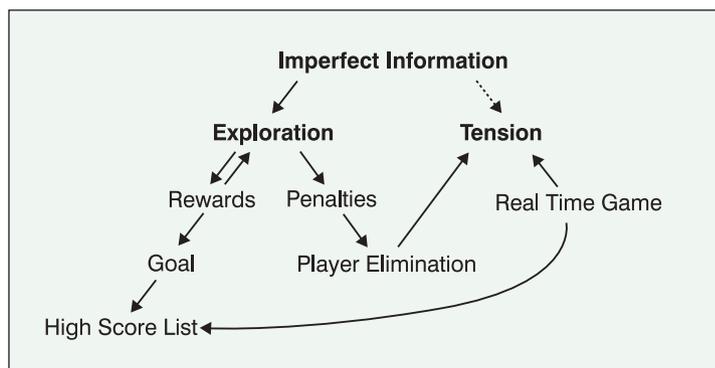
▶ The game Minesweeper and a pattern map for it.

Since most of them were developed as parts of workshops, they are between three and eight hours long. You can use them to come up with game ideas or to explore (perhaps when teaching) the close connection between a changed rule and a change in gameplay, i.e., how one design decision can affect the entire outcome. These methods are intended for groups of at least two but preferably four people. And most important, all of the methods can be used to design any type of game. A board game. A card game. A computer game. An outdoors game. A game played with mobile phones, indoors or outdoors, or perhaps over time. A game played with a Wii control or a dance mat. A game played with nothing more than a set of dice and an ability to bluff [4]. Any kind of game.

Redo It Right…
The participants start out by playing a dysfunctional game of some sort, like a game based entirely on luck or one that is "broken" in some aspect (it may never end, it may be boring, it may be frustrating…). The game's rules should be fairly simple; public-domain games for children (like Memory, or simple card games) can be good candidates. The game is played and analyzed in terms of what mechanics or patterns it contains and how these affect not only gameplay but also which kinds of feelings they evoke (e.g., lack of control may result in either boredom or stress). Sometimes it helps to draw a kind of pattern map to see interconnections. Then, possible rule changes are suggested, discussed, and tested. A new analy-

not done it yet: to explore new problems and possibilities, and to work with a set of aesthetics that is freer— and more demanding. This leads us to the next question: *How?*

I Have No Tools and I Must Design?!
Back in 1994, game designer Greg Costikyan stated, "I have no words and I must design [2]" as a response to the upcoming breed of game designers' need for a common terminology on game-related stuff. Since then, an extensive terminology has been created, collected, and discovered, as well as theories on how to run development and test the ongoing design [3].

However, there is still a dearth of idea-generation methods for games and gameplay; typically, "normal" idea-generation tools, for instance brainstorming, are described in the game design literature, whereas more direct game design methods are lacking or only briefly described.

For the professional game designer, constantly looking for inspiration and playing what-if, this may not be a problem, but the rest of us may need a hint. Therefore, I take the opportunity to present a set of methods for quick idea generation. All of them have been tested numerous times with gamers, students, and people interested but inexperienced in game design.

sis is made and so on.

There are two benefits with this method. First, one does not have to come up with anything from scratch. Second, being a game design newbie is fine; anyone can improve a broken game, which can be good for one's self esteem. However, some may feel that it is "cheating" to take someone else's idea (even if it is a public-domain idea, like card games). Whether this is a problem or not depends on the aim of the exercise; if it is to come up with an original game to publish, this may not be the way to go. If, on the other hand, it is the first in a series of exercises aiming to teach game design, this is not a problem at all.

Designing for Emotions
This is a variant of "redo it right," wherein the participants make the initial analysis the same way but then decide to design for one of the emotions that the game evokes. Trying to design for a feeling, rather than a theme, will result in rather different design choices! One can stretch the design process in absurdum toward the chosen emotion and then "bounce back," using this extreme variant of the game as a new

"broken" game that one has to fix and make more playable by changing or removing parts of it.

By designing for an emotion (especially a not-so-pleasant one!) one opens up the design space for unusual ideas. This is very useful, but one must be aware that the most extreme variants are seldom "playable" in a wider context. They may not even be possible to redesign, but one may still find useful ideas in them that may otherwise not have been found. It's a bit like using extreme characters [5] instead of personas as a design tool.

D6—Killing Someone Else's Darlings
Originally, this was an exercise for designing board games (hence the name; a D6 is a six-sided dice), but it can just as well be used to come up with ideas for any kind of game (if so, the time may have to be extended). The idea is that each group of participants starts with one game component (a six-sided dice, or a card, or a score track, an item or a graphic image). A participant may add a rule to the game, and thereafter the next participant may add or remove rules or components.

Every once in a while the game is play tested. This carries on for about an hour, and the aim is explicitly to not "finish" the game but to deliver a "baby" game in need of further development. Then two groups meet and present their respective games to each other, after which point they spend another two hours refining the design of the other group's game. They meet again, demonstrate what they have done, and get their own game back with a final hour to refine it.

This method is very effective, since the ideas undergo a constant testing and questioning due to the rotation of design ideas. Interestingly, the fact that the games will not be fully described during demonstration (and there is rarely a comprehensive written description) often leads to new ideas or other manners of play based on misinterpretations of the rules, widening the design space. Also, the games benefit from being played by different groups of players since different groups may have very different player styles (aggressive, helpful etc.), which also highlights different strengths and weaknesses of gameplay. These two effects

[5] Extreme characters is a design method where one creates very odd characters to design for, i.e. red-haired, shy, left-handed terrorists. The aim is to let darker emotions and desires influence the design for once. See Djajadiningrat et al "Interaction Relabelling and Extreme Characters: Methods for exploring aesthetic interactions," working paper, DIS 2000, New York, N.Y.,2000.

Group A Design **Group B** Design

Analyze Redesign — Analyze Redesign

Analyze Redesign — Analyze Redesign
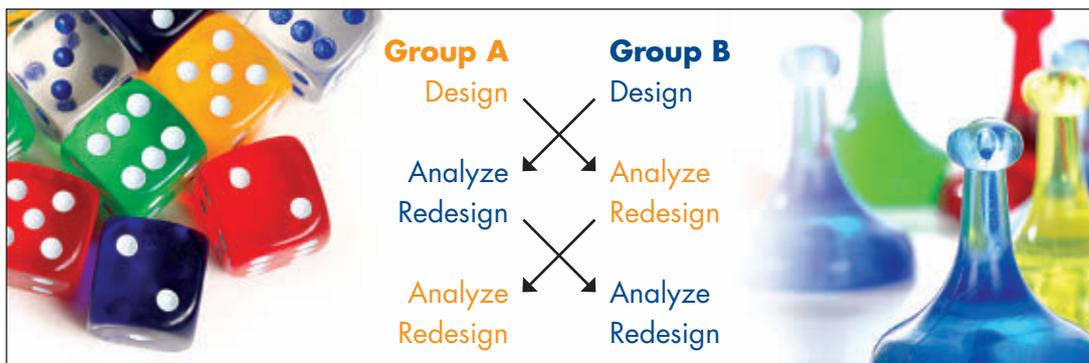
▶ The main idea behind D6: Provide lots of game components and then constantly switch games between groups.

NOMADIC

Lonely cowboys
• Birth rate plunges
• Everyone has weapons
• No trust
• Online exchange
• Lonesome poets

Online circus
• Self-expression
• Brief relationships
• Extreme fashion swings
• Online worlds and friends
• Few belongings
• Creative environment

INTROVERT   **EXTROVERT**

Dull world
• Boring
• Reruns on TV
• People are fat and ugly
• No change
• Strong traditions

Disneyreich
• Retro always in
• Entertainment docu TV
• Talent shows
• At home only to sleep
• Very distinct subcultures
• Rivaling subcultures

STABLE

▶ A map of four possible future worlds

▶ Prototyping MonstroCity: from left to right,
Anders Quist, Leif Ryd, and Anders Mårtensson.
Below, a MultiMonsterMania monster.

may result in some groups being astonished or disappointed when their "baby games" are developed further in a way that they had not expected!

This method can also help if you want to design a game for a certain device (i.e., a cell phone); the device, with all of its functionality, is the start item instead of the dice.

**The Future Map—
Designing Game Worlds**

In this exercise, participants list a set of opposites, e.g., rich-poor, introvert-extrovert, nomadic-stable, hot-cold, science-New Age [6]. Thereafter, each group chooses two sets and uses them to create a diagram with four quadrants combining the two opposites. They then try to imagine four future worlds (one for each quadrant) strongly characterized by these properties.

These future worlds are then used for inspiration. Either the worlds themselves become the environment of the games (e.g., a first-person shooter game set in a post-holocaust world), or one can take imagination a step further by trying to come up with what kind of games would be played in this particular future. Both approaches can result in very odd game ideas, but the latter may be more demanding. However, it can also be more rewarding; during a workshop in 2001 [7], this approach led to the idea of MultiMonsterMania, a collectible card game system in which some cards had programmable content and others had DNA—the patient could breed monsters. The background was a world with lots of self-expres-

sion and large gaps between the rich and the poor, and MultiMonsterMania was a cross-society game that street kids could use to get money, either by programming cool stuff or breeding cool monsters.

This method can be used to widen the design space, especially if creating games for that world, but unlike the other methods, it sets the conditions for the game, rather than stating anything about the game itself—a potential downside. Also, there is a risk that all the creative effort goes into imagining the worlds, leaving nothing for the games. This is of course easily solved by letting the exercise run over two occasions. Also, if more than one group is doing this, they can benefit from describing their worlds to each other; any group may then pick any world that inspires them.

**Gameplay Design Patterns—
Designing With Special
Interactions in Mind**

Gameplay design patterns are a way to describe the patterns, or parts, of gameplay and the interrelations between them. Patterns can be high level and deal with emotional outcomes (e.g., tension or immersion). They can be very low level and deal with components (e.g., dice, cards, or avatars). They can also fall somewhere in between, dealing with interaction (e.g., bluffing, betting, movement, and so on), information (e.g., symmetric information, public information etc.), or game conditions (e.g., safe havens, race, rewards, etc.). There is a collection, by Holopainen and Björk [8], but even without this you can find and name the patterns

you would like to use.

Gameplay design patterns can be used as a starting point for game design. Pick two or three and set them as a requirement; the game must include these in some way. Interestingly, several groups using the same patterns will still come up with very different games. For instance, I ran a workshop in which three groups designed games using the pattern Real-Time Game and either cooperation, espionage, or a team or outdoor game [9]. The result was one mobile phone game about a race across the polar regions, another mobile phone game played in the city that was now populated by monsters and treasures, and one Pictionary-like camera game.

Creative Constraints
In this exercise the participants receive constraints in forms of components (if they are going to design a board game) or graphics (for a computer game). They must use only some, not all of the components. Again, different groups will come up with very different ideas.

Here, the choice of components will affect design more than you can believe. Small things like color (coding) may matter a lot, as may things like different shapes, so it is worth designing or choosing these with care.

What to Use When and the Art of Providing Inspiration
The methods I describe have their own pros and cons. "Redo it right" is by far the easiest for non-experienced gamers, because there is an existing set of rules. "Gameplay design patterns" is the most complex tool;

▶ These (plus some dice) were the components I provided for the first creative constraints workshop I organized. When designing the components, I thought the coupling between the colors on the cards and the colors on the boards was too obvious, but not all groups used this connection. In addition, all groups but one got typical player pieces (like the ones to the right), but I did not have enough, so one group got small sturdy cylinders instead. Sure enough, they used the fact that these could be stacked!

it takes time to get to know, but as any other comprehensive tool (the collection contains more than 200 patters), it is very useful once mastered.

"D6" and "creative constraints" are much each other's opposites, D6 being very free, while creative constraints can be very limited, depending on how many components you provide and how many have to be used. Having tried out both in several cases, I would say D6 works slightly better—when trying it on a class of interaction designers and game designers, some four games out of 14 were promising. I've tried creative constraints only as a game design competition with time pressure added, which does not work well; this task may work better if the participants can review the material beforehand. On the other hand, most of the material is already designed, so the focus is much more on

actually designing the gameplay than making the perfect components, as in D6.

Actually, there is an imminent risk that prototyping or programming issues may interfere with gameplay design. This can be countered either by sticking to lo-fi prototypes and/or bodystorming if necessary, or by involving experienced programmers, or by limiting the scope to designing board or card games only. Also, you must be a bit cautious in what materials you choose to display; D6 and creative constraints are highly dependent on what prototyping material you provide as inspiration. The others, not so much. It all comes down to what type of game you want—for instance, if you provide dice markers, etc., you will most likely get a board game. In order to skew the ideas toward, say, a live action game, you will have to provide more everyday-life things—props like

[6] To my knowledge the method with the future maps (albeit not called this name) was created by Lars Erik Homlquist and Ramia Mazé.

[7] See special issue on ubiquitous gaming: S. Björk, J. Holopainen, P. Ljungstrand, and K.P. Åkesson, "Designing Ubiquitous Computing Games - A Report from a Workshop Exploring Ubiquitous Computing Entertainment," *Journal of Personal and Ubiquitous Computing* 6, no. 5 and 6 (December 2002).

[8] To read more about gameplay design patterns and get a full collection, check out Björk and Holopainen, *Patterns in Game Design*, Boston: Charles River Media, 2005.

[9] See S. Lundgren, "Facets of Fun: The design of Computer Augmented Entertainment Artifacts," Master's thesis, Chalmers University of Technology and Göteborg University, 2006, 145-153. <http://www.cs.chalmers.se/~lundsus/publications.html>

bags or bizarre hats or water guns—perhaps some maps, and last but not least, a means of communication like PDAs or mobile phones. In order to get computer-game prototypes, you really need to have skilled programmers in the group, and preferably someone good at graphics as well. Then you must provide hardware, software, an image-, texture-, and sound library and anything else that may get them going. If you want more unpredictable outcomes, you can provide things like cameras (always tempting), LEGO Mindstorm, perhaps an AIBO robot dog, and other intriguing things… like whatever is in your bottom kitchen drawer right now. And always provide paper of different sizes (and cardboard if you have some) and pencils of different colors!

"But," you may be wondering, "doesn't it require a certain amount of game knowledge to do all this?" Well, as with anything else, experience helps when designing a game. However, this experience can come from different sources—for example, from playing games of any kind. Or it can come from that instinct we designers work so hard to achieve, the gut feeling telling us when something actually is interesting, entertaining, or "working," and why. As a matter of fact, if everyone is inexperienced in game design, it's often the interaction designer who carries forth the strongest ideas, simply because of this valuable and carefully trained ability. This may come from having user tested one's designs every so often, which may not be the case for everyone. Actually, designing a game (or the embryo of a

game) and then letting others test it is not at all different from running some other kind of user test, like, for instance, thinking aloud. And we all know how to do that!

Still, the methods mentioned above will not work for everyone, every time. But if a method doesn't work for you, try another. Or, if you like the method, try it out with others. Since a method takes a maximum of eight hours (but typically four) to carry through (although, admittedly it may take longer if prototyping requires a lot of time), it is not time-consuming to try out two or three.

If you use any of these methods to teach, make sure to divide any gamers among the rest so that each group can benefit from having an experienced gamer. Also, make sure to point out to your students how much a small change of a rule can change the entire experience of a game; imagine, for instance, a game of chess where the goal is not to strike the opponent's king but all of her or his pawns. This small change has a huge effect on how the game is played. (Try if you don't believe me!)

Wishing all of you the best in your gameplay design endeavors, I'd like to end with a tip I've gotten more than once when interviewing game designers of different kinds: Start with only a few components and rules, make a very simple game, and add complexity with care. And, as they always say on the telly: Have fun with it!

P.S.
Oh, about the three and a half solutions to the negotiation problem (and note that using

voice-based interaction is not allowed), here goes: (1a) You can assign each of the negotiating players an area and let everyone drag and drop the jewels to and from these areas, (1b) and you can also turn this into a kind of turn-based distribution. (2) Or, you can let all the jewels lie still and let each player mark their interest in a particular jewel instead. Each of these three solutions requires ways for the players to agree or disagree with what is going on. (3) Or, you can let all players get their own subset of the jewels, each suggesting how they think the entire division should turn out. Here, players need to be able to agree with one or several of the other's suggestion.

Regardless of the solution, players also need a means of showing that they want a particular jewel particularly, or if there is someone to whom they won't give a certain jewel. Also, regarding color-blindness issues, it is not a good idea to keep all the nine colors as is; working with shapes is necessary to facilitate jewel recognition for everyone [10]. Oh, and by the way, that's another method of exploring unusual interaction design problems: Take a board game and make an online version of it.

ABOUT THE AUTHOR
Sus Lundgren is currently pursuing a Ph.D. in interaction design at Chalmers University of Technology, Gothenburg, Sweden. She has a background in game design research, and has worked with Web design and GUI design for several years. She also owns some 400 games.

[10] Read the rest in S. Lundgren, "Teaching Gameplay Design is teaching Interaction Design," working paper, HCIEd 2008, Rome, Italy, 2008. <http://www.cs.chalmers.se/~lundsus/publications.htm>

An Evolving Map of Design Practice and Design Research

Liz Sanders

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Design research is in a state of flux. The design research landscape has been the focus of a tremendous amount of exploration and growth over the past five to 10 years. It is currently a jumble of approaches that, while competing as well as complementary, nonetheless share a common goal: to drive, inspire, and inform the design development process.

Conflict and confusion within the design research space are evident in the turf battles between researchers and designers. Online communities reveal the philosophical differences between the applied psychologists and the applied anthropologists, as well as the general discontent at the borders between disciplines. At the same time, collaboration is evident in the sharing of ideas, tools, methods, and resources in online design research communities. We can also see an increase in the number and quality of global design research events and a growing emphasis on collaborative projects between industry and the universities, particularly in Europe.

Why Make a Map?

When asked to write a paper about the state of design research, I found that I had to make a map so that I could see what I was writing about [1]. People who know me are aware that orienting and finding my way around physical space is not one of my strengths. Making a map is a way to hold a domain still for long enough to be able to see the relationships between the various approaches, methods, and tools. Maps are good for visualizing relationships.

Maps can be useful for showing complexity and change. For example, the underlying landscape of the map may be relatively permanent, changing only as major forces affect it. But the tools and methods shift and change somewhat like trends. And the people who inhabit the landscape may come and go. As in the real world, some people like to stay put and others like to travel. So maps are good for layering complexity and for revealing change as it occurs.

In making the map, I found that I needed to name the dimensions of the design research space in a way that would help bring clarity and light to the landscape. Once this happened, everything else fell quickly into place.

How Is the Map Organized?

The design research map is defined and described by two intersecting dimensions: One is defined by approach and the other is defined by mind-set. Approaches to design research have come from a research-led perspective (shown at the bottom of the map) and from a design-led perspective (shown at the top of the map). The research-led perspective has the longest history and has been driven by applied psychologists, anthropologists, sociologists, and engineers. The design-led perspective, on the other hand, has come into view more recently. (See Figure 1.)

There are two opposing mind-sets evident in the practice of design research today. The left side of the map describes a culture characterized by an expert mind-set. Design researchers here are involved with designing for people. These design researchers consider themselves to be the experts, and they see and refer to people as "subjects," "users," "consumers," etc. The right side of the map describes a culture characterized by a participatory mind-set. Design researchers on this side design with people. They see the people as the true experts in domains of experience such as living, learning, working, etc. Design researchers who have a participatory mind-set value people as co-creators in the design process. It is difficult for many people to move from the left to the right side of the map (or vice versa), as this shift entails a significant cultural change. (See Figure 2.)

The largest and most developed of the areas on

[1] Sanders, E.B.-N. "Design research in 2006." *Design Research Quarterly* 1, no. 1, Design Research Society, September 2006.
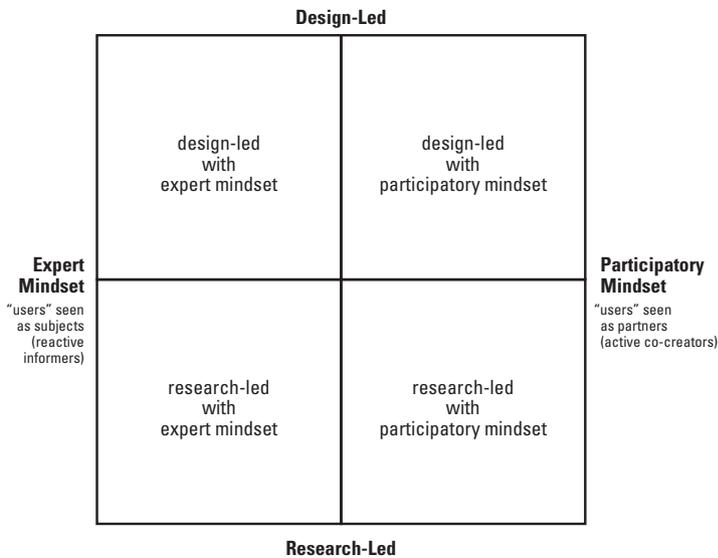
▶ Figure 1. Map of Design Research — Underlying Dimensions
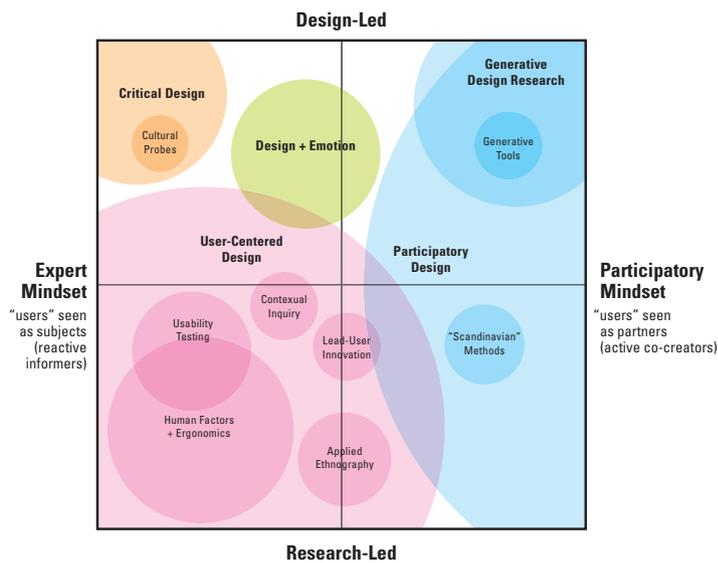
▶ Figure 2. Map of Design Research — Research Types
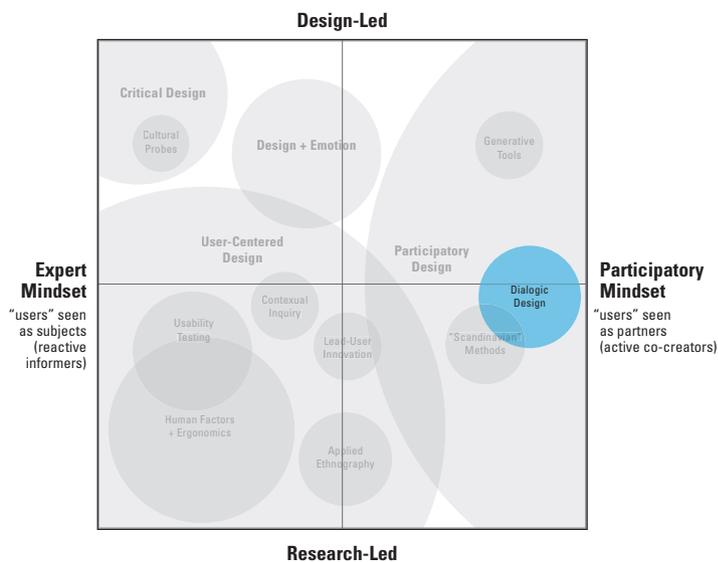
▶ Figure 3. Dialogic Design Overlaid on Map of Design Research

the map is the *user-centered design zone*. Thousands of people in this zone work to help make new product and services better meet the needs of "users." They use research-led approaches with an expert mind-set to collect, analyze, and interpret data in order to develop specifications or principles to guide or inform the design development of product and services. They also apply their tools and methods in the evaluation of concepts and prototypes. The three large areas of activity in the user-centered zone come from the applied social and behavioral sciences and/or from engineering: human factors/ergonomics, applied ethnography, and usability testing. There are also two smaller bubbles within the user-centered territory: contextual inquiry and lead-user innovation. (More information about the map can be found in my 2006 *Design Research Quarterly* article [1].)

The *participatory design zone* spreads across both the research-led and design-led approaches on the right side of the map. Participatory design is an approach to design that attempts to actively involve the people who are being served through design in the process to help ensure that the designed product/service meets their needs. Its origins are generally traced back to work done with trade unions in several Scandinavian countries in the 1960s and 1970s [2]. Participatory design attempts to involve those who will become the "users" throughout the design development process to the extent that this is possible. A key characteristic of the participatory design zone is the use of physical artifacts as thinking tools throughout the process, common among the methods emanating from the research-led Scandinavian tradition.

The *design and emotion bubble* emerged in 1999 with the first Design and Emotion Conference in Delft, the Netherlands. It represents the coming together of research-led and design-led approaches to design research. Today it is a global phenomenon, with practitioners as well as academics from all over the world contributing to its development. Interested readers can learn more about it at the website of the Design and Emotion Society (www.designandemotion.org).

The *critical design bubble* (in the top left corner) is design-led, with the designer playing the role of the expert. The emergence of this bubble came about as a reaction against the large user-centered zone, with its overwhelming focus on usability

and utility. Critical design evaluates the status quo and relies on design experts to make things that provoke our understanding of the current values people hold. Critical design "makes us think"[3]. *Cultural probes* is a methodology in the critical design bubble [4]. Probes are ambiguous stimuli that designers send to people who then respond to them, providing insights for the design process. Probes are intended to be a method for providing design inspiration rather than a tool to be used for understanding the experiences of others.

The *generative design bubble* (in the top right corner) is design-led and fueled by a participatory mind-set. Generative design empowers everyday people to generate and promote alternatives to the current situation. *Generative tools* is a methodology in the generative design research bubble. The name "generative tools" refers to the creation of a shared design language that designers/researchers and the stakeholders use to communicate visually and directly with each other. The design language is generative in the sense that with it, people can express an infinite number of ideas through a limited set of stimulus items. Thus, the generative tools approach is a way to fill the fuzzy front end with the ideas, dreams, and insights of the people who will be served through design [5].

Both critical design and generative design aim to generate and promote alternatives to the current situation. But they operate from opposing mind-sets. Many of the new tools and methods that have emerged in the last five years are design-led and sit along the top of the map, spanning the range from the critical design bubble to the generative design research bubble.

How Have I Used the Map?
The map has already been useful in a number of different ways. In my academic role, the map has been very useful for teaching about the changing state of design practice and design research. At the graduate level in particular, I see a trend toward a broader mix of disciplines wanting to learn how to do design research. The map can help students from different disciplinary backgrounds to understand each others' mind-sets, approaches, and tools for doing research. The map can help students recognize where their past training and/or experience positions them as researchers, and it can also show them new directions for exploration and learning. I have used the map to support and

scaffold different modes of exploration and experimentation in the design research process.

For example, graduate students (from design and engineering at Ohio State University) who took a class in design research were asked to show where they stood on the map as a result of their previous research exp eriences [6]. The students located themselves primarily on the expert-driven side of the map, spanning research-led (the engineers were here) and design-led (the designers were here) approaches. The students formed teams (made up of people from both disciplines), and each team selected a topic to explore through design research. They were then asked to decide where on the map they would like to explore. All of the teams decided to move away from the expert-driven side of the map in order to explore participatory, design-led approaches to design research. Each team made a successful learning journey on the map. The engineers were surprised to learn that research can be a creative process that can open up ideas and new opportunities. They had previously been more familiar with research for problem solving. The designers learned how to think and work with a participatory mind-set, inviting non-designers to become their partners in the creative process.

On a more strategic side, I am currently using the design research map as a framework for establishing new curricula to ensure the effectiveness of learning experiences for students from diverse disciplines. One question that arises is this: Should we make separate design research maps for the different design domains such as industrial design, interior space design, interaction design, architecture, etc.? That may be useful as an interim step, particularly in academia where the design disciplines have not yet been integrated for the most part. A more useful end goal is to begin to connect the separate maps to help show the relationships between research tools and methods across all the different design domains. After all, people are people, whether they are finding their way around a building, using a product, reading a package, or using a software application. With the increased interest in and application of participatory design thinking, we will see that the professionals who understand people (whether designers or not) will be the ones to lead design in the future.

In my role as a practitioner, I have used the

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Design-Led

Critical Design

Cultural Probes

Design + Emotion

Generative Tools

Co-Creation

User-Centered Design

People-Centered Innovation

Expert Mindset

"users" seen as subjects (reactive informers)

Contextual Inquiry

Usability Testing

Lead-User Innovation

Participatory Design

Participatory Mindset

"users" seen as partners (active co-creators)

Human Factors + Ergonomics

Applied Ethnography

Research-Led

► Figure 4. People-Centered Innovation Overlaid on Map of Design Research

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[8] Barrett, J. "The Hybrid Designer." Master's thesis, Emily Carr Institute of Art and Design, 2008.

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[10] Kirah, A. "Methods or Mindset? Issues of Concern in Designing for a Global World with the Goal to Improve Lives," Powerpoint presentation. <http://www. indexaward.dk/content/ image.asp?id=2684& download=true&lcid =1030>

[11] Brandt, E. and J. Messeter. "Facilitating collaboration through design games." Working paper, Participatory Design Conference 2004, Toronto, Canada, 2004.

[12] Mattelmaki, Tuuli. "Design Probes." Ph.D. diss., University of Art and Design Helsinki, 2006.

[13] Raijmakers, B., W. W. Gaver, and J. Bishay. "Design documentaries: Inspiring design research through documentary film." In the *Proceedings of the 6th conference on Designing Interactive Systems,* 229-238, New York: ACM Press, 2006.

map as a framework for writing proposals and workplans. It can also be used to explain to clients (as well as team members from other disciplines) why a variety of research approaches are needed to address different points along the design development process. On a more strategic side, I am currently using the design research map as a landscape in which to position changes taking place on the competitive front and as a framework for future scenario development.

For example, by looking at changes in activity on the map over time, you can see where design research is heading and how fast it is getting there. This long view can be very useful in making strategic business decisions.

How Have Others Used the Map?

The map was originally offered as a scaffold to support conversation and to spark future thinking and doing. It was presented as a collage that is still taking shape. I invited readers to contribute additional dimensions, layers, zones, clusters and bubbles [1]. (See Figure 3.)

A few people have taken me up on that offer. Peter Jones, managing principal at Redesign Research, Inc., used the map to position his primary area of expertise called Dialogic Design. This adds new content to the map and enriches it tremendously.

"Design Dialogues imagines the possibilities of design as a transformative revisioning of systems that matter. We require new tools of design thinking and social engagement to energize the wisdom of participants. Dialogue is between perspectives, around a multi-perspective design canvas of products, systems, organizations and societies. In a world of complex, wicked problems, design has many cultural instruments, of dialogue, arts, research, and action [7]."

Jaime Barrett, a recent MAA in design graduate from Emily Carr Institute of Art and Design, found the map to be useful in helping her find her way on the thesis journey [8]. "When Liz presented her cognitive map at Emily Carr Institute, I became acutely aware of the spaces where designers and researchers could learn from one another. It was astounding to see the work Liz has done to show just how different disciplines overlap. Liz painted a larger picture for me that day: I had always wondered if many different disciplines and fields actually do the same thing, but we all just call it something different. This inspired me to actually see myself and my work as sitting in both fields of research and a design; and it has especially allowed me to feel as if I could contribute and make a difference. Even just knowing that there are others out there with similar interests has inspired me to continue looking for new and interesting ways to contribute from a design perspective. And all of this came from such a small little map [9]." (See Figure 4.)

Anne Kirah, a consultant in People Centered Concept Making, on the other hand, adds no new content to the map. She modifies it to serve her needs, i.e., to reflect her own perspective and perhaps that of a European audience. (From a pre-
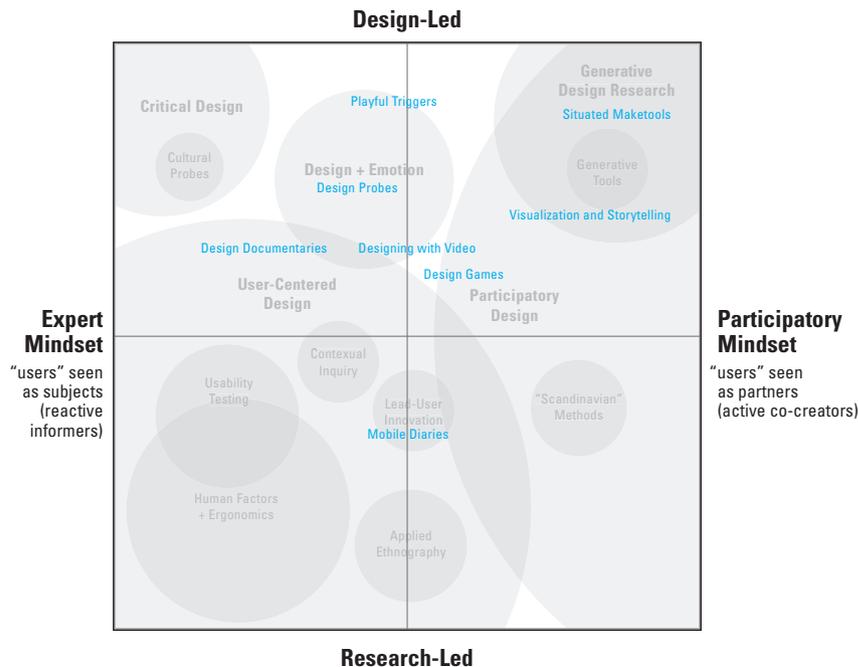
► Figure 5. Map of Design Research—New Tools and Methods

sentation called: "Methods or Mind-set? Issues of concern in designing for a global world and with the goal to improve lives.")

Anne has changed the map by relabeling some of the areas (e.g., participatory design becomes people centered innovation) and by changing the size and manipulating the areas of overlap between some of the bubbles. She also chooses to leave certain bubbles off the map (e.g., generative design research) [10].

How Is the Map Evolving?

The map of design research methods can be used as a framework for organizing design research tools and methods and also as a net for capturing and revealing ideas about possible futures. It is clear that the current growth in design research is on the design-led (versus the research-led) side of things. We can expect to see more definition on this side of the map in the near future as we look to the arts and design for inspiration. Some of the new tools and methods for design research are listed below. It is interesting to note that most of them are from the European design research community. (See Figure 5.)

- design games [11]
- design probes [12]
- design documentaries [13]
- visualization and storytelling [14]
- playful triggers [15]
- designing with video [16]
- Mobile Diaries [17]
- Situated Make Tools [18]

Loose Ends

An unresolved issue is what to do with the explosion of interest in co-creation from a marketing perspective. This view appears to be focused primarily on digital forms of co-creation that takes advantage of the social networks in harnessing enormous amounts of input at a low cost. Marketing-driven approaches to co-creation are generally not being practiced from a participatory mind-set as is evidenced by their (over) use of the phrase "customer co-creation." If people were truly valued as co-creators, they would likely be seen and referred to as "partners" or "co-creators," not "customers." It is as though the co-creative marketers are not on the map, but are seeing/sensing the landscape and figuring out how to take advantage of the activity for their own gain. It is interesting to see how this will turn out.

Thanks to Carolina Gill (assistant professor in design at OSU) for the title of this article.

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Signifiers, Not Affordances

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It's time for a review. As times and technologies change, as we have moved from individual to group, social, and even cultural computing, and as communication technologies have become as important as computational ones, how well have our design principles kept up?

One of our fundamental principles is that of perceived affordances: how we know what to do in novel situations. That's fine for objects, but what about situations? What about people, social groups, cultures? The answer is the same, yet different. Yes, there are still perceived affordances, constraints, and conceptual models, but there's more. There are trails. There are behaviors. We know how to behave by watching the behavior of others, or if others are not there, by the trails they have left behind. As we move from the world of stand-alone objects to social structures, complex, intelligent products, and a heavy dominance of services, then new principles are needed.

Powerful clues arise from what I call social signifiers. A "signifier" is some sort of indicator, some signal in the physical or social world that can be interpreted meaningfully. Signifiers indicate critical information, even if the signifier itself is an accidental byproduct of the world. Social signifiers are those that are relevant to social usages. Some social indicators simply are the unintended but informative result of the behavior of others. Let me illustrate.

Suppose you are rushing to catch a train. You know the train was scheduled to depart soon. You run across the city, run up the stairs in the train station, and rush on to the platform. But there is no train. Did you miss it, or perhaps it simply has not arrived yet? How can you tell? The state of the platform serves as a signifier. People milling about? The train has not arrived. An empty platform? Oops, you missed it. This is an example of an incidental, accidental signifier. It isn't completely reliable, working better in small towns with only occasional trains than in crowded cities where many trains use the same platforms, but that is the nature of signifiers: often useful, but of mixed reliability.

Social signifiers, such as the presence or absence of people on a train platform, painted lines on the street, the trails that signal shortcuts through parks or across planted areas, are examples of signaling systems. Signals come in many forms, sometimes naturally evolved, sometimes conventions of culture. Cues carry evidence, sometimes completely unintentional, as in the emptiness of the train platform. A flag's fluttering in the wind is a clue to wind direction and speed, usually unintentional, but nonetheless useful evidence to the observer. Sometimes the evidence is a trail or trace of previous behavior: desire lines, as these are called in architecture and city planning—when the trails made by people's footsteps across fields indicates their desire for paved paths.

I call any physically perceivable cue a signifier, whether it is incidental or deliberate. A social signifier is one that is either created or interpreted by people or society, signifying social activity or appropriate social behavior. Thus, although there are many possible signifiers of wind speed and direction, including flags, the movement of grasses or tree leaves, or traveling debris, if the signifier is a flag, it is also a social signifier—people placed that flag in its location, presumably for a reason (which may have nothing to do with providing an indication of the wind).

Signifiers, Not Affordances
The concept of "affordance" has captured the imagination of designers. The term was originally invented by the perceptual psychologist J. J. Gibson to refer to a relationship: the actions possible by a specific agent on a specific environment. To Gibson affordances did not have to be perceivable or even knowable— they simply existed. When I introduced the term into design in 1988 I was referring to perceivable affordances. Since then, the term has been widely used and misused. The result has been confusion and a gold mine

for academic scholars, who get to write learned articles about the true meaning of the term.

People need some way of understanding the product or service—some sign of what it is for, what is happening, and what the alternative actions are. People search for clues, for any sign that might help them cope and understand. It is the sign that is important, anything that might signify meaningful information. Designers need to provide these clues. Forget affordances: What people need, and what design must provide, are signifiers. Because most actions we do are social, the most important class of these are social signifiers.

We are all detectives searching for clues to enable us to function in this complex world. Whether it is flags waving in the wind, the difference between empty or crowded train platforms, or the desire lines illustrated by footprints in the fields, we search for significant signs in the world that offer guidance. In the social world comprising people and technology, these cues are social signifiers.

Consider a bookmark, a deliberately placed signifier of one's place in a book. But the physical nature of books also makes them an accidental social signifier, for the placement of the bookmark tells the reader how much of the story remains. Most readers have learned to use this accidental signifier to aid in their enjoyment of the reading. With few pages left, we know the end is near. And if the reading is torturous, as in a school assignment, one can always console oneself by knowing "only a few more pages to get through." Electronic book readers do not have the physical structure of paper books, so unless the designer deliberately provides a cue, they need not convey any signal at all about the amount of text remaining. The traditional browser on the computer screen provides a deliberate social signifier, with the position of the scrollbar showing how much more of the document remains and its length showing what proportion is visible at the moment. Hill, Hollan, Wroblewski, and McCandless's addition of usage marks—edit wear and read wear—is yet another clever way for designers to add signifiers to guide readers of electronic documents [1].

The signifier is an important communication device to the recipient, whether or not communication was intended. From the purpose of surviving in the world, it doesn't matter to an individual whether the useful signal was deliberate or incidental: To the recipient, no distinction is necessary. Why should it matter whether the flag was placed as a deliberate clue to wind direction (at airports or on the masts of sailboats) or whether it was there as an advertisement or symbol of pride in one's country (on public buildings): Once I interpret the flag's motion to indicate wind direction, the flag's intended usage no longer matters.

Whatever their nature, planned or accidental, signifiers provide valuable cues as to the nature of the world and of social activities. For us to function in this social, technological world, we need to develop internal models of what things mean, of how they operate. We seek all possible cues to help in this enterprise, and in this way, we all act as detectives, searching for whatever guidance we might find. If we are fortunate, thoughtful designers provide the clues for us. Otherwise, we must use our creativity and imagination. (This is the premise behind Distributed Cognition [2].)

Social signifiers replace affordances, for they are broader and richer, allowing for accidental signifiers as well as deliberate ones, and even for items that signify through their absence, as the lack of crowds on a train platform. The perceivable part of an affordance is a signifier, and if deliberately placed by a designer, it is a social signifier.

Designers of the world: Forget affordances. Provide signifiers.

ABOUT THE AUTHOR Don Norman wears many hats, including cofounder of the Nielsen Norman group, professor at Northwestern University, and author. It should not come as a surprise to learn that social signifiers play a major role in his new book, tentatively entitled *Sociable Dezsign*. He lives at jnd.org.

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User Experience Design for Ubiquitous Computing

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I think 2005 was the year we began living in the world of commonplace ubiquitous computing devices. That year Apple put out the screenless iPod Shuffle, Adidas launched the adidas_1 shoe, and iRobot launched the Discovery—its second-generation vacuum robot.

Sadly, even though we live in that world, the user experience design of most everyday ubiquitous computing devices—things you see in gadget blogs—is typically terrible. That's because we do not address ubicomp user experience design as a distinct branch of interaction design, much as we did not treat interaction design as separate from visual design in the early days of the Web.

In the last couple of years, I have conducted research for and designed a number of ubicomp user experiences. In the process, I've seen some of the seams between industrial design, interaction design, architecture, and ubiquitous computing user experience design. In this article, I have tried to pull together some approaches that seem particularly valuable in the ubiquitous computing user experience world. None is unique to it: They're all general design guidelines, but they seem to apply particularly well to the particular design challenges of this field.

Make Tools, Not Platforms

Like the fashion aphorism that just because you can wear two things together, it doesn't mean you should, the ability to do arbitrary information processing does not imply the need to design yet another general-purpose device. We have laptops and phones for that.

It is because CPU power is so cheap that ubicomp UX design should concentrate all design and processing on a narrowly focused set of functionalities. Yes, a single device can be a dictionary, a calendar, a notebook, an alarm clock, a TV, an audio recorder, play every media format, and work as an 8-bit game machine, but doesn't that just sound like an underpowered laptop?

Define Services Before Designing Devices

Service design gives to ubicomp UX the notion that every object is more than just a stand-alone tool; it's now the representative of a service. A physical, networked object is an avatar of a service that can be accessed in many other ways. This requires that affordances for the immediate task be included in the design of the product experience, and that the relationship between various pieces be taken into consideration.

ThingM, my company, developed WineM, our prototype smart wine rack, as an avatar of a service. The rack uses RFIDs on each bottle to track where every bottle is and then displays information using glowing LEDs behind the bottles. When we designed it, we treated the rack as one way to provide access to a service that associated a specific bottle with corresponding metadata, which was in turn part of a system that linked wine producers, distributors, retailers, and consumers together in such a way that everyone in the chain benefited from adopting the technology. The rack is a particularly visual manifestation of the service, but the service would be available through an API that could be accessed through many avenues.

Don't Overload Affordances

Ubicomp UX inverts several basic assumptions of traditional screen-based interaction design. While Web and software design aim to represent physical-world tasks on a monitor, the goal of ubicomp devices is to skip representation and directly enable activities in the world. Likewise, while many of the challenges of screen interaction design involve using rich general-purpose input and output methods in a novel way, many ubicomp products use narrow-focus, spe-

cialized devices.

Mixing the two philosophies can create confusion. Your doorknob doesn't double as a volume control for your stereo, though in today's fly-by-wire world, it can. For example, when BMW developed its iDrive system, which mapped a large number of different functions to a single input device, the mismatch in expectations created interface havoc that took the company many revisions to correct.

Don't Reinvent the Wheel
Although the ubiquitous computing industry is new, the field itself is close to 20 years old; it predates the Web. It's relatively unusual that a technology takes as long to leave the research world and enter the market, and it's a situation that provides an unusually rich backlog of academic and corporate research projects to learn from. Virtually every idea appearing commercially has been tried and documented in conference proceedings. When doing background research for a museum project, we discovered more than 20 closely related academic and commercial projects. Reading those gave us important guideposts that let us focus on creative solutions that improved on what had come before, without first having to recreate it. It took a couple of days of reading and
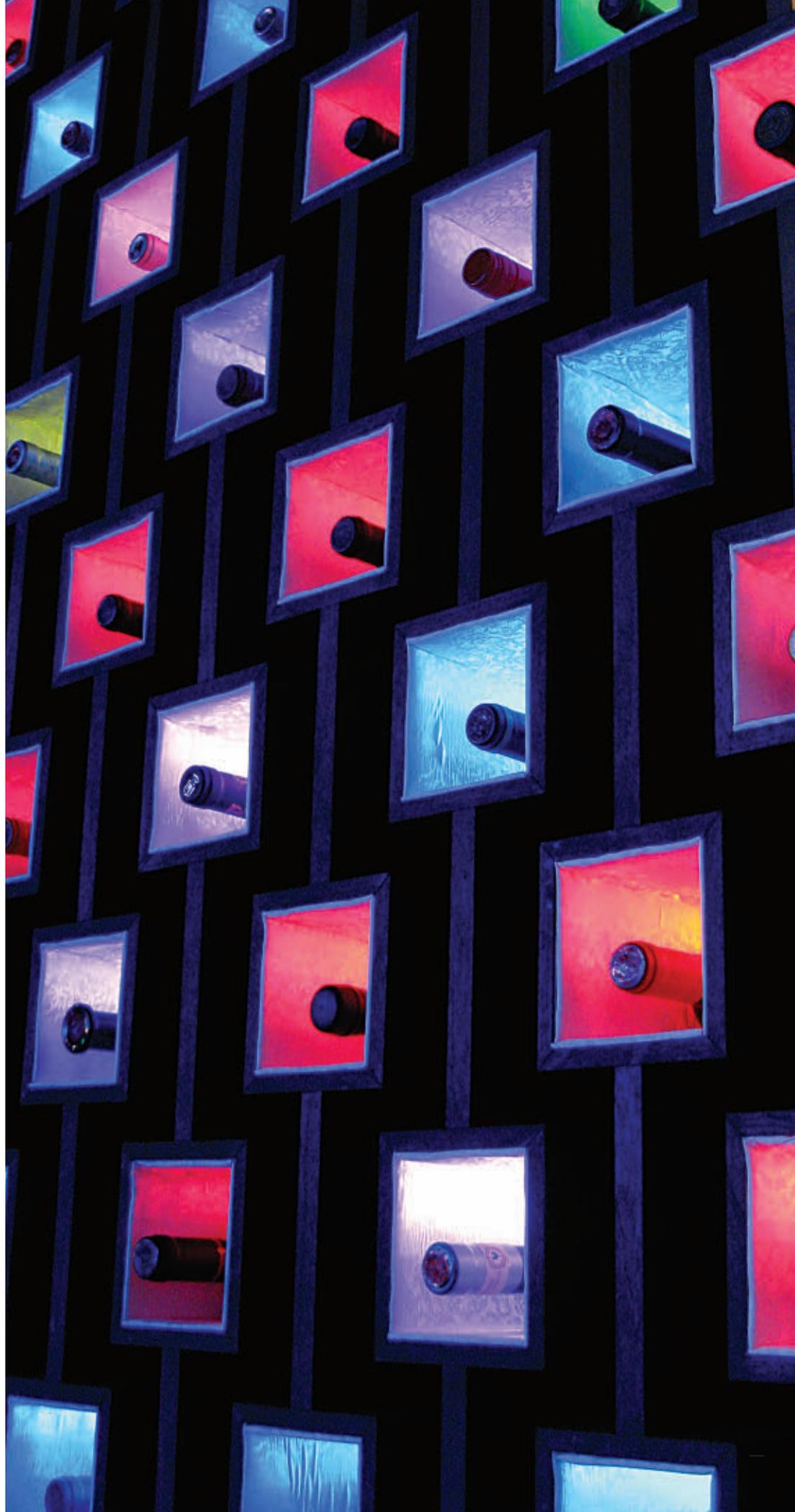
synthesis—and saved us weeks of wrong directions.

Respect the Society of Devices
Few devices exist in a vacuum. General-purpose computers are designed largely to stand alone or exist as a hub connecting a bunch of peripherals. Technology-savvy Westerners simultaneously carry (or ride in) a large number of devices, everything from laptops to smart key fobs.

Riffing off of Marvin Minsky's *Society of Mind*, let's call this technology cloud the society of devices. Each device does something specific, and some are more powerful than others. How do they all work together? How do they integrate into the larger set of devices and services out in the world?

On the interaction-design level, this means understanding users and their needs in light of the all of the devices that they may have. For example, while it's possible to get email on many different devices, presenting it in a way that respects the unique constraints of a device and stays consistent with other devices becomes key when helping people transition between them. Text email accomplishes this using a universal format (text) with a well-defined structure (To:, From:, etc.). The minute that an attachment is included or there is HTML in the message, that consistency vanishes.

Create Physical Behaviors, Not Visual Representations
Screen interface design is essentially a visual practice, with some audio. But screens are expensive, power hungry, and large. Too many quickly overwhelm vision, our primary sense, and become a distraction, rather than a tool. However, not all information is so primary that it requires the attention of our primary sense.

Industrial design incorporates the physical senses of temperature, texture, and vibration into devices. Ubicomp UX is essentially the coupling of these two sets of ideas to create behaviors that match information priority with available sensory bandwidth and less cognitive load.

For example, say I'm looking for a new apartment in the town where I already live. I don't need to move, but I'd like to. I set my (hypothetical) GPS unit to download a data stream of apartments that match my criteria of price, size, neighborhood, and proximity to at least three cafes with free Wi-Fi. As I drive/ride/walk around the city when I approach one of these locations, the GPS vibrates in proportion to how well it matches my criteria. I don't need to look at it; I just need to feel it to get the crucial piece of information.

Use Information Processing As a Material
When a designer can include information processing in a product for very little cost, the calculation becomes not one of complexity, but of competitive advantage. Including a CPU to produce behaviors in a product becomes a line item when deciding what to make it out of, rather than the expensive core around which to wrap a case. And like a material, that information processing capability creates some new capabilities, and imposes new constraints.

We designed BlinkM, a smart LED, with this in mind. It's designed for interaction designers, industrial designers, and artists to prototype sketch ideas in hardware. The user experience around it emphasizes its role as a material. We designed it to be inexpensive, robust, and to offer just enough capabilities to be easy to work with immediately, while still remaining openended.

I believe that ubiquitous computing technologies are incredibly powerful. However, ubicomp user experience design is still a very young discipline, without a track record of obvious best practices. In its failures, we see the inadequacy of applying older design paradigms to the capabilities of new technologies. If design people first encounter new technologies through design, then careful reflection on our design processes early on is essential for increasing the chances of technology's positive impact. That time is now.

ABOUT THE AUTHOR
Mike Kuniavsky is a writer, designer, and researcher exploring the intersections of high technology and everyday life. People around the world use his 2003 book, *Observing the User Experience*, to understand the relationship between people and products. He is a cofounder of ThingM, a ubiquitous computing development studio and was a founding partner of Adaptive Path, a San Francisco design consultancy. His next book will discuss ubiquitous computing user experience design. He blogs at orangecone.com.

Cultural Theory and Design: Identifying Trends by Looking at the Action in the Periphery

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Cultural theory helps us understand users' needs and desires; it sheds light on why people are likely to adopt one trend but not another and helps indicate what cultural influences are shaping society at any given time. It points out things like why our love for the iPod extends beyond its functionality as an MP3 player and includes our collective embrace of its distinctive white headphone cords. So although design practice has ways of understanding technological features—and of eliciting user needs—cultural theory helps to illustrate the symbolic value of technological artifacts, which is often at least as important to their adoption and use as their instrumental functions. This makes cultural theory a viable way for a designer of new technologies to produce a well-received product or service.

The use of cultural theory in the design process is not necessarily about telling designers to "do" something different. Instead, like other theories, it is about thinking differently. The use of cultural theory is being applied in the development of a mobile phone prototype called Swarm, illustrating how different conceptual thinking can lead to actual results [1]. This is followed by speculation about how this type of thinking can be applied as part of the design process.

Application of Theory to Practice
A three-year study of mobile phones and youth culture revealed that participants' needs were not about technology; they were about culture, style, fashion, identity, friendship, and deceit. Translating such complex, subtle user needs into design called for a framework to contextualize these nuances of mobile-driven interactions [2]. Cultural theory was ideally aligned to do this because it provides an in-depth perspective on the ingrained and intangible practices that are at the heart of social communication [3]. What follows are two key concepts—"focusing on the action in the periphery" and "digital identity"—along with an illustration of these concepts as found in user data and in a design.

Focusing on the Action in the Periphery
Cultural theory looks beyond mainstream culture and focuses on activities occurring on the periphery. This means that previously unrepresented groups and practices come to focus [4]. For example, one of the peripheral groups that have been of most interest to cultural theorists is youth. Significantly, cultural theory provides a holistic critique of everyday social behaviors of youth cultures, not as some sort of novelty but as unique, meaningful cultural formations. This is important because innovation is often occurring within the subcultures of youth cultures: Think hackers and gamers. By understanding the activities of these fringe users, new designs can successfully be brought into the mainstream. The process through which illegal underground peer-to-peer file sharing culminated in the development of the iPod is a classic example of this.

When taking this view, the focus of attention is not what properties youth have as a class of users, but rather by what mechanisms youth is constituted as a cultural category—not so much "what youth is doing," but "how youth is doing it." This highlights the contrasts between what the HCI usability specialist would look for and what the cultural theorist would look for. Another way of considering the difference is an emphasis on goals as compared with experi-

[1] "Cellphone Tells the World What Mode You Are In." *New Scientist.* 23 December 2006.

[2] Satchell, C. "Cultural Theory and Real World Design: Dystopian and Utopian Outcomes." In the Proceedings of *CHI '08,* Florence, Italy, 2008.

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[4] Eagleton, T. *AfterTheory.* New York: Basic Books, 2003.

Cultural theory offers an alternative to traditional usability approaches by focusing on the cultural contexts in which technologies are put to work.

[5] Turkle, S. Life on the Screen: Identity in the Age of the Internet. New York: Simon & Schuster, 1995.

[6] Laurel, B., ed. *Design Research: Methods and Perspectives*, 196. Cambridge: MIT Press, 2003.

ences; traditional ethnographic HCI technique watches work unfold in a very pragmatic sense. Cultural theory watches culture unfold, in a much more ethereal sense.

Cultural theory, then, provided a useful lens for understanding the needs of young people in the user study and helped to reveal features of youth culture as a social construction. In doing so, the signifying features, as distinct to those of mainstream society, were revealed. This analysis demonstrated that for a new generation the mobile phone was integral in the formation of fluid social interactions and had accelerated urban mobility. Users once restrained by premade plans were able to spontaneously traverse the city and suburbs, swarming between friendship groups and activities. A distinct user archetype was emerging from these mobile-phone-driven subcultures—the Nomad. While this may have been a predictable finding for older generations, it represents a dramatic shift in thinking about

teenagers and youth. For these users, the mobile phone was central in the construction and expression of social existence, resulting in mobile-phone-generated spaces becoming the new place for the digital generation to "hang out." Could current systems be improved to better meet their needs?

Looking at the signifying elements of youth culture itself provided insights that shaped the development of a design called the Swarm. Mobile users were disconnected physically but connected digitally. They responded to increasingly fragmented lifestyles by turning the mobile artifact itself into a kind of virtual home base. This enabled them to continually express and maintain their identity, albeit a digital representation of it. In response, the Swarm has at its core a virtual lounge room where, through the use of avatars, users can maintain a virtual presence where they can always be found.

The avatars depict the user's current activity and can be programmed to appear on the user's friends' mobile phones. As the activity changes, the avatars can be updated accordingly. This allows individuals to see at glance what the other members of their friendship networks are doing at any particular time. By providing users with this contextual information about what other members of their social group are doing, presence and intimacy are maintained. This can give serendipity a nudge, facilitating interactions with individuals or groups who may be in the same vicinity. In turn, users can draw on their sense of social and cultural etiquette,

and depending on the nature of the activity, decide not to disturb one another.

Instead of focusing on user goals and tasks, cultural theory identified an emerging trend, and design activities were used to capitalize on this trend in the creation of tangible screens.

Digital Identity

A central interest for cultural theorists is the representation of identity and how in the disembodied world of digital space, the cues to identity that we have in the real world are absent. The result is that digital identities have greater fluidity. For example, Turkle finds that digital environments allow users to shed the human qualities of age, gender, race, disability, and even—as in the case of an HIV-positive man who had promiscuous online sex—disease [5]. Furthermore, unlike notions of identity held within ubiquitous computing that aim to reveal where a user is located and what their activity is, the use of culturally informed perspectives into digital identity presents the challenge of allowing different identities to be expressed in a range of contexts.

At a time when designers are theorizing about the nature of user experiences in digital environments—and asking, as researcher Laurel does, "Can we create real social depth? [6]"— these perspectives provide more than academic insights into the ideology of identity politics. They have a practical application, encouraging us to consider the implications as a new generation extends their identity into an increasingly pervasive digital sphere. Being digital is not about

being anonymous; it's about reconstructing identity in digital spaces. What qualities do people want to include as they rebuild their digital self? What do they want to leave out?

A major challenge in developing a prototype of the Swarm was to allow the user to create a digital identity that, as in real life, was not singular or static. Instead, users can take on many different personas in accordance with the nature of the activity they are conducting or the person they are interacting with. Therefore, the Swarm supports avatars that simultaneously represent the users' multiple identities. For example, a user can set a social avatar for friends to see while simultaneously projecting a professional avatar to colleagues. Furthermore, in order to allow greater creativity when creating digital identities, the user can embed their avatar with digital content that will be revealed when it is clicked on. This can act as an incentive for those not present to join the person or allow for those who can't be there to "get the picture."

Situating Cultural Theory in a Broader Design Spectrum
Cultural theory, then, offers an alternative to traditional usability approaches by focusing on the cultural contexts in which technologies are put to work, and it offers a way to understand not just how they are deployed and used but how they are experienced and understood. These glimpses of the complex forces that drive us to engage with technologies in a particular way are useful for designers wanting to move beyond "efficiency" and "function" to incorporate more

abstract user needs such as "identity" and "friendship."

If we took an engineering approach to digital systems, we would ask questions about how users or systems worked. If we took a usability approach, we would ask questions about how people would understand systems and put them to use. However, both approaches leave other questions unasked. How do pages on MySpace or Facebook reflect youth subcultures? How do digital cameras change the way that people think about images? What roles do mobile phones play in people's lives? Reflecting the idea that digital media are not simply engineering artifacts but cultural objects, these sorts of questions are the domain of cultural theory.

Applying Cultural Theory
Our experience with the Swarm prototype demonstrates that a cultural analysis had relevance for our project. You might ask, how could it have relevance for yours? By and large, cultural theory resists easy reduction to rules of thumb and straightforward communicable "implications for design." There are no simple formulas or slogans. A cultural theorist could be hired as part of a commercial design team to provide insights into the forces that drive us to adopt a particular trend. Yet these insights would be inexorably entwined with the discipline's origins in Marxist theory, meaning they would be arrived at via a searing critique of consumer culture. For this reason, although a cultural theorist could be an immensely useful addition to a commercial design

team, in all likelihood, their perspectives may not seamlessly align with the vision of corporate culture. So is there a middle ground between these options and the direction to go absorb Baudrillard, Deleuze and Guattari, Derrida, and Foucault?

There is, but it lies not so much in "what we should do" and more in sensitizing one's self to cultural theory concerns about "what we should recognize" as we go about traditional ethnographic approaches. We should recognize that digital artifacts are important not so much for how they work, but for what they mean to people and for people. What we need to address is not so much how people use technology but how they live their lives through it. If there is a take-home message for design practitioners, then, it is to be aware that usability of information technologies is often secondary to their utility, and that cultural theory offers a perspective on the uses that technologies and artifacts serve for people in everyday life.

ABOUT THE AUTHOR
Christine Satchell Ph.D. is a senior research fellow with creative industries at Queensland University of Technology and an honorary research fellow with the Interaction design group at the University of Melbourne. My research is about understanding the social and cultural nuances of everyday user behavior in order to inform the design of new technology. Currently, I am part of a team focusing on the relationship between constellations of technologies including mobile devices, social networking sites, sensors, and shared displays in urban environments.

Understanding Children's Interactions: Evaluating Children's Interactive Products

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It was Peter Medawar who wrote, "Today the world changes so quickly that in growing up we take leave not just of youth but of the world we were young in...." The world of interactive technology changes so rapidly that for most adult observers, the interactive world inhabited by children is both unknown and, once entered into, under-comprehended.

Some interaction design researchers have tried to make sense of children's interactive technology by immersing themselves, as much as they are able, in children's worlds. In particular, these researchers place great emphasis on involving children in the design and evaluation of interactive technologies, both to learn about the technologies and to learn about children's interactions.

This immersion was, to some extent, a result of the considerable activity in the study of interactive technology for children that took place about 10 years ago. One product of this era was the seminal work by Hanna, Risden et al. on usability testing with children [1]. This work was published in *interactions* at a time when the emphasis on the design of interactive technology for children was shifting from a concern with educational aspects to a more general interest in designing for children [2].

As it was set in an industrial landscape (the authors of this work were usability engineers at Microsoft), the paper provided well-considered advice for "would-be" evaluators of children's interactive technology at a time when the inclusion of children in the testing and design of their own products was only really just gaining ground.

So What Did We Know 10 Years Ago?
The paper offered practical advice regarding the setup and planning of a lab-based evaluation session with children. This advice included:

- Make the lab child friendly
- Use input devices that the children are familiar with
- Use recording devices and one-way mirrors sympathetically
- Give younger children shorter lab times than older ones
- Be aware that children get tired; shuffle tasks around

The authors then made several suggestions for how to make children comfortable. They described some methods for getting to know the children and making small talk with them. They emphasized the need to make children aware that the interactive technology, not the child, was what was being tested. They also stressed the need to ensure that the children's expectations were met (if they came expecting fun—they should have fun!). Instructions were included for would-be evaluators about how to make the children, and their parents and siblings, comfortable in the lab and the area of test task design—test tasks that can be broken down into bite-size chunks—was discussed as well. In particular, it was stressed that the evaluator needed to ensure that all children, including those with reading difficulties, could easily understand any instructions associated with the test.

What Has Changed?
If time stood still, and technology and children never changed, the original work by Hanna, Risden et al. would no doubt still be as valid now as it was then. But as we all know, nothing stays the same, and in the dynamic area of interactive technology and children, change is inevitable and rapid.

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Technology has changed. In 1997 the iPod had not been invented, the Internet was primarily dialup, the phone tended to have a cable attached. "Mobile computing" referred to heavy laptops, ubiquitous computing was still not much more than an idea, and RFID technology was restricted to cows' ears! Many new technologies cannot be easily evaluated in usability labs and as technology has changed, usability is no longer the only attribute of interest. There is now a much greater emphasis on fun, desirability, and user experience.

Social changes. The world now feels much smaller than it was. Online communication has grown—children now communicate effortlessly online in social networks and chat online in much the same way as they do face to face. Schools now emphasize collaboration with online learning environments, and children play online computer games with other children they will never meet. In these contexts, evaluations of interactive technology need to take account of children working together, over time and across locations. The lone child at a computer is becoming a rarity.

Political changes. No longer can children be regarded simply as subjects in user tests. Changes in legislation and in children's roles in communities mean that they now have greater social capital than ever before. Children expect to be included in the design of their worlds; they certainly know about technology and have a lot to say. When looking at interactive technology with children, this confidence can unnerve the less savvy evaluator. Twenty-first-century evaluators need to ensure that children's rights are observed while also giving them a voice.

New evaluation methods. As would be expected, the past 10 years have seen research into the use and usability of different evaluation methods with children. Notable examples are methods like peer tutoring [3], studies that validate existing methods [4, 5], and studies that create and validate new tools for use with children [6]. In planning an evaluation, as in all work with interactive technology and children, we need to take note of what is already known—failing to learn from the research of others can often result in a poor experience for children.

Giving the Original Guidelines a Makeover
The original guidelines are essentially still highly relevant because, after all, a child is still a child. However, there are three areas where it appears, in the light of the changing times, that some adjust-

ment is needed: these are timing, screening, and participation. Also, as there is now new knowledge about interactive technology and children, there are some additional guidelines to be aware of.

In the original work, the researchers held usability tests between 30 minutes and an hour long. In our experience, and that of many others, this now seems rather liberal. Maybe children have shorter attention spans than they used to, but modern young children can often concentrate for only very short periods—as short as 10 minutes—and even older children find sessions beyond 30 minutes problematic. A good rule is to keep evaluations as brief as possible. It is possible, with short breaks and a sufficiently engaging product (maybe a game), to keep children for longer, but this is more of an exception than a recommendation.

The screening of children for participation in evaluations of interactive products might be a necessary evil in the time-poor world of commercial usability testing (in which you really might not want children who cannot read), but in a world where equality and inclusion are center stage, as many children as possible should be allowed to join evaluations, even if their contribution might not be useful to the researcher or test administrator. Nowadays, the mantra should be, "the child's experience matters as much as the evaluators' results!"

In designing for the child's interactive experience, whereas Hanna, Risden et al. advocated keeping a parent or adult with the child, it is more common these days to have children paired with a friend (which after all is what generally happens in the real world when the children are using interactive technology), with the parent playing a more disconnected role. At the same time it is necessary, in an era of litigation and concerns for the safety of children, to warn against any situation that places a single tester in a room with a single child.
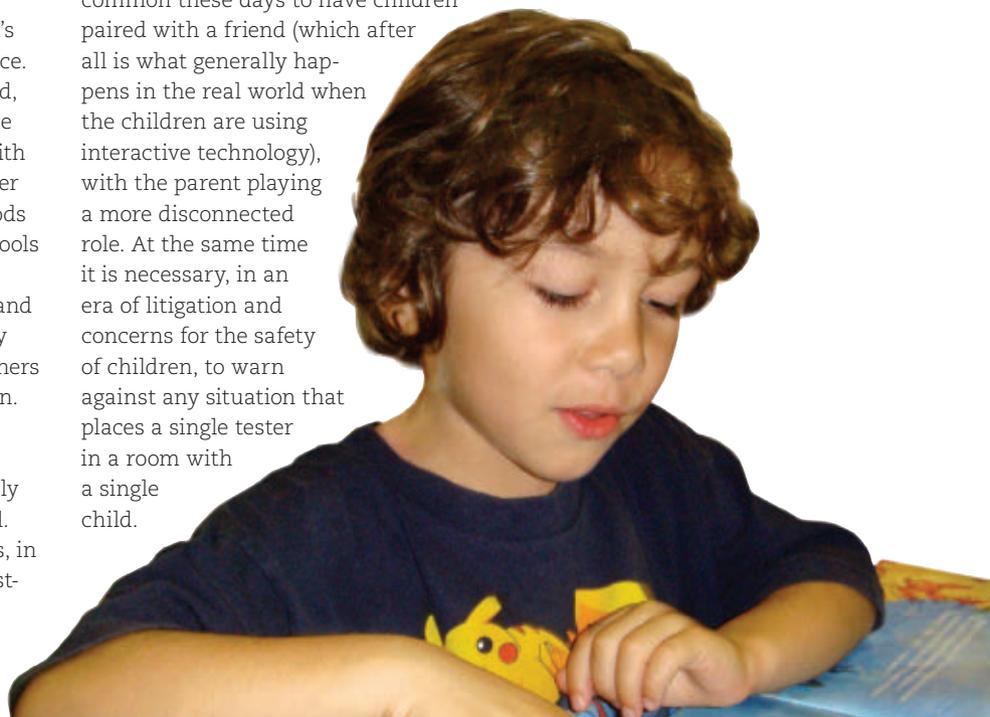
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Some Extra Tips

The new advice given here is in three parts: We consider the stage before the evaluation, some tips for during the evaluation, and include guidelines for wrapping up the evaluation.

Planning the evaluation. Because children are, at the same time, predictable and unpredictable, it is important to plan well. In particular, carrying out a pilot evaluation that mimics as closely as possible the real evaluation is valuable. This pilot will demonstrate if the chosen recording methods are sensible, if any test tasks are doable, and if any survey instruments are age-appropriate.Before the real evaluation of the technology, there are often some design-and-create activities to be completed. Logging sheets for evaluators, survey instruments for use with the children, or diaries for the evaluation process might all need designing and piloting. Once these tasks are complete, there will also be a need to fix up transport, obtain consent from the children and their guardians, book rooms, arrange refreshments, and carry out a risk assessment.

Different locations and different methods. As interactive technology has become more mobile, and as schools have become more open to interactive technology, evaluations in labs are now quite rare. When looking at technology in schools, it is necessary to work within the structure and confines of the school day. The lesson length, for instance, is often an impermeable feature around which the evaluator will need to plan. Outdoor evaluations are difficult to control; our advice is to keep the evaluation as simple as possible, rely as little as you can on the use of technology, and carry out a very careful risk assessment. In many locations there will need to be a bad-weather backup plan.

Four methods that have been studied in some depth over the past 10 years are diary methods, think-aloud methods, surveys, and the Wizard of Oz method. Diary methods are well suited to home evaluations and those that take place over a length of time; think aloud—previously assumed to be unusable with younger children—has been shown to be possible with children as young as seven and eight; and for surveys, many evaluators now use the fun toolkit, which is a validated method for gathering children's opinions of technology. The location and maturity of an evaluation can dictate the method used. The use of diaries, for example, can be a good choice for evaluations at home, and Wizard of Oz studies (where children interact with a partially functional product that is in part "driven" by an unseen assistant) can be very handy when a fully working system is not available. It should be noted that Wizard of Oz studies present some ethical issues, especially in relation to the use of deception. After the event, researchers will need to tell children that deception has occurred and give them the opportunity to withdraw their consent; where at all possible, open configurations should be used with the wizard seen.

Wrapping up. After evaluations, researchers need to thank the children and tell them what they've contributed. As outlined earlier, the child who participates in an evaluation has some right to know what the point was. While thanking the child, the researcher must often thank teachers and parents, and the more information that they can share about the nature and purpose of the evaluation, the better.

Back at the lab, the modern-day evaluator can breathe a huge sigh of relief (once any data has been made anonymous and safely stored and tagged) after what is often a noisy, but very enjoyable, day's work. The information gathered about the interactive technology should inform better design of products for children—the time spent with children will have deeper, less tangible benefits—an understanding of the child's world, a moment to lapse back into a space long departed, and a gentle, much-needed, confirmation that humanity still has possibilities.

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An Exciting Interface Foray into Early Digital Music: The Kurzweil 250

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The name Raymond Kurzweil is likely to be familiar to most readers. One of his many inventions, the Kurzweil 250, was the first 88-key polyphonic digital synthesizer on which chords could be played and that was capable of realistic reproduction of the sound of a grand piano and other acoustic instruments based on digital sampling and recording of real sounds. Stevie Wonder knew of Kurzweil because of the latter's earlier invention of a reading aid for the blind and interest in building a synthesizer, Wonder asked Kurzweil if he could create an electronic musical instrument specifically adapted for him. Because Wonder represented the kind of professional musician Kurzweil wanted to cultivate as a user and advocate for his instrument, he actually created a Braille prototype of the synthesizer.

With the expected functional complexity and a target selling price of $1,000, the design of the new machine presented a significant and very interesting challenge. For BBN Technologies, the opportunity to confront that challenge came in the summer of 1982. It all started when I received a phone call from Aaron Kleiner, a principal in the New York–based startup company Kurzweil Music Systems, who asked if I would undertake the human factors design and packaging of "a revolutionary keyboard-based electronic music synthesizer." The only thing I was not to be responsible for was the piano-like keyboard because Kurzweil had a "friend" who had invented a way to make a keyboard that simulated the feel and percussive dynamics of a real piano.

There was no formal request for proposal. My colleague Carl Feehrer and I were shown a glossy prospectus that pictured (opposite page) and touted the features of this unusual machine for the benefit of potential investors. There appeared to be no one else invited to compete for this HCI opportunity. They wanted a proposal now and a completed, detailed specification within six months. At BBN we called

such an inquiry a "bluebird"—an unsolicited opportunity that just "flew in the window." Since neither Carl nor I nor anyone at BBN had real experience with the packaging aspects of industrial design, we immediately located an industrial design collaborator, Paul Brefka of Latham, Brefka Associates in Boston. Both Carl and I could claim human factors expertise, but Carl was trained in music and I had no real music experience at all, except that I survived listening to my son "percuss" daily on his drum set in the basement. We acquired a Casio VL-1, almost a toy, for under $30 just to find out what a keyboard synthesizer was all about.

Together with Brefka, we submitted brief proposals, and after a financial negotiation during which BBN refused to accept stock in the fledgling company with an uncertain future in lieu of cash payment for our work, we embarked on a brief but fascinating project.

We immediately broke up into two teams. Brefka worked with the mechanical and electrical engineers on packaging constraints and specifications. The human factors team included Pew, Feehrer, a rock musician, and two or three Kurzweil employees—"software gurus," one of whom was accomplished both as an electronic and acoustical engineer and as a musician. We were given a very detailed 300-page technical specification for the instrument's functional characteristics and circuit design that we were told had been written single-handedly by Ray Kurzweil. We visited local music studios and synthesizer repair shops to acquire the requisite contextual data about the use, programming, and repair of such instruments. We had two kinds of meetings at Kurzweil headquarters—weekly design meetings of the two teams independently and, less frequently, coordination meetings of the combined staff.

Ray Kurzweil himself attended most of these coor-

dination meetings. He was a friendly, soft-spoken young man in his mid-30s. He exuded confidence and frequently redirected some of our activities.

The design problem for this intricate bundle of electronics hardware and software was twofold. First, musicians are rarely, and usually don't want to be, electronics engineers. They want to play. The control panel had to look slick and be perceived as simple to operate at performance time. We needed to bury the inherent complexity. Second, there were actually three levels of complexity from the point of view of the musician-user. Besides the performance time instrument, there were the pre-performance setup requirements. Contemporary professional musicians use sequences—repetitive series of notes in selected "voices" that are pre-programmed and can be selected quickly and introduced into the performance as repetitive background accompaniment. Like organists, the keyboard players want to be able to call up different sound effects while playing. Some of these to-be-called features were made directly available on the panel, but others had to be assigned to buttons ahead of time. Besides pre-performance setup, the more sophisticated user was also given the capability to record new sounds or to modify or adapt a factory-preset library of sounds.

Oh, I forgot to mention an additional design problem. Because of cost considerations—remember, this was 1982—we were told, in spite of protests, that we were limited to a one-line, 16-character

LED display with which to communicate all of these interactive control activities.

At performance time, the user was given direct access to controls needed in the course of a "gig" through sliders, wheels, buttons, and foot pedals. A digital number pad was used to call up prearranged sequences and keyboard assignments rapidly. For example, the keyboard could be "split" and have different instrument sounds assigned to different blocks of keys. Some numbers were assigned to factory presets and many more to user-defined presets.

For setting up keyboards, the time and effort constraints associated with live performance could be relaxed. We utilized the display to provide specific prompting of what to do next at each step. Preparing pre-recorded sequences was handled similarly.

The more difficult problem was providing access for purposes of creating new or modified versions of the stored keyboard layouts, i.e., the detailed features of stored sequences of notes and the parameters that make up each instrument sound specification. This was accomplished by thinking of the keyboard layout in terms of a spatial, two-dimensional matrix with different keyboard layouts arrayed vertically while horizontally, the detailed parameter specifications of key assignments were provided. The 16-character display could present only one cell of this matrix at a time, plus enough information to identify the context. The user employed the left-right and up-down arrow keys to move freely

▶ Artist's original conception of the Kurzweil "Music Machine"

among different layouts and among specifications. While in principle these arrays were very complex, the use of a spatial layout as a mental model and maintenance of consistency in the order of parameter specifications allowed a simple, predicable way of providing access.

We completed our design specification on time and almost within budget and delivered it to Kurzweil in March 1983, fully expecting to hear back from them so that we could answer questions and/or iterate our design. However, as is so often the case with consulting contracts, especially those with cash-hungry startup companies, we never heard from them again.

The commercial version of the Kurzweil 250 was officially announced at the 1984 summer show of NAMM, the International Music Products Association, with a price of $10,715 plus options —just a bit above Kurzweil's original price point. It was manufactured commercially until 1990 with several follow-on versions. Of course, comparable synthesizers today are available even below his

original thousand-dollar target price. The version introduced appeared, at least superficially, to conform largely to our original specifications, but it had capabilities well beyond those we provided for, including midi- and Apple Macintosh connections. At some point, the small display was replaced with a two-line, 48-character display.

In 1990 Kurzweil Music Systems was sold to Young Chang, a large Korean musical instrument company. It remains active as a division of Young Chang today as one of the market leaders in computer-based musical instruments, marketed in more than 40 countries.

ABOUT THE AUTHOR   Dick Pew spent 11 years at the University of Michigan and the past 33 years at BBN Technologies in Cambridge, MA, where his current employment status is "part-time irregular." His interests have spanned a range of human factors activities, from HCI to human performance modeling. At this stage of his career, history becomes an attractive topic.

Some Different Approaches to Making Stuff

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Business case studies are the ultimate in reductionism: A complex business activity rooted in a specific context of people, company culture, time, and place is boiled down to a few key ideas. Consultants, designers, students, and people who read Malcolm Gladwell are especially prone to this form of simplification. Don't get me wrong—these simplified stories can be helpful as touchstones. We just need to remember that they are often apocryphal archetypes more than investigative summaries.

With that in mind, I propose an incomplete framework for how companies go about making stuff (products, services, miscellaneous). In characterizing this as incomplete, I hope to hear about other approaches that will flesh out the framework.

Let's call the first approach "Be a Genius and Get It Right." The poster child for this is James Dyson. Dyson famously spent five years and built 5,127 prototypes in developing his Dual Cyclone vacuum cleaner. He reimagined the architecture and performance of a commodity product and built a premium brand around his approach to innovation. The company has developed other vacuum-cleaner innovations, such as The Ball, and has explored (so far without success) other home-appliance categories, such as refrigeration and clothes washing. Regardless of how these products were really developed, a significant element of the Dyson brand involves the narrative of the single individual—a "genius" who brings powerful clarity of vision and an ability to execute.

In contrast, there's "Be a Genius and Get It Wrong." A strong example is Dean Kamen's Segway. Kamen's audacious vision for personal transportation in modern cities and Segway's amazing technology captured everyone's imagination when the device was first introduced. But the "best" technology doesn't always win. Literature on innovation is filled with stories of path dependence and explanations for the failures of technologies like Sony's consumer Betamax, the Dvorak Simplified Keyboard, or HP's 100VG networking protocol. In Segway's case, Kamen failed to understand the crucial importance that we place on how we look to others in a new behavior. The gestural language of Segway didn't evoke the appropriate response. The gyrostabilized device itself rapidly became a comedy touchpoint on TV shows like "The Simpsons," reaching an almost-literal tipping point when George Bush fell off one in 2003.

Meanwhile, Dean Kamen has developed another amazing technology: Luke (think Skywalker and the hand that his father sliced off), a mind-control prosthetic robot arm. This could potentially offer amputees (and anyone else) a more learnable, precise, and intuitive prosthetic. But current prototypes of Luke evoke "Phantom Menace" more than phantom limbs and seem to deny the importance of cosmesis, where artificial limbs are being made out of realistic-looking materials. Will Kamen eventually acknowledge the necessity of partnering form with function for our personal technologies? With Segway, sheer "genius" still led to a failed attempt at making stuff; let's hope that Kamen avoids that pitfall with Luke.

Another common approach is "Don't Ask Customers If This Is What They Want." In 2006 the NBA and Spalding introduced a redesigned basketball. Replacing the traditional leather with the latest in material technology (i.e., synthetic microfiber), the ball was supposed to be easier to grip, more durable, and wear more consistently. The NBA did not consult players in the development of the ball or in the decision to adopt it, and they were understandably put off. Despite official insistence that the new ball was documented to be measurably better, the players gave voice to their objections. Eventually, NBA Commissioner David Stern reinstated the

old ball, in a Coke Classic–like move. There may have been an opportunity to improve the ball's design, but in refusing to involve users in making a change, that chance was squandered and next time could be even harder.

Frequently seen in software, especially in enterprise software where there may be a small number of key customers, is the "Do Whatever Any Customer Asks" approach. We encountered this recently with a company that provides software for trading in financial markets. These applications present an enormous amount of real-time numerical data (and are often used alongside other equally data-dense programs over multiple monitors). Our client was the initial player but lately had seen their key competitors launch elegant and easy-to-read updates to their platforms. This company was very frustrated because they felt they were working hard to be user-centered and not seeing the expected results. But their version of user-centeredness was to respond to customer requests by (where possible) implementing changes exactly as requested.

This company hadn't really realized that users are not designers; that a request for a solution is an expression of a need. For example, when a customer says, "I want a handle," they're really telling you that "I need a way to move this from one place to another." In working with these traders, we were able to ask for, infer, and ultimately understand why they were requesting certain changes. Additionally, we were able to look at how widespread those concerns were. We encouraged our client to bring a design step

into their process, in order to architect a coherent solution. In fact, by taking a step back and looking at the way the tools were being used, we found some fascinating aspects of trading culture that the tools on the market were failing to fully serve. Since other traders can see all transactions, there is a practice of misdirection and second-guessing: Entering a number in a field in the software isn't as straightforward as the interface suggests. The goal may not be to complete a transaction using that number, but to influence others for a certain period of time. There's a wonderful opportunity to innovate here that can't be addressed by simply fulfilling requests: How might this indirect and influential behavior be acknowledged and supported by the tool? An organization will need to move beyond implementing customer requests in order to take advantage of these insights.

The final approach in this framework is "Understand Needs and Design to Them." Needs, as considered in this approach, can be functional, like when a design firm discovered women shoveling snow more than men and redesigned the ergonomics of a snow shovel for this typically smaller user. Needs can also be emotional, such as when Sunbeam studied the backyard-grilling process and realized that the grill itself was associated with family moments and social connectivity rather than a set of meat-cooking features. Sunbeam then worked with Continuum to design the Coleman Grill to connote nostalgic camping cookouts. Needs can deal with shifting mental models of common behaviors, too. Work by B/R/S for Colgate identified

that brushing teeth is seen by people as a way to maintain their entire mouth, not just scouring the surface of the teeth. This led to Colgate Total, which promises "Superior Oral Health."

In this article, I've proposed an incomplete framework, articulating how companies go about making stuff:
1. Be a Genius and Get It Right
2. Be a Genius and Get It Wrong
3. Don't Ask Customers If This Is What They Want
4. Do What Any Customer Asks
5. Understand Needs and Design to Them

Examples of all five of these approaches can be found in corporations today, yet not all five of these approaches guarantee that the stuff will be successful. We can group this framework into two chunks: the seductive myth of the genius inventor (where getting it wrong happens more often than getting it right) and the difficulty of doing the right thing for customers (where thinking you know best or doing whatever you are asked is the darker side of asking questions and designing solutions). If you can look at your own organization and diagnose the approaches you see, you are better prepared to help move them toward the final approach: understanding needs and designing to them.

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Design:
A Better Path to Innovation

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Three years ago, I got a call from an editor of one of the biggest business magazines in the U.S. (who shall remain nameless, not to preserve his anonymity but simply because I can't remember which magazine it was). What he said over the phone was this: "We're planning on writing a book about how businesses can innovate like Apple does, and I was told to talk to you about it." I'm not sure if he was asking me to write it or just wanted feedback and leads, but my answer stumped him: "You can't write that book."

He thought I meant that it would be best written by another organization. I had to explain that, no, the book wasn't writable. "It would consist of one sentence: Hire Steve Jobs." I went on to explain that what Apple practiced was "expert design," a type of design perspective and process that is highly risky, usually disastrous for most companies, and works only when you have a leader with ultimate authority who also happens to have a keen sense of design and amazingly accurate understanding of what customers need and want. Without this person, no organization, no matter how much money they had to spend, was going to be able to pull off the kind of innovation

that Apple has. For proof, just look at Microsoft (and, specifically, at Vista, Zune, MSN, and UltimateTV).

Microsoft is an interesting case, in fact. It spends millions of dollars a year on exactly the kind of user-centric research regaled in the industry (you know, ethnographic research, customer personas and scenarios, user testing, etc.), and yet it can't even create workable products, let alone innovative ones (at least, on average). This is because it has no support for customer experience within the company that has any power to affect change in process, products, services, or strategy. This won't change, by the way, until it either hires someone in place of Steve Ballmer who cares and understands about customer experiences, or hires an experience czar at a senior level in the company with the authority, backed by Ballmer, to kill projects that don't measure up experience-wise.

Why Innovate?

With all of the talk in the business press over the past four years about innovation, you would think that it would be clear to businesspeople what it means to innovate and why it's important. However, while engineers and designers have an innate appreciation for

appropriate and significant innovation, most businesspeople still need to be convinced because of the risks involved and because it's not an easy thing to do.

What most businesspeople don't realize is that everyone who goes to business school, plus anyone else who's simply paying attention to the business press, knows almost exactly what they do. There are only so many paths to stimulate growth, and almost every businessperson on the planet already knows them (and how to implement them):

- Increase operational efficiencies (including cutting jobs and expenses)
- Sell off assets (such as technologies, IP, or divisions)
- Mergers and acquisitions (which are usually only temporary and often actually result in lower growth once they're completed)
- IPOs (if the timing is right or your business is the kind to which these markets respond)
- "Rebranding" (again, often temporary)
- Innovation

What most don't realize is that these paths are now the cost of doing business. Every company does them—or should (though not everyone can implement them successfully)—but there are no mysteries or dif-

Should I Get an MBA?

On a panel in San Francisco this past June, this very question was posed to four leaders, including myself. All agreed that while an MBA wasn't a requirement, what was necessary was for developers (designers, engineers, managers, etc.) to have a better understanding and appreciation for all business functions as well as the ability to use the vocabulary of business to describe design and innovation concerns in relation to traditional business issues.

This is the imperative behind the creation of California College of the Arts' (CCA) new MBA in design management. While it's a business degree, not a design degree, its perspective comes from design thinking and processes. The purpose isn't to create the next generation of leading designers (that's the purpose of CCA's design MFA), nor is it to create a generation of managers of the design function (like the many design-management degrees around the world). Instead, the focus of this program is to create the next generation of innovation leaders, whether from a design or other business background, who can lead organizations through innovation at any level.

The program is structured around traditional MBA courses, though it's focused entirely on innovation. Students interested in MBAs focused on real estate management, international trade, or international finance will, undoubtedly, go elsewhere. However, this program seeks to attract those wishing to understand how to implement innovation in the best possible ways and in a variety of contexts. Every course is infused with the best thinking, perspectives, and tools of meaning, innovation, and sustainability.

Though the program is small (limited to 30 people per year) and new (the first students started this fall), it has already attracted a surprising interest. With only a bit more than four months' notice, we received 90 applications for the 30 openings. Next year we project at least 250 applications.

In the near future, we plan to launch an executive certificate program for those who already have a business degree or extensive business experience as well as workshops for shorter, more intense learning that reach even more people.

To further help people navigate the intersection of design and business, we've created a resources center on the program's website that lists the best articles, books, resources, blogs, and other programs that address design-led innovation, meaning, and sustainability: www.designmba.org.

ferentiable strategies among them. Only the last two create an opportunity to differentiate products, services, experiences, brands, or companies, and only innovation creates lasting, organic growth (including forging new markets, not merely new offerings). And as the markets become ever more global, competition from even more players makes innovation that much more critical.

What Is Innovation?

Innovation can take several forms:
- Better offerings and experiences (in other words: products, services, and events)
- Better processes (internal and external)
- Better organizations (structures and functioning)

Each of these can create an advantage and, oftentimes, one that is both differentiable and protectable (to ensure that it's not one others can quickly use to relevel the playing field). Innovation can also serve to create better markets, not only better solutions, and, ultimately, even a better world. Before you think that sounds too lofty, consider how innovations in clean energy, new materials, new services, and new investment solutions are serving to send us down a more sustainable path—one that is direly needed.

One of the missteps that many businesses make, however, is to equate innovation simply with "new." The most successful innovations are not merely novel, but meaningful and significant. It may be too much to think that any innovation can be sustainable (in the sense that it will create a long-

term, lasting advantage) but, certainly, significant innovations create short- and medium-term advantages that last far longer than other solutions.

Appropriate innovations create opportunities for both customer and company that provide value for both. The technology field, for example, is continually awash in solutions brought to market that are novel, well designed, and well engineered (take the Segway, for example) that nonetheless fail because they don't satisfy a real customer need. Some innovations are hidden from the customer (or, often, other stakeholders such as suppliers or partners, competitors, and communities), as in the case with WalMart's restructuring and streamlining of operations and relationships with manufacturers throughout their entire, and multiple, supply chains. Other innovations are visible to everyone engaged to buy, use, interact, deconstruct, etc., such as Method's line of less-toxic cleaning products. Not only are these innovative products but Method is positioning them in the marketplace in innovative ways, which is mostly about effective messaging in packaging, ads, and online.

Why Can't Most Organizations Innovate Effectively?

Innovation isn't a big mystery either. There are already plenty of books, workshops, consultants, and programs to help organizations innovate effectively. But most organizations are still finding it difficult to innovate. Some of the reasons include:
- They lack the right context

- They don't have the right culture
- They aren't "creative"
- They don't have the courage
- They don't understand sustainability
- They don't understand meaning
- They don't have the right process

None of these is a complex problem to solve, but without the will, attention, tools, and commitment, it simply can't be changed. In addition, some of these issues are difficult to shift (particularly those dealing with culture, management, and leadership—which is to say, all of them).

What's the Right Context for Innovation?

One of the most fundamental handicaps that organizations of all sorts don't realize they have is that they don't understanding marketing. At its most basic definition, and this could be a book itself, marketing is not messaging to customers. Most companies position marketing within their organizations as the mechanism they use to tell their customers, partners, competitors, markets, and the world what they want them to know about their products, services, mission, vision, and organization. They often lump in marketing with sales, advertising, PR, and other departments, further erasing the distinctions. But these functions already have their own disciplines, namely: sales, advertising, PR, promotion, etc.

A better way to think about marketing is to think of it as breathing. Marketing is the inhale. It's what you learn from your customers, competitors,

industry, market, etc., and PR, sales, advertising, etc., are the exhale. It's what and how you communicate to the rest of the world. Many marketers will tell you that they already inhale, through "market research." But most traditional market research is worthless for innovation because it emphasizes the quantitative over the qualitative, and the techniques often employed are laughably inaccurate and misleading. To distinguish traditional tools from new tools, some use the term "market insight," which refers to ethnographic and other techniques to uncover qualitative attributes that are otherwise invisible or unmeasurable (such as customer needs that operate at the level of emotions, values, and meaning). These are techniques that many designers understand better than their peers and, as such, are often the best people in an organization to connect these learnings with corporate strategy.

To be sure, the best marketers use both qualitative and quantitative techniques, but they do so with only the best tools. To date, most marketing departments inhale only competitor and industry data effectively and find many reasons to discount the need for qualitative customer understanding—especially technology-focused organizations. Yet this is where everything needed to truly innovate effectively lies.

It's also important to look not only at customers but also at all of the stakeholders who have influence over your business. That's stakeholder, not shareholder, and there are, potentially, a lot of them: customers,

clients, employees, distributors, wholesalers, retailers, suppliers, partners, creditors, stockholders (shareholders), communities, government courts and departments (city, state, federal, and international), banks, media, institutional investors and fund managers, labor unions, insurers and reinsurers, NGOs, media, business groups, trade associations, competitors, the general public, and the environment (local, regional, and global).

Different stakeholders can exercise different types of power and be impediments or partners to innovation. Engaging them helps organizations operate effectively and make better decisions (both strategic and tactical).

What's the Right Culture for Innovation?

Most organizations don't understand that their culture makes it easier or more difficult to innovate effectively and requires a different approach for success than what might work at their competitors. Consultants, too, often fail to understand their clients' culture, which drastically affects their ability to develop

successful solutions for them. In 2006 Cheskin identified five different types of innovation cultures common to organizations:
• Structured Innovators
• Creative Innovators
• Dynamic Innovators
• Ad Hoc Innovators
• Innovation Outsourcers

Each requires a different approach to engage innovation—in some, like innovation outsourcers, it's probably not even worth trying to innovate from inside the organization. To be successful, an organization must honestly know itself and choose a path that works for it.

Why Aren't Organizations Creative Enough?

It's not that companies aren't creative, it's that most don't realize that that are. "Creativity," as a term, has been so poorly defined that it's now confused with "wild and crazy" approaches, wacky ideas, and frivolous effectiveness. However, creativity is simply the ability to create new and appropriate solutions to challenges, and people throughout organizations do that every day (when given the opportunity). It's not the exclusive skill or domain of

designers or those in the "creative department." It's a skill regularly employed by managers, leaders, and workers in all aspects of an organization, include engineering, operations, marketing, and finance.

Until creativity is restored with an understanding that everyone has a duty to be creative in their job, creativity will be wielded (if at all) as a kind of last-ditch, heroic effort when all else fails. Organizations can't wait for everything else to fail. Creative solutions need to be part of standard operating procedure, not emergency, extracurricular, or offsite procedure.

Why Aren't Organizations Courageous?

Innovation isn't easy or obvious, and it's often messy. It certainly isn't guaranteed. So many organizations already think they're innovating, and yet most are failing miserably in their efforts. This makes innovation look risky—and it is. But it's a risk that no organization can fail to take.

It may feel like things aren't going forward at times, and the most successful techniques for innovation are unfamiliar

to business leaders—or even threatening to their control, stature, or perspective (which is why they're often discarded). However, despite all of this, innovation can be exhilarating and rewarding, and it must be done in order to succeed. Conditions often require wholesale change in an organization's strategy, including the abandonment of old approaches, understandings, and offerings. Innovation can enable this kind of change, but it takes courage to follow this road.

What Does Innovation Have to Do With Sustainability?

Very briefly, and according to the authors of *Natural Capitalism*, sustainability is the successful management of four kinds of capital:
• Financial Capital (monetary assets and financial value)
• Manufactured Capital (IP plus other organizational assets)
• Natural Capital (environmental assets)
• Human Capital (people and sociocultural expectations)

Why is sustainability important to all organizations (as opposed to merely those serving "green" markets)? Because

STRUCTURED INNOVATORS (18 PERCENT):	CREATIVE INNOVATORS (26 PERCENT):	DYNAMIC INNOVATORS (39 PERCENT):	AD HOC INNOVATORS (10 PERCENT):	INNOVATION OUTSOURCERS (8 PERCENT):
• Formal process	• "Big Ideas" inspire	• Strategy guides process	• Accidental innovation	• Relies on consultants
• Led from the middle	• Led from the top	• Led from top	• Innovation not valued	• Acquires innovation
• Low collaboration	• Often haphazard process	• Cross-functional teams	• Creativity not valued	• Focus on marketing/PR
• Analytic evaluations	• Focus on creativity	• Collaborative	• Haphazard process	
• Iterative	• Risk taking is accepted	• Creative environment		
• Risks minimized		• Rational inspiration		
		• Risk taking is accepted		

we no longer have the luxury of ignoring it, as organizations, individuals, or as a planet. The competition for resources in all of the forms of capital listed above is now so fierce that all organizations need to address how their strategy intersects with sustainability. However, this is not merely a safeguard against scarcity or competition. Besides being a business imperative, sustainability is a source of tremendous opportunity. Most businesspeople only truly understand the first two types of capital, and the importance of conserving, expanding, and caring for them. One of the problems in the business world is that we measure success only in terms of money. This is often liberating of larger responsibilities but can lead to irresponsible behavior and results—many of which come back to haunt organizations anyway.

As Hunter Lovins, one of the authors of *Natural Capitalism*, likes to say, "we're managing the planet's resources like a fire sale." There are both ethical and operational reasons why organizations of all types (including nonprofits and governments) need to be paying more attention to all capital resources available to us. And, we don't have to become experts in sustainability before we start operating with this mind-set.

What Does Innovation Have to Do With Meaning?

One of the challenges most organizations struggle with is in differentiating novel innovation from meaningful innovation. Meaning is a specific attribute of customer experiences that represents the deepest level of

significance that customers connect between offerings and their lives. Along the same spectrum of significance as emotions and values, and meaning is the most powerful aspect of customer experience. It can transcend traditional and "rational" price and performance decisions. It surrounds all products, services, and events, whether we acknowledge and address it or not. And it can be the most effective guide for organizations to use in determining whether an idea or solution is truly valuable and not merely "new."

Before you think that meaning (and values and emotions, for that matter) are applicable only to "consumer" offerings, let me remind you that despite protests to the contrary, all customers, even "business" customers, are people and, as such, issues of emotions, values, and meaning are just as powerful players in these relationships. My father, a swimming-pool contractor for most of his life, used to say that "you can sell anything to a salesperson." He meant that people in sales who built relationships by triggering emotions, values, and meanings in their customer were often the most susceptible to these very same elements. Just because a customer is another businessperson, this doesn't insulate them from being influenced by the often subconscious and irrational aspects of evaluation and decision making. Many businesspeople, in fact, can easily cite examples where decisions were made that either downplayed or downright ignored rational issues of price and performance.

Meaning is an attribute of experience that describes how

people understand the world around them. Though core meanings are universal—across all cultures—our prioritization and expression of them represent opportunities for organizations to forge connections with customers at the deepest and strongest point possible. This becomes a metric with which to measure the appropriateness of innovative solutions.

The most effective innovation focuses past price and performance and instead starts at meaning, working outward toward the details most companies begin with. In this way, organizational strategy can align all efforts at the deepest connection point with customers, allowing the rest of the tactical decisions to better support these connections. Not only does this create more significant innovations, but it does so in less time with fewer resources—since the focus is always on meaning, throughout development.

"Meaning research" should be an integrated part of customer research. This is key data that should affect corporate strategy for your organizations and clients. Then, corporate strategy can start reflecting customer meaning. This is the first step toward specifying the right offerings (the right business to be in). As meaning becomes an integrated, accepted part of the development process, organizations can naturally focus on the right offerings and make them as great as possible.

What's the Right Process for Innovation?

Lastly, most organizations don't know how to approach innovation and integrate it into their

Duration

4

Intensity **3**

Triggers **5**

Experience

Interaction **6**

2 **Breadth**

1

Significance

4 **EXPERIENCE
DIMENSION 4:
DURATION**
Initiation

Immersion

Conclusion

Continuation

5

**EXPERIENCE
DIMENSION 5:
TRIGGERS**
Senses:
Taste

Sight

Sound

Smell

Touch

Cognitive:
Concepts

Symbols

6

**EXPERIENCE
DIMENSION 6:
INTERACTION**
Passive < > Interactive

3

**EXPERIENCE
DIMENSION 3:
INTENSITY**
Reflex

Habit

Engagement

2

**EXPERIENCE
DIMENSION 2:
BREADTH**
Product

Services

Brand

Nomenclature

Channel/Environment

Promotion

Price

1

**EXPERIENCE
DIMENSION 1:
SIGNIFICANCE**
Meaning

Status

Emotion

Price

Function

Models of
Customer Experience

Performance/Features

Price/Value

Emotions/Lifestyle

Values/Identity

Meaning/Reality
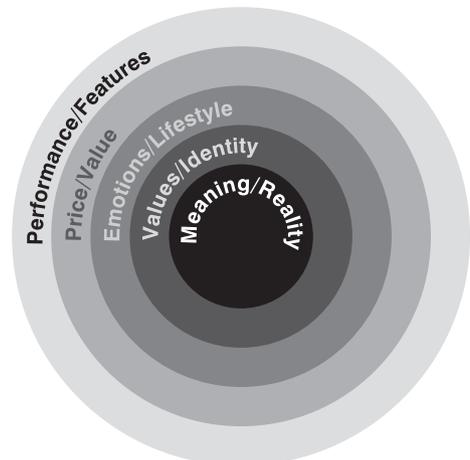
SIX DIMENSIONS OF EXPERIENCE:

Breath (consistency across touchpoints)	
Intensity	
Duration (time)	
Triggers (how sensorial and cognitive choices are interpreted by customers)	
Interaction	
Significance (diagram)	

FIVE LEVELS OF SIGNIFICANCE

Meaning (Reality)	How does this fit into my world?
Status/Identity (Values)	Is this me?
Emotions (Lifestyle)	How does this make me feel?
Price (Value)	Does this meet my expectations of value?
Function (Performance)	Does this do what I need done?

15 CORE MEANINGS:

Accomplishment	Justice
Beauty	Oneness
Creation	Redemption
Community	Security
Duty	Truth
Enlightenment	Validation
Freedom	Wonder
Harmony	

established processes. In trying to control and optimize the experience, they make it nearly impossible to innovate. In addition, the lack of understanding from managers at all levels often kills off the products of innovation (and often the process, too), even when truly innovative solutions emerge.

Design-led innovation has an edge on other approaches because of its history of user-centered research, prototyping, critique, iteration, and embracing of constraints. Unlike other development processes, it makes room for meaning and other questions to be addressed before requirements are solidified. In addition, developers have an opportunity to play a role not only in the product development realm but also in the boardroom, where organizational strategy is set (and needs to reflect better customer understanding). The fruit of design and user research is often more valuable at the strategic-management levels of an organization than even at the product-development level. Unfortunately, like the often inadequate market understanding available to leadership and senior management, their "deep" understanding of their custom-

ers is often shallow and off the mark.

Implementation and approach, of course, depend on an organization's innovation culture (described previously). But since innovation hasn't been the focus of most organizations, their processes often prevent the possibility of innovation. Also, most business functions, from accounting to operations and even marketing, are focused on optimization and standardization. Innovation is entirely different from these and most often needs to be shielded from other business processes and measurements within an organization. For example, Six Sigma can be a highly effective tool for optimizing quality within a supply chain but it is probably the surest way to kill innovation within an organization. Trying to apply the same management processes to every department and every activity within an organization is, perhaps, the biggest failure of organizations trying to innovate.

In this way, the entire concept of design can be described as the process of meaningful innovation.

ABOUT THE AUTHOR
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A Call for Pro-Environmental Conspicuous Consumption in the Online World

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Biological researchers have suggested that the phenomenon of conspicuous consumption [1, 2] can be an evolutionarily viable survival technique. Conspicuous consumption can enhance an organism's fitness because it demonstrates that the organism has sufficient resources to live, and then some. This abundance of resources suggests to other members of the organism's community that he or she may be a valuable social or sexual partner, with sufficient resources to squander some on goals beyond mere survival [1].

Two forms of conspicuous consumption are particularly notable. "Sexual handicapping" involves an individual exhibiting resource-intensive behavior or morphology in order to communicate his or her (but usually his) good genes [1]. For example, the brightly colored tails of many birds are a significant handicap to those organisms; the tails require a lot of energy to produce (since bright pigments are energy intensive), and make it harder for the organisms to survive (since predators can see them). A bright tail conveys unequivocally that the bird sporting it is a "winner," with sufficiently abundant resources to have reached maturity despite the encumbrance of the tail, and is therefore a prime mate.

A second form of conspicuous consumption is "competitive altruism [2]". In this behavioral pattern, organisms behave in prosocial ways, issuing alarm calls or saving the offspring of other members of their community, in order to demonstrate their abundance of resources. Similar to sexual handicapping, competitive altruism is a drain on the resources of the individual and marks that individual as a high-quality social or reproductive partner.

There are several characteristics that make an attribute or behavior a good vehicle for exhibiting conspicuous consumption. It must be obvious, so that other members of the target community can easily recognize it. It must be accurate; community members must be able to use it to evaluate the relative merits of different individuals. And it must be unfakeable; that is, it must be easier for the organism to exhibit the attribute or behavior than to exhibit an indistinguishable facsimile of that behavior [1].

Like many other animal species, humans exhibit a tendency for conspicuous consumption [3]. To an evolutionary biologist, a BMW looks a lot like a peacock's tail. The bird's tail is obvious; so too is the Beemer's logo and characteristic body shapes—visible on the highway, in the driveway, and on a date. The bird's tail requires the expenditure of significant resources. So too does the BMW; no resource-poor losers here. Finally, the bird cannot attach a fake tail to itself; neither is it viable to manufacture a fake BMW, with glossy paint and carefully tuned engine. Thus, a BMW has a lot in common with a brightly colored tail; in both cases, the owner is clearly an excellent mate choice.

Similarly, people engage in competitive altruism in a range of ways. The high-end grocery store Whole Foods has begun selling an organic cotton and burlap bag with a large logo reading "Feed the Children of the World" on it. To own this bag, a shopper must pay $29.95, $10 of which will be donated to the World Food Program's Rwanda School Feeding operation. This amount is sufficient to provide 100 meals to school-age children in Rwanda. This demonstration of resource abundance may not only make the bearer feel good, but it may also cause others to consider them worthy social or sexual partners. (While one might find charity irrelevant to sexual ends,

[1] Zahavi, A. and A. Zahavi. *The Handicap Principle: A Missing Piece of Darwin's Puzzle.* New York: Oxford University Press, 1999.

[2] Roberts, G. "Competitive altruism: from reciprocity to the handicap principle," *Proceedings of the Royal Society B: Biological Sciences* 265, no. 1394 (1998).

[3] Veblen, T. *The Theory of the Leisure Class: An Economic Study of Institutions,* 1912.

The world would be more sustainable if the human urge to squander resources could be piped into socially beneficial efforts rather than into corporations' bank accounts.

[4] Griskevicius, V. et al. "Blatant Benevolence and Conspicuous Consumption: When Romantic Motives Elicit Strategic Costly Signals," *Journal of Personality and Social Psychology* 93 (2007): 85-102.

a group of psychologists recently found that "although mating motivation did not lead women to conspicuously consume, it did lead women to spend more publicly on helpful causes [4]."

Whenever resources are squandered, there must be some "sink" into which those excess resources are poured. For example, when a species of birds tends to have long colorful tails, their resources are being poured into the populations of snakes and other predators that are better able to catch and eat the birds because of their highly visible tails. When people drive BMWs and other luxury cars, the resources are being poured into the corporations that produced them. (When people drive luxury SUVs, the resources used to buy the gas needed to move so much metal around ultimately end up poured into the atmosphere as carbon dioxide and other pollutants.) Snakes and corporations serve the same role in this system; they are the keepers of the unfakeability needed to make a trait costly.

Corporations, like snakes, are not evil. They are simply tasked with a single purpose—maximizing shareholder value. Unless there is a profound shift in the corporate law in the U.S. and many other capitalist countries, we can reasonably expect that environmental sustainability will never be the primary goal of corporations. At best, it will be an indirect goal, when consumers

have it as their primary goal and the corporations must satisfy the consumers. Nevertheless, the world would be more sustainable if the human urge to squander resources could be piped into socially beneficial efforts rather than into corporations' bank accounts.

Online Tools

Many behavioral patterns that people exhibit are being enhanced by online tools. We are able to communicate over great distances, play games with millions of people, and spawn fast-spreading grassroots political movements. There are also a variety of environmental efforts that seek to harness the strengths of information technology, using social networking systems, blogs, mobile devices, and new design techniques. However, there are few if any online systems that seek to achieve environmental ends by explicitly encouraging people's evolved desire to squander resources. If people are going to engage in conspicuous consumption, they may as well do it in a way that is sustainable. We need online social tools that can help enable pro-environmental conspicuous consumption.

An awareness of the characteristics of a good medium for conspicuous consumption—one that is obvious, accurate, and unfakeable—can help inform the design of these online tools. The Web is very good at making projects obvious—the popularity of some websites grows so rapidly that it becomes problematic to scale fast enough. "Accurate" and "unfakeable," though, are a bit trickier. Accuracy is difficult because what constitutes "value" may vary across communities; monetary expenditures, time, skills, or other factors may be the key to social status within a given group. Making the display of conspicuous consumption unfakeable requires the community to settle on an inherently hard-to-duplicate medium, to agree on some standard through which to verify authenticity, and/or to enact ways of punishing fakers. Reputation-management systems may be able to help with both accuracy and unfakeability to some degree, as can connections to existing institutions with credibility and longevity.

This article is a call for readers of this magazine to design and build systems that enable communities to engage in conspicuous consumption in ways that recycle resources into the same

local community and/or serve environmental ends. To provide some unimplemented examples of how these systems might work, consider the following project ideas:

• *Wickedly Expensive Local Green Products and Services.* Each local community maintains some directory of the greenest members of that community, anyone from farmers to manufacturers to recyclers. These individuals are reimbursed for their services well beyond the sheer financial need, in exchange for explicit acknowledgment of the purchaser via a website or other medium. The green community members benefit from the increased prices, and the conspicuous consumers are honored for their contributions.

• *Integrated Environmental Action and Dating.* While organizations such as the Sierra Club already have "singles" events, few if any of them explicitly celebrate their most vigorous volunteers in an obvious, accurate, and unfakeable way. An online dating system could be designed such that, for each time a person spends a day planting trees, his or her profile could be listed higher in the site's search results.

• *Craigslist-to-Credit-Card Ratio.* Craigslist could team up with credit card companies to enable people to have an officially sanctioned score of what percentage of their purchases are made through Craigslist (or other recycling venues) rather than through providers of brand-new goods. The system could provide people with a dynamically updating widget that they could include on their blog or website. Used IKEA table—$40. Sustainable capitalism—priceless.

Each of these examples may have conceptual problems or implementation challenges, but perhaps they can initiate a conversation about how to enable conspicuous consumption in ways that are more environmentally sustainable than current online systems. By tracking, analyzing, and sharing the pro-social squandering of resources that a community cares about, systems such as these may provide pathways for people to engage in conspicuous consumption in ways that match their ideologies. Doing so can help people find friends, business associates, and romantic partners who belong to similar communities, and who share similar values.

A concern that has been raised involves the possibility that these systems could be seen as gauche or tacky. Volunteerism, for example, loses its charm if one toots one's own horn about it. However, there are clear examples that this does not need to be the case. The "I Gave Blood" or "I Voted" stickers often seen around college campuses and other communities demonstrate that it is not necessarily frowned upon to wave a flag for civic engagement. While it would certainly be important to remain aware of this potential challenge, it is certainly not an unsolvable problem.

This article draws inspiration from human biology and social behavior for the design of novel technological systems that can help us live together more sustainably. While we are smarter than monkeys, the Earth has begun to suffer from the success enabled by our intelligence. Human technology has looked to biology many times for inspiration, from robots to AI to flying machines (including the airplane in which I'm flying right now). Perhaps we can look to biology for inspiration once again and design systems that satisfy our evolved needs. Systems that let us engage in conspicuous consumption (as we appear to need to do in order to demonstrate our quality as social or sexual partners) but that do so without wasting resources unnecessarily could be the basis for new social interaction styles. An understanding of the biological and cultural issues underlying these phenomena could help inform the creation of a range of new technological systems that support these novel interactions.

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Of Candied Herbs and Happy Babies: Seeking and Searching on Your Own Terms

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A friend asked me to buy some candied herbs for her while I was in Italy. I had never heard of such a thing. It sounded dubious—and entirely likely, therefore, to be some foreign delicacy that I would in fact turn out to adore. And that was the case. But before getting there, I needed to find out where to buy said "candied herbs." My friend had thoughtfully sent me a link to a shop where they were apparently available. But while the shop was easy to find, every time I went, it was closed, windows shuttered.

So I figured I would try to find another source. What better way to do that than to search the Internet? The world is, after all, at my fingertips via a query in a box. "Candied herbs buy torino" yielded no results, at least none I could make sense of. So I translated "candied herbs" into Italian: canditi erbe. I typed this into a search box and got back many (many) pages in Italian, a language I don't speak or read. I translated said pages. No luck. I tried Yahoo! Answers and found recipes for candied everything-you-can-imagine. But, as to where I could buy them in Torino? Still no luck.

Getting truculent, I start typing in broader terms—perhaps the problem was the word "can-

died." I tried various combinations of "sweet" "sugar" "herb" "plant" "eat" "cook" "tourist" "gift" "edible," and various herb names—all of which sounded disgusting when combined with "sugar" or "candy"—sage, basil, borage….and so on. Still no luck.

Since I was looking for a foreign food in a foreign language and would not have been able to recognize a candied herb if one bit me on the nose, I was not really surprised that I was having this problem. But, I also suspected there must be a way to find this elusive information—if only I could just enter the right combination, the correct incantation of words into that little search box.

There is a nice term called "gaslighting" that means a willful undermining of someone's sense of reality in order to drive that person mad. I was feeling a little less sane as I tried to semantically link previously unconnected concepts to generate possible relevant query terms and review the results —so much information, so little of use. The search engine asserted dominance, drawing me out and then under-scoring my linguistic (perhaps conceptual) inadequacy: I was free associating and getting punished for my efforts.

In the end, I just kept return-

ing to the shop that my friend referred me to. There in the amazing sweet shop cum apothecary store, circa 1836, lay the fabulous prize.

So what does this all have to do with design? To pose the question differently, what does this have to do with person-centered [1] interaction design? A lot.

Internet search has become the dominant paradigm of information seeking for many of us. However, the paradigm of Internet search is in its infancy, and search as an Internet experience is often construed very narrowly. There is much discussion about matching query terms, indexing, and ranking relevant results, and determining which are the best algorithms to determine which content is delivered back as a result of a query. These are, of course, crucial factors in the design of good search experiences. Search engines have personalities based on how these processes are prioritized and how results are presented.

But as the example above shows, seeking and finding involve (many) keyword queries. And a lot more than a page and a query box is involved. For just that scenario, I opened at least 20 browser windows over two days, interweaving my search

[1] "person" could be "user" or "human" or "agent". I suggest picking one that acknowledges a human is present in the transaction.

for "candied herbs" with alternative activities, including searches for other things: "candied herbs torino," "longboard sales," "united airlines flight information," "Brahmin handbags," "turin shroud," "Taryn Rose shoes," "spime" (I have spared you my crude translations and the typographical and spelling errors.) Often I had many windows open at one time. I copied and pasted content I found that might be relevant into a text editor. I bookmarked potential sites for my friends to look at and translate for relevance. I looked at images of what could be candied herbs; I even found a video showing how to candy things at home. I asked friends by email and instant messenger; I posted photos to Flickr; I searched YouTube. My friends Twittered to ask their friends. I spoke to people by phone.

That was a lot of surf, send, and sift. I should say it was thoroughly enjoyable—a treasure hunt—and ultimately worth it to find and finally experience candied rosemary.

My story is not unusual; it's mundane, even. We routinely engage in human-human, human-machine, human-multimodal representation, human-place (digital and physical) interactions and use multiple browsers, devices and displays, text editors, bookmarking services and applications, notepads and pens. Search is also social— we use the phone, email, social networking sites, and services to seek knowledge from others and to get people to look for things on our behalf.

Fascinated by the wealth of design and engineering challenges in this world of information-finding, Cristen Torrey of

Carnegie Mellon University and I have spent this summer conducting field interviews, collecting stories of the hard-to-find-on-the-Internet—from people not knowing the words for things, to things for which there are no words. We have been charting examples of how people search when they don't know the specific words or terms for the things they are seeking (domain language/literacy), when they don't know how to articulate the concepts (not named and/or complex concepts), and when the content or learning need involves visual, kinetic, or physical knowledge in the pursuit of an embodied skill, such as screen printing, bodycasting, or looking for yoga poses like "Happy Baby" when you know what it is but not what it is called. Our investigations have followed people as they triangulate between different media (words, pictures, videos) and social search sites and forums such as Yahoo! Answers and Flickr, where there are many examples of images that are posted with the title "What is this?" We have begun to characterize searches by first understanding people's term, concept, and domain familiarity, and their willingness to expend energy becoming search strategy literate and/or to turn to collaborative seeking. And we have been looking at whether that which is sought has a name at all. Without getting too linguistically relativist, there are some things for which there are simply no words in one language or domain of expertise but an abundance in another language or domain. Suffice it to say, there are many strategies that people use to find the known and named (recall and

recovery searches), the known but unnamed (discovery and recognition searches), the undefined (recall, describe, and name), and the unknown and unnamed (discovery and/or name).

Clearly, we are not all done in this research and design world of Internet search. There are open questions about what is the appropriate unit of analysis. To be concrete, did my search "session" above start and end in one browser? Across several browsers? Did the search begin with the request and end with the purchase? Or did it end unsuccessfully with the failure to find a second source? Has it ended yet? What are the boundaries of the search experience, and what different kinds of tools are needed to support these different activities? What are the applications that will blur the boundaries between seek, search, browse, recommend, remember, and augment? How can we give the search experience some continuity, over time and place? Observing people engaged in ongoing inquiry and discovery over time, my group has designed an application for project-oriented, multi-media, iterative searches, so people can garner and glean in collaboration with others.

But we need a lot more research. Examples of rich areas include personalization and what that means to people, and considering how mobile search differs from desktop search. We need to design more effectively for domain-specific search. In this regard two of my favorite sites of late are Octopart (http://octopart.com/) and Shazam (http://www.shazam.com/music/portal). Octopart is a search site special-

ized for electronics. It embodies what librarians have been saying about the differences between generalized search versus vertical search, offering deep cataloging and deep linking, as well as nice experimentation with features for refining queries in the electronic domain. Shazam is a music discovery engine that helps you find that elusive, hummable, but unnamable track from your past.

Yes indeed, these are exciting times—there is much design and engineering work to be done. As a result, I get a little irritated when an otherwise perfectly nice person told me that the "real" work of search is what happens at the engineering level and that designers are really involved only in the "fluff." This guy underscores a sad fact of life: that there is a productive but not always comfortable relationship between design and engineering. However, if we think Internet search is only about the underlying engine—what goes on under the hood (the "back end")—then we are mistaken. And of course, design is more than generating graphics for an interface. The interface is the broker between the person, the "user," and the underlying algorithms, and that involves many levels of understanding.

Here are the things I personally and informally associate with design thinking, analysis, and practice, and all of these are needed to move the search experience forward: 1. aesthetics, which, as Don Norman's book *Emotional Design: Why We Love (or Hate) Everyday Things* suggests, are more important than one might think. It is easier to be patient with the worst of tools if it looks good and feels good; 2. graphics, and information repre-

sentation, surfacing information so it is comprehensible, readable in context; 3. the design of interaction and information flows, understanding information in use over time and foundationally, 4. ontologies and information architecture, considering the ways in which information structures underlie and drive information flows and interaction over time—addressing questions of what constitute data and metadata given different orientations, tasks, activities, practices, and worldviews.

It is important that designers of interactive artifacts take an active role in shaping the ways in which information is gained from the user in an interactive way and an active role in understanding how that information is used systemically—by the engine, under the hood. Because it is here that some notional "user" with some model of their "intent" is being tacitly or explicitly constructed. Human-centered design is about providing tools that allow people to acquire and use knowledge over time. Therefore, design professionals are perfectly placed to work with engineers to consider conversational and ideational aspects of enquiry and knowledge exploration, as well as to help people create knowledge that is searchable and ultimately, to develop the dynamic ontologies that are part and parcel of a responsive, reactive, evolving information-seeking experience that utilizes domain-centric, advanced search features. Recent developments mean it is increasingly possible for great design to couple with excellent engineering and prove this point. SearchMonkey and BOSS (Build Your Own Search Service) are

part of Yahoo!'s open search Web services platform [2]. Designers and developers are invited to build on top of the existing infrastructure to create new search experiences.

As a field-based designer/evaluator who likes to observe technologies in action, I often feel like my work is to point out anomalies and to bring about paradigm shifts that are not just changing the look but that are pointing to a shift in the way in which the problem is constructed and therefore the way in which the solution is engineered. Thomas Kuhn, in his work on scientific revolutions, talks about anomalies as instigators of change, of paradigm shifts. He defined an anomaly to be a violation of the "paradigm-induced expectations that govern normal science." If we want a paradigm shift in information seeking and finding, it is up to us to bring about that revolution by more deeply understanding human information seeking and finding, by challenging assumptions that exist about information production and consumption, and showing that information can morph and make itself known to us in more artful ways.

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Experiencing the International Children's Digital Library

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We all know what a book is. It's made of paper; you hold it in your hands; it contains words and sometimes pictures. We know that books have certain affordances such as ruggedness, ease of reading, portability, and are relatively expensive (at least compared with electronic forms). But perhaps most important, books afford deep attention. They engage and focus. They are relatively unchanging, and so they become cultural references. And these same characteristics also encourage writers and publishers to invest a lot in their creation—knowing that they may well not have a second chance.

A children's book is all that, and more. This is true not only because of the pictures and larger format printing, but also because of the impact these books can have. There is potential to be unlocked in every child—if only he or she can be exposed to rich and diverse experiences and ideas. We want our children to grow into everything we envision the world should be. From board books to the rich pop-out books of Robert Sabuda, from the obscure titles to the Harry Potters, children's literature has a rich history of many forms that support this vision.

And then there is the Web— also somewhat magical in our idealized cultural vision of free and broadly accessible information of all kinds. The Web is easy to change and inexpensive; it is these characteristics that encourage different behaviors and attitudes about content on the Web in the minds of readers.

What Is It About Books?

We can find so much, so fast on the Internet. But when we find that content, do we focus on it and engage deeply? Or do our minds wander as we interpret and envision our own lives in the stories we read? Do children do the same?

It was from these questions and many more that a growing realization emerged: Despite the breadth of the Web, and the diversity of our world, something was getting lost when looking at online content. Do children concentrate on the Web with the same degree of attention as books? My colleagues and I often saw children engaging with computers and the Web in ways that were so much less meaningful than the books that were being replaced.

In 2002 this led me, with my colleagues Allison Druin and Ann Weeks (and a cast of many more), to build the International Children's Digital Library (ICDL)—a website of exemplary, freely available children's books from around the world with a child-friendly interface for finding and reading books online [1]. There are currently more than 2,500 full books online from 59 countries in 48 languages.

The access afforded by the site presents a risk. Do we gain breadth and access? Or do we lose focus and depth because of the form? The answer, of course, is both.

By deploying a live and widely used website, we have studied its use both informally and through a variety of academic studies. We have partnered with institutions such as the World Bank, the Government of Mongolia, and One Laptop Per Child and have learned what the library can mean through deployments in developing countries.

Children and Adults

Children are not just short adults [2]. Their interests and abilities differ from ours, and they change over time. Children are often more physical and concrete than adults. This becomes clear when they search. Younger children, especially, are likely to want to search by physical characteristics of the book such as the length, size, and even color of the cover. They also are more likely to focus on concrete characteristics of the book while

[1] Hutchinson et al. "Supporting Elementary-Age Children's Searching and Browsing: Design and Evaluation Using the International Children's Digital Library." JASIST 58, no. 11 (2007).

[2] Montemayor et al., "PETS: A Personal Electronic Teller of Stories," University of Maryland, 1999. http://hcil.cs.umd.edu/trs/99-25/99-25.html

To experience the ICDL visit:
www.childrenslibrary.org

[3] Druin, Allison. "What children can teach us: Developing digital libraries for children." *Library Quarterly* 75, no. 1 (2005): 20-41.

[4] Druin, Allison. "Cooperative Inquiry: Developing New Technologies for Children With Children." Working paper, CHI 1999, Pittsburgh, Pa., 1999.

[5] Druin, Allison et al. "The International Children's Digital Library: Description and Analysis of First Use." *First Monday* 8, no. 5 (2003) <www.first-monday.org/ISSUES/issue8_5/druin/index.html.>

[6] Druin, Allison et al. "Children's Interests and Concerns When Using the International Children's Digital Library: A Four-Country Case Study." Working paper, JCDL 2007, Vancouver, Canada, 2007.

older children start thinking about more abstract issues [3].

We worked closely with children throughout the design, implementation, and deployment of the ICDL through a process called Cooperative Inquiry [4]. We have children come to our lab regularly and work with us as design partners. For the ICDL, we went further and even had the "kidsteam" children visit libraries to observe and interview other children as they used the library. Our intergenerational efforts responded to these concerns, resulting in the current interface. Children can search not only for traditional genres, but also other search parameters such as the color of the book cover, how the books make you feel, and more.

An ICDL weblog analysis confirms the academic research with practice. For example, our youngest users (indicated by self-reporting during an optional registration process) search more for the categories "rainbow," "real animal characters," and "make believe books," Twenty-year-old users, on the other hand, search more for the categories "short books," "award winning," and "true books."

We also know from our early observations that children often select books (and start their reading process) by flipping through the pages to get a sense of how long it is, and what kind of pictures are in it. We observed them reading in every imaginable physical location—in chairs, on desks, on floors, under

desks—occasionally, upside down. When talking with these kids, we discovered that sometimes they just want different physical experiences.

Therefore we built different ways to read the book. We always start by showing an overview of the book by initially displaying thumbnails of every page (that are magnified on mouse-over). The book can then be read in order or starting at any page by clicking on it. My daughter's favorite ICDL book is *Axle the Freeway Cat*, and strange as this may seem to a logically oriented adult, she always reads it by first looking at the picture of Axle eating breakfast in the car. Then, laughing, she begins again at the beginning of the book. We also implemented a spiral book reader that presents the pages in a more playful manner: They flow across the screen in a spiral (but the form still supports reading by presenting the current page very large in the center). An early study of these book readers [5], confirmed by recent weblog analysis, shows that kids like all the book-reader styles—and the match isn't usually by kid, but rather by mood. That is, sometimes a child prefers the simple page-at-a-time book reader, and sometimes he or she prefers the animated spiral reader.

Another interesting trend we see is that there are a fair number of questions from adults about very specific features of the ICDL website—about issues such as exactly how the book-cover-

color search works. But we get very few questions from children. Of course they are likely to have less access and ability to contact us, but still, the lack of questions from children is striking. This is backed up by our lab observations of first-time users of the library. Children are just much more accepting than adults. They are more likely to use the interface without question, and interestingly, they are also more likely to start reading whatever book they stumble upon.

Challenges and Opportunities of Thinking Worldwide

Where the ICDL really gets interesting is when we start to look at how it affects the children who use it, and what the challenges and implications are of deploying a technology like this for such a basic activity as reading. These questions get even more complex when we think about its use in the developing world.

Let's start by looking at how children use the ICDL. We ran a longitudinal four-year study observing how 12 children used the ICDL in Germany, Honduras, New Zealand, and the U.S. [6]. The children read at least one ICDL book per month, created drawings and book reviews about those books, and participated in an interview with an ICDL researcher (along with their teachers and librarians) once per year. To reduce technical challenges, we gave the children Tablet PCs with a version of the ICDL running locally. This enabled them to have consistent

and fast access to their library, even when their Internet connections were unreliable.

We observed a number of interesting trends in this study relating to how children read and feel about reading. To begin with, the diversity of available books was greatly appreciated. Children, their parents, and librarians all reported that the easy access to a broad set of books from many cultures intrigued them, and they frequently found themselves reading books that they happened upon—even though they very likely would never have searched them out. This general trend resulted in many children reading an increasing number of books over time. And some children used the easy availability of books to reread the same books over and over again. Interestingly, the single strongest finding in the data was that the children showed increased interest in exploring different cultures. Finally, most of the children reported that while they very much liked the ease of access to the digital books, they still preferred physical books for reading. In explaining this, they referred to ease of navigation, ease of carrying (since the Tablet PCs were significantly heavier than most books), and the risk of carrying expensive computers around in sometimes dangerous urban neighborhoods.

With this increased understanding and generally positive feedback, we were ready to respond when we received

a request from the World Bank and the Government of Mongolia to create a Mongolian version of the ICDL, aiming to support rural use. This somewhat unusual opportunity came about because the Mongolian children's publishing industry collapsed when the country became independent about 20 years ago. With almost no new children's books being published, the culture of children's reading for pleasure largely disappeared.

The World Bank chose to fund a general literacy program, which included commissioning 200 new picture books for grades 2-6 that were to be distributed throughout the country, along with teacher training and other activities. They wanted a digital library of those books as well. It may at first seem a questionable choice to spend money on this kind of technology in a developing country where much of the countryside has unreliable electricity and little or no Internet connectivity. However, upon closer examination we saw that only a small part of the overall literacy project was spent on technology. Further, they know that computers are coming throughout the country. They wanted to make sure that there are good activities for children on those computers, and to encourage an increase in technological capacity in the countryside. They also saw the economic impact that technology has had on many of their Asian neighbors (such as Taiwan and Singapore), and want to

push technology forward in a variety of domains.

And so it was with this context that the ICDL received rights to all 200 Mongolian books, translated the website into Mongolian, and even set up an ICDL mirror server in Ulaan Baatar (at www.read.mn). I literally carried a Dell PowerEdge server with me on my first trip there, and it remains happily installed at a local hosting facility—offering much faster access to the 50 percent of the country that lives in the capital region. My second trip focused on the first pilot of the ICDL in the countryside. Travelling with UMD graduate student Sheri Massey, we set up local ICDL servers in three very rural pilot schools that recently had computer labs set up. The Web server ran on the teacher's computer, and a local network gave all the classroom computers access to the library through their standard Web browsers. Ironically, these local servers and fast local connections gave these children faster access to the ICDL than anyone in this country who accesses it over a regular Internet connection.

We ran into a wide range of deployment challenges that you might expect from a developing country novice like myself installing a complex technology in such a place. Everything

For extended essays about the ICDL trips to Mongolia visit:
www.cs.umd.edu/~bederson/mongolia

tripped us up. We were plagued with viruses, power problems, network configuration issues, missing drivers, scratched CDs, and even a lost private key (needed for encrypting some of the books) that I managed against all odds to leave in Maryland—requiring an extra eight hours of rural driving to get to an Internet connection. But those were just "stupid engineering hurdles" we got past. And then we were able to focus on the amazing situation of working with teachers and children in rural Mongolia, many of whom had very little exposure to computers and none with digital books.

In the months before this rural trip, my biggest fear was that the people I would be trying to help would be uninterested in this technology. What, I wondered, would these people who spend most of their time in exceedingly remote farming situations see in modern computer technology? Would they see an American imperialist, unaware of their needs and actual lives? Would they see technology as something foreign and beyond understanding? Or would they be interested in engaging in this alternative world? Much to my delight, it was clearly the latter. The teachers in the training workshops in every school that we visited were deeply engaged. They skipped lunch breaks and kept us on well past the planned ending times. The schools had welcoming ceremonies with song and dance. And the children were thrilled to have a seemingly unending supply of books and technology, all rolled up together. They clearly saw the broad potential that computers could have in their lives and wanted

to explore what it had to offer them. And so when I returned, I redoubled my efforts to improve the technology to match the real-world challenges of deployment scenarios I saw. We have since improved readability on small screens, added support for transcription and translation, eliminated the need for browser plug-ins, and now we're even starting to explore how we can support reading books on mobile phones.

And so, this brings us back to where we started. What does it mean for children to read books on computers?

Lessons and Conclusion

Perhaps my favorite anecdote that explains what I've come to think about children reading books online is from our four-country study. At the beginning of the study, we asked children to draw a picture of themselves reading a book in the ICDL. One little girl drew a picture of a tablet computer in her lap. A year later, we asked them to do the same thing. This same girl drew a picture of a paper book in her lap. She wasn't playing with a computer anymore. She was reading books.

And this goes to the essence of the potential of technology for children. After the novelty is gone, people go about their business doing what is important to them. And to children, reading stories and understanding the people and world around them is always going to be important. The more access to books and stories we give to children, the more they will engage in them.

But are computers distracting, and is there the potential for children wasting their time, or

worse? These fears are founded, and quite possible. But technology is becoming a central part of children's lives almost everywhere. We can ignore it and hope that children find good things to do with computers on their own, or we can dive into the reality of our children's lives and build the best technology we can to give them exciting and valuable things to do when they are using that technology.

It is time to deploy the ICDL and other educational technologies widely throughout the rural developing world. Many places have computers but no content, and they need resources such as the ICDL. For those without computers, it may not yet be cost effective to buy them just for the books. But computers are being deployed for other reasons, and initiatives like the One Laptop Per Child project are making them much less expensive. Now is the time to start experimenting and learning about what is required to make projects like the ICDL function effectively. The ICDL needs your help. Visit the website to see what you can do to volunteer.

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Taken For Granted: The Infusion of the Mobile Phone in Society

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It is sometimes interesting to look at the parallels between the development of the mobile phone and the automobile. In the century since the late 1800s the automobile moved from being a odd contraption on the edge of society to being a taken-for-granted factor in everyday life. In the late 1800s none of the major elements of today's automobile culture were in place. Cars were rickety contrivances. There were rarely cabs for the passengers, cars needed constant prodding and maintenance, and they were more often seen as the hobby of determined tinkerers or eccentric millionaires than as an item of daily necessity. As if to ensure cars' marginalization, the roads were poor, and there were few gas stations and even fewer automobile-repair shops. If you were an early user, it was almost in spite of their usefulness. Society was clearly oriented toward other forms of transportation. This had consequences for the way that people organized their lives. Work, shopping, and schooling were often within walking distance. Daily activities did not require the individual to move about to the degree that we often see today. Neither the automobile nor the culture of the automobile had gained the purchase that they have today [1].

If we fast-forward 100 or 130 years, we see the difference. There are parking lots, paved roads, service stations, and all the standard automobile-related features of life. While there are often downtown areas in the towns and cities, the automobile has also spawned strip malls and shopping centers. It is often easier to drive a few hundred yards from one strip mall to another (and belch out the consequent pollution), since walking involves detouring around multilane streets that are more car than pedestrian friendly. In addition, there is a whole sector of society that is oriented toward servicing the automobile and the passengers within. There are not just "filling" stations but service areas where the nutritional needs of both the car and the passengers can be attended to and where we can also buy music, kitschy art, and reading material.

Unlike the early motorists, our lives are in many ways defined by access to the automobile. We need it to get to work, to deliver the children to after-school activities, or to go shopping. Serious courting takes place in the car. Our vacation habits are often tied to driving, automobile-friendly hotels, and automobile-accessible sights and locations. The cars we drive are, for some more than others, a reflection of who we are and what we want to be. If we do not need it directly, then the wares that we purchase in the shop were delivered using the automobile/truck-based system. Perhaps the most telling indication is that it is difficult to think of carrying on our daily life in the absence of the automobile.

All of this has resulted in an over reliance on the automobile. In effect, we have a system of reasoning that assumes access to and use of the automobile. It has moved from being a somewhat risky curiosity to being a central part of everyday life. It can be said that, with our willing acceptance, the automobile has restructured society in its own image. Bringing this back to the mobile phone, we can ask if we are in the process of developing a similar logic on that front.

The Structure of a Mobile Society
The ownership of the mobile phone is not—at least not yet—ubiquitous. The landline telephone has been a part of the scene and indeed has established its own logic. We have ordered Chinese takeout, swapped numbers with potential boy/girlfriends, and then sat by the landline phone awaiting their call.

Following the example of the automobile, however, we can speculate that the mobile tele-

[1] The inspiration for this article arose out of a discussion with my colleague Jonathan Donner as well as the insightful comments of James Katz.

[2] Farley, T. "Mobile Telephone History." *Telektronikk* 3, no. 4 (2005): 22-34.

[3] Ling, R., and J. Donner. *Mobile Communications.* London: Polity, in press.

phone will develop its own logic. The story of the mobile phone is shorter than that of the automobile or the landline phone. While various forms of mobile radio contact have been possible since the early 1900s [2], the popular adoption of the cellular-based mobile telephone system is more recent. To draw somewhat more clearly the parallel with the automobile, until recently mobile communication was the province of either the rich or the technically determined. Mobile phone devices were heavy and required inordinate amounts of power to use. They were quirky, and the coverage was spotty. From the mid-1990s, we have seen the rapid acceptance of the

mobile phone in first the developed and now in the developing world. Indeed, in many parts of the world, mobile telephony is taken for granted as part of daily life. Mobile communication devices are available from dedicated stores, kiosks, in grocery and convenience stores, and over the Internet. They let us chat with friends, send and receive text messages, order goods and services, find the address of a restaurant, take a photo, listen to music, and keep a calendar of appointments. Interestingly, the development of so-called m-marketing challenges some of the dynamics of traditional store- based (and strip-mall-based) marketing.

Individual Addressability

One of the most striking aspects of the mobile phone is that it makes each user individually addressable [3]. That is, with the mobile phone we call individuals, not locations. This basic characteristic means that we have an alterative way of interacting. We need not take into consideration where our interlocutor is since he or she is always reachable. In addition, the rise of texting means that we do not need to engage in extensive forms of greetings and monopolize one another's time. If we need only a short bit of information, texting allows us a discrete form of contact. Because of these characteristics—ubiqui-

tous and yet discreet reachability—this technology has become a tool of the intimate sphere [4]. Research indicates that we are mostly using the mobile phone to talk to our closest family and friends.

One of the main effects of the mobile phone is that it changes the way that we micro-coordinate our everyday affairs [5]. Previous to the rise of the mobile phone, we most often coordinated activities by agreeing to a time and a place where we would meet. In this regime, there was—and indeed often still is—the assumption that all participants have access to a correctly synchronized time-keeping device. Thus, we coordi-

nated our meetings by referring to our watch and assumed that the other meeting partners also did the same, with a device that was in good working order. If they had forgotten to wind their watch, if it was running fast or slow or, in more contemporary times, the battery of their watch was dead, the efforts at coordination were frustrated.

The mobile phone changes this process. We can negotiate both the time and the place via the mobile phone in real time [6]. If one partner is a bit late because of traffic, for example, he or she can simply call or text to the others in order to rearrange the meeting. If the cafe where we were to meet our

friend is too full, we can suggest an alternative. If we do not remember if our spouse wanted cheese or milk from the store, a quick call will clear up the issue. The ability to micro-coordinate may indeed be the most profound social consequence of the mobile phone. It provides us with a simple way to keep in touch with one another and to make, and re-make, arrangements.

It is wrong, however, to think that the mobile phone is used only for instrumental interaction. It is also a channel through which we express our emotions ("I love you so much John, but I still need to divorce Harry"), we experience power relations

[4] Ling, R. *New Tech, New Ties: How Mobile Communication Is Reshaping Social Cohesion.* Cambridge: MIT Press, 2008.

[5] Ling, R., and B. Yttri. "Hyper-coordination Via Mobile Phones in Norway." In *Perpetual Contact: Mobile communication, private talk, public performance,* edited by J. E. Katz and M. Aakhus, 139-169. Cambridge: Cambridge University Press, 2002.

[6] See A. M. Townsend, "Life in the Real Time City - mobile telephones and urban metabolism," *Journal of Urban Technology* 7 (2000): 85-104; and R. Ling, *The Mobile Connection: The cell phone's impact on society.* San Francisco: Morgan Kaufmann, 2004.

[7] Ito, M., and D. Okabe. "Intimate Connections: Contextualizing Japanese youth and mobile messaging." In *Information Technology At Home,* edited by R. Kraut, 235-247. Oxford: Oxford University Press, 2006.

[8] This is not to say that we can not also argue and bicker via the mobile phone.

[9] Weiner, E. (2007). Our Cell Phones, Ourselves [Electronic Version]. National Public Radio website. Retrieved 31 January 2008.

("Smithers! I want that report on my desk by Monday"), and we work out our feelings about others ("I saw Frank at the party, and he was being an absolute boar"). We can give a friend what Ito and Okabe call a discrete "tap on the shoulder" [7], or we can carry on a full-blown impassioned argument. Thus, in addition to its function as a coordination device, the mobile phone is a channel through which we maintain and develop the relations in our intimate sphere. We can tell jokes via the mobile just as we can gossip, nurture, flirt, quarrel, condole, assuage, and scheme. In the process of doing this, we work out—or perhaps destroy—our sense of trust with one another, and by and large we cement our relationships [8].

The very accessibility afforded by the mobile phone also means that we often need to manage our communications in different situations. Using the mobile phone can disturb well-established routines and assumptions about accessibility and who is able to speak to whom at different times and places. Is talking with our children during an intense business meeting just as inappropriate as talking to a business partner when we are at home intensively reading a bed-time story to the child? Because of these considerations, romance, courting, the courtesies of working life, and family interactions have taken on new dimensions as a result of the mobile phone.

While the device helps to maintain our interactions with those in the intimate sphere, it can also be a threat to our sense of local sanctity. We are attuned to rules of courtesy that govern our copresent interaction. However, since people from our intimate sphere have direct access via the mobile phone, we are faced with an awkward situation. In some cases, we may have to choose between using the mobile phone to speak to those who are emotionally close to us or to put them on hold while we maintain our copresent interaction with individuals who are perhaps more peripheral. Because of this we are in the process of developing strategies with which to limit mobile access. We are also working out how to deal with our more intimate interactions that take place in the public sphere. Different types of barriers are used to work out the degree to which the moral logic is applied.

The Reciprocal Taken-for-Granted-ness of Mobile Communication

There are various ways in which the mobile telephone is establishing its place in our lives. It has become a quasi-indispensable part of our daily kit. Perhaps the way to best understand this is to think about what it is like to do without the device. Leaving without our mobile phone is somewhat like leaving without a wallet; it's the occasion of a short panic. Forgetting our phone also means that others must work around our forgetfulness. Given other's assumption that we can plan—and re-plan—our meetings with friends, not having a mobile phone means that we are cut off from others. Being without a telephone means that we do not know the latest changes in the plans of our eventual meeting partners. If being phoneless it is not a problem for us, then, as James Katz reminds us, it presents a problem for others [9]. This means that we not only take our own phone for granted, but more important, others take for granted that we have one. There is a developing web of reciprocal expectations with regards to our ownership and use of mobile communication. Not having a mobile phone can be seen as a sign of independence, but it also means that others increasingly have to make special considerations with regard to the phoneless individual.

The automobile and the mobile phone are curiously linked. The automobile gave us a certain radius of travel. The adoption of the automobile resulted in the expansion of cities, the dispersion of travel and commuting, and increased complexity in daily transport. In many ways, the mobile phone completes the automobile revolution. Given the automobile-induced diffusion of individuals, the mobile phone reconnects us with our closest family and friends. In that process it is becoming an assumed part of daily life.

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How Society was Forever Changed: A Review of *The Mobile Connection*

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I found myself reading Richard Ling's *The Mobile Connection* in the discomfort of an airport terminal gate. When I say discomfort, I refer not only to the hard vinyl seat and poor lighting but also to the multitude of fellow passengers chatting loudly on cell phones. The audible barrage of one-sided conversations is a distraction to which society is reluctantly growing accustomed. We soon may not imagine a world without it. While the book did little to quiet the Bluetooth-equipped gentleman sitting next to me, it did provide an illuminating and enjoyable understanding of how and why we arrived in this cell-phone-rich society.

Truly disruptive technologies are rare. New products that fundamentally shake the status quo don't just grow on trees. Even more rare are technologies that disrupt society and fundamentally alter interpersonal communications. With rapid advances of technology, the mobile phone has done all this with unprecedented speed. The astounding pace has fascinated researchers and businesspeople alike. Rich Ling is one of those fascinated researchers, and he has documented the rise of the mobile phone in captivating detail in the *Mobile Connection.*

Ling has the appropriate background for the task. His career as a research scientist for Telenor (Norway's largest telecom company) provides a foundational body of experience. His work there focuses on the interplay between technology and society. *The Mobile Connection* appears to be a culmination of his research findings as applied to mobile telephony.

At a tactical level, the book is logically organized into eight chapters across 200 pages. A historical perspective of mobile phone adoption is provided, followed by five chapters dissecting the impact that cell phones have had on our lives.
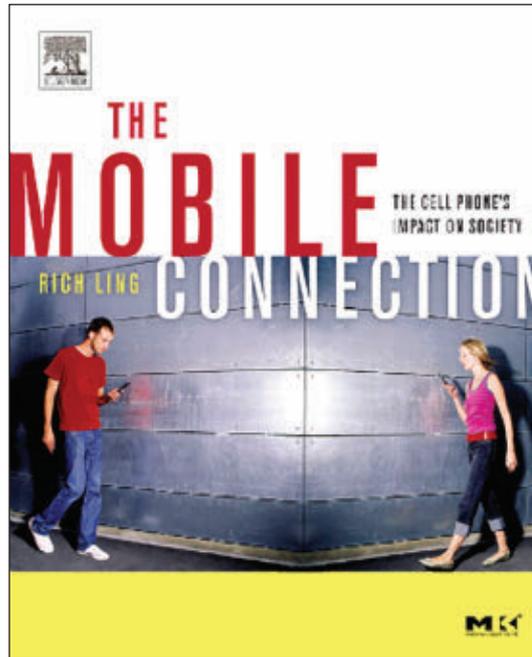
For instance, Ling describes how mobile telephony enables a new level of "microcoordination." This is "the redirection of trips that have already started [and] the iterative agreement as to when and where we can meet friends." We are no longer required to agree on meetings with a fixed time and place. Coordination is fluid.

These five chapters don't focus entirely on the enablement offered by mobile devices. Equal time is spent discussing the ways in which the technology has become a sociological pain. Unfortunately, for every person who finds benefit from cellular phones, at least one other has the opposite response. My time at the airport is evidence of this.

The final chapter recognizes the fact that a book about mobile technology's impact on society can quickly become outdated. Ling takes a broad, forward-looking glance at everything that mobile technology has already accomplished and prods the reader with provocative questions about what society is and how we are all tied together. It's a logical conclusion, but I can't help feeling that something is missing. With the popularity of smart-phones like the Blackberry and iPhone, additional mobility features will become mainstream. Mobile Internet, location-based services, and other new technologies are already prevalent. A discussion of the impact of these technologies would be a much-welcomed addition. Nevertheless, it's worth mentioning how well Ling is able to stick to topics that are likely to stand the test of time. The mobile phone industry's product life cycle is measured in 18-month intervals. Considering that *The Mobile Connection* was published in 2004, I was expecting more of the content to seem irrelevant. Ling avoids the issue by sticking with capabilities at the core of mobile telephony.

Throughout, *The Mobile Connection* is full of both quantitative and qualitative research findings. The data sources referenced are distilled from almost a dozen primary research studies from the likes of Telenor, The Pew Research Center, and Rutgers University. Insights provided are backed by verifiable data and are incredibly relevant for design decision making.

However, the most compelling aspect of *The Mobile Connection* is the anecdotes from various research subjects. Research-related books often feel dull and impersonal. Distilling facts to their essence has the unfortunate side effect of losing the details that make individuals interesting. While trends and patterns provide evidence for decision making, they don't make for compelling reading.

Ling recognizes this and makes sure to regu-larly interject interesting stories from his myriad interviews. These often funny, regularly insightful interludes keep the book well paced and interesting. For example, take teens Anders and Harald discussing the aesthetic considerations of their cell phone choice:

Anders: *The model has a lot to say, you know. A Philips "Fizz" from 1995 is nothing that you show off.*

Harald: *I think that blocks of cement are cool.*

The same position that cellular phones are seen as a statement of fashion could easily have been presented with survey results or questionnaire samples. It's the personality and humor present in these interviews that gives *The Mobile Connection* charm.

Ling provides a compelling, easily digested overview of the important research into the cell phone's impact on society. Ultimately, *The Mobile Connection* is a great book for anyone working in the mobile industry or interested in the impact this device has had on society. It's a quick read that you'll likely find yourself using as a reference book in the future. We now take for granted the fact that cellular phones have penetrated our culture deeply. This book is an interesting dissection of exactly how the roots were planted and disseminated.

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Also by Richard Ling

The recently published *New Tech, New Ties* is available from MITPress.

Audiophoto Narratives for Semi-literate Communities

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It is widely assumed that the Internet is a global information resource. This is not true. For many people in the poorest parts of the world, the Internet is both technically and psychologically inaccessible through lack of infrastructure, money, and the requisite forms of textual and computer literacy. The StoryBank project has been tackling some of these issues by using the fast-growing infrastructure of mobile telephony to support an alternative form of information sharing in pictures and sound.

Situated in the Indian village of Budikote and inspired by developments in audiophotography and mobile imaging [1, 2], we have been exploring the possibility of semiliterate communities using the camera phone as a new kind of pen and paper for creating and sharing audio-visual stories. The system design has been described in a recent conference paper [3], and we are currently preparing a full write-up of the trial results. Here we want to promote the simple story format arrived at in the research, and point to some of the interaction design challenges of supporting it in this context.

The mobile is undoubtedly a transformative technology for development work. Networking and power-management innovations and large-scale investment mean that even very remote rural locations are getting connected. But a word of caution: One cannot necessarily deploy in-built phone interfaces and applications for populations that do not have our exposure to computing or the levels of textual literacy we assume.

Hence, three non-textual applications were written for the Nokia N80 camera phone: StoryCreator, StoryPlayer, and StorySender. This was a considerable challenge, since all existing mobiles employ a menu-based style of interaction with textual labels. In contrast, we used culturally sensitive icons developed with our village population to control simple multimedia and file-handling functions. StoryCreator was used to author short audio-photo narratives, comprising a storyboard of up to six still images synchronised to a voice-over of up to two minutes long (see Figure 3). Users are led through a story-creation process to fill media slots in a template, either image first or sound first. Once the media elements in each stream are recorded, users are prompted to synchronise the streams by replaying the sound clip and tabbing through the images at the time they want them to appear. The only editing supported is to review and delete media elements or their synchronisation.

Despite the creative limitations of this design and a very slow response time on some of the actions, rural Indian users were able to use it in a one-month trial to record a variety of story content with minimal training. One hundred and thirty-seven stories were recorded by 79 people, using 10 phones, on topics ranging from agriculture and health to education, self-help groups, and entertainment. The average number of images used was 4.5, with a mean voice-over length of 66 seconds. A typical story is shown in Figure 1, with the local Kannada language voice-over translated and transcribed below the picture to which it relates. A young boy describes the challenges of rearing cows in a short agricultural story lasting 1 minute 50 seconds; this plays back full-screen like a PowerPoint slideshow with spoken narration. A range of creative effects were demonstrated across the corpus, including the use of song during activities, the unfold-

[1] Frohlich D.M. *Audiophotography: Bringing photos to life with sounds*. Springer Verlag, 2004.

[2] Sarvas R., M. Viikari M., J. Pesonen, and H. Nevanlinna "MobShare: Controlled and immediate sharing of mobile images." *Proceedings of Multimedia 2004*, 724-731. New York: ACM Press, 2004.

[3] Jones M, W. Harwood, D. Bainbridge, G. Buchanan, D. M. Frohlich, D. Rachovides, M. Frank, and M. Lalmas. "Narrowcast yourself: Designing for community storytelling in a rural Indian context." Working Paper. DIS 2008, Capetown, South Africa, 2008.

ing of procedures, the sequencing of landmarks in route directions, the illustration of different products, benefits or problems with individual images, and the demonstration of yoga positions.

In some ways, this format can be seen as a simpler (non-textual) form of multimedia message than those currently in the marketplace or proposed as future extensions [4]. However, we prefer to see the audio-photo narrative as kind of stand-alone digital story [5], capable of interpretation by a wider audience than an MMS and providing a different structure and aesthetic than a mobile video clip. This is because it builds on a more accessible practice of talking and pointing to things and can be shared more widely and cheaply by uploading to a community repository (or "StoryBank"). Hence, in the project we avoided the cost and bandwidth limitations of MMS by supporting Bluetooth P2P sharing between phones and Bluetooth/cable connectivity to a digital library repository in the village ICT Centre.

Stories could be played through a direct manipulation interface to a changing story collage presented on a touch screen display [3]. This was a second design challenge because stories had to be accessible without recourse to the usual text annotation and search facilities found in other multimedia repositories such as YouTube. So we made use of a combination of other techniques, including ambient recommendations, unique story numbers, and filtering by topic and phone icons. In ambient mode, the display presented about 10 initial index photographs corresponding to 10 stories, any one of which could be played full screen with a touch. These photos grew and shrank in size while drifting around the screen and were systematically replaced by others from the total set. When playing full screen, each story displayed a unique number that could be memorized or noted for direct re-entry later on via an on-screen keyboard. The collage itself could also be filtered by pressing combinations of phone and topic icons down each side of the screen. Phone icons referred to one of 10 phones on which stories were recorded, while topic icons referred to one of nine topics by which stories were classified at the end of the creation process. These were developed collaboratively with villagers and reflected their "best guess" as to what infor-

[4] Jokela T., J. T. Lehikoinen, and H. Korhonen. "Mobile multimedia presentation editor: Enabling creation of audio-visual stories on mobile devices." *Proceedings of CHI 2008,* 63-72. New York: ACM Press, 2008.

[5] Lambert J. *Digital Storytelling. Capturing lives: Creating communities.* Digital Diner Press, 2003.

"I am speaking about rearing cows. We maintain three cows. We need two people to look after them. They have to be washed every day. Then we milk them twice every day."

"We receive 10 Rs for a liter. There is expenditure for the fodder and this and that. We make a little profit. If we feed farm grass."

"Then the milk yield is more and better the profit."

"It is not easy rearing cows. Just as man eats three times, we have to feed the cows three times and look after them."

▶ Figure 1. Example farming story of up to six photos with the corresponding voice-over translated and transcribed (#1268).

mation would be most useful to share on the system. Topics include student, entertainment, farming, health, legal, news, Panchayat (local council), self-help groups, and education.

The potential value of audio-photo narratives for information sharing in this context is suggested by an analysis of trial story content and preference. Stories were recorded across the full range of designated topics, confirming the initial categorization. No one category of story

"Oh beautiful dear children who have blossomed in yards of each home. Tomorrow you will be running this land. You have to do as told by your parents."

"You have to learn the lessons taught by the school-teacher. You have to respect the elders. You have to be truthful in speech and action. Oh beautiful dear children"

"Dear children"

▶ Figure 2. A song sung during a children's dance practice (#1229).

▶ Figure 3. Cameraphone interface to story-creation application

was significantly favored over others because people tended to watch stories related to their own interest or profession, leading to a spread of preferences. However, a small number of functionally similar forms of story dominated the corpus, indicating particular value to the community. These included advertisements for local produce and handicrafts, farming and business problems or processes (such as that shown in Figure 1), and community news or advice.

While the first two types of story are related to economic "development" issues, the third is not, relating more to a form of personal and cultural expression. Such content included mythical tales, moral stories, festival recordings, advice to children and the community, and the occasional song such as that translated in Figure 2. This was recorded by a teacher in a children's dance practice session.

In many ways the content of these stories was similar to that of news items on a community radio station run in Budikote village called Namma Dwanhi ("Our Voices"). In contrast to the Internet, Namma Dwanhi is a popular and effective way of sharing information in the area [6]. However, in contrast to radio broadcasts, the audio-photo narratives of the StoryBank system are shorter, illustrated, and easier to create by a broader section of the community, including children. They are also accessible at any time from the community display and open to new forms of mobile circulation and distribution between people and places.

From a development perspective we have begun to see this medium as an extension and complement to community radio, rather than as a new form of Internet access as we expected. A future challenge is to bring these two perspectives together by reintroducing wide area or even global communications into our architecture and considering how spoken narrative content can transfer outside the language speaking area in which it was developed. We believe this will involve the kind of mobile and situated device ecology used in StoryBank, with new connections to paper-based information such as booklets, magazines, and posters. The mobile phone is critical to this ecology because it forms the bridge between large distributed information repositories and local people, places, and things. It can also serve as a new kind of multimedia pen and paper as we have shown.

Because of price sensitivity and the community orientation of life in developing communities, phones and other technologies will continue to be shared resources rather than personal ones for some time to come. So another challenge for Western designers is to shift from a user-centered design approach to what we have called a "community-centered design" approach, involving different elements of a community in the design of

[6] Pringle I. and S. Subramanian, eds. "Experiences in ICT Innovations for Poverty Reduction." UNESCO Report, 2004.

shared technology for community benefit. Looking over the shoulders of the crowd of villagers using the StoryBank repository for the first time, we began to see the great potential of this approach for the rural Indian context in which we were located. In a culture founded on extended family and community living, this very public interface, with its noise and color, seemed to be an altogether more fitting form of Internet than we usually think of in the West, and a perhaps a lesson in how far we still have to go in making it more accessible and culturally appropriate in other parts of the world.

Acknowledgements

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Matt Jones is a reader in computer science at Swansea University where he is helping to set up the Future Interaction Technology Lab. He has worked on mobile interaction issues for the past 13 years and has published a large number of articles in this area including *Mobile Interaction Design* (Wiley & Sons, 2006) with Gary Marsden. He has had many interactions and collaborations with leading industry partners and is currently a visiting fellow at Nokia Research, Finland.

Think Before You Link: Controlling Ubiquitous Availability

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The survival of the species depends upon communication between its members. The mechanisms underlying human communication have long been scrutinized, from Darwin's examination of the role of emotion, to later studies related to the ways in which people form attachments. Of particular interest are studies about how individuals and groups communicate. Whole journals are dedicated to human communication and communication disorders.

Although survival is dependent upon communication, as a species, we need to do more than simply survive. Maslow attempted to enhance understanding of this with his proposal of a number of "human needs," which start off with the most basic, physiological needs and progress to self-actualization at the apex of the pyramid. Only once a person feels that Maslow's lower-level needs have been satisfied can they enjoy an "enhanced survival status," in which those aspects of daily existence that preoccupy them are of a "higher order." The kinds of issues that might preoccupy people at the highest level are: which computer to buy, whether to go on holiday, or whether to purchase an iPhone. Communication, according to Maslow's model, becomes a need to be satisfied only when physiological and safety and security needs have been satisfied. However, experience tells us that people have the need to communicate even when their lower-order needs are not satisfied, as evidenced by the behavior of people in concentration camps. It is also well known that solitary confinement is the most dreaded form of discipline in prison. We argue that despite interaction being such a basic need, the glut of communication media has overloaded us to such an extent that the biggest luxury of all is to choose not to interact with others.

The explosion in communication in the past few years has been facilitated by a number of innovations such as affordable mobile phones, social networking sites, email, and BlackBerries. Based on our observations of emailers, we forecast a gradual withdrawal from electronic communication based on the fact that people obviously are unable to be sensible about their email interactions. For example, continually thinking about and monitoring email, just in case something interesting has arrived, is not productive. This is exacerbated by the multitude of other information we have to deal with on a daily basis as part of our working day.

Several studies have foreshadowed this. Nonnecke and Preece found that the very great majority of the members of online technology and health support groups were non-active members ("lurkers") [1]. In this context, people are refraining from interacting; however, we have not observed this kind of restraint when it comes to emailing behavior. What we have found is that emailing behavior is often characterized by a kind of compulsion, with emailers not even being aware of how often they engage with their email client.

Individuals need to retreat from interaction, to engage in a

[1] Nonnecke, B. and J. Preece. "Lurker Demographics: Counting the Silent." Working paper, CHI 2000, The Hague, Netherlands, 2000.

process of self-renewal and rein-vigoration so that they can cope with a hectic and demanding world. The need for solitude is undisputed [2]. Naturally, people differ and have varying solitude requirements. Unfortunately, not everyone feels empowered to make the decision not to interact. There are institutional impera-tives for communicating. Email comes with your PC at work; you can access it from home, and the pressure to check email is strong, ubiquitous, and attentionally demanding. Yet how many job descriptions explicitly mention the need to engage with email, and how often is time formally allocated to it?

Problem No. 1: Unbidden Email-Related Thoughts, a "Recipient Generated" Phenomenon

Email usage requires us to invest a significant amount of time and energy in reading, acting upon, making decisions about, remem-bering, and removing emails. This takes place in one of two ways. First, in the same way that alcohol researchers investigate "alcohol-related cognitions," we posit the existence of "email related thoughts" —unbid-den thoughts that compel the individual user to check email. This reflects the wider debate about whether Internet addic-tion should be recognized as a clinical phenomenon. Email was initially the plaything of aca-demics and technophiles, but it has quickly become the de-facto communications technology of choice for business, academia, and personal users. It is ubiqui-tous: available at work, at home, from "third party" locations such as Internet cafes, from mobile devices such as BlackBerries

[2] Cramer, K. M. and R. P. Lake. "The Preference for Solitude Scale: Psychometric proper-ties and factor struc-ture." *Personality and Individual Differences* 24, no. 2 (February 1998): l92-99.

or mobile phones. Many of us check our email first thing in the morning, regularly throughout the day, last thing at night, and during our holidays. Research that we have conducted over the past three years signals an urgent need to develop proto-cols for managing interpersonal interaction if the power of these communication technologies to distract, interrupt, and pressur-ize is to be controlled.

Although the clear benefits of email are apparent (person-to-person, personalizable, almost instantaneous, archivable, with ability to attach text and pic-tures, etc.) the research that our team has conducted over the past three years has indicated that user engagement with inter-action technologies has now reached the high watermark. Partly, we suspect that the problem is their misuse. How much of the content of what we communicate is really truly necessary? Often, we commu-nicate simply because it makes us feel connected. What we call small talk or gossip is the vitally important grease of social life, but not every technology and every context, for example work-place email, is appropriate for this type of interaction.

Problem No. 2: Unbidden Email Interruptions, a "Sender Generated" Phenomenon

Unlike paper correspondence or telephone calls, email is unusual in that it imposes a disproportionate amount of the cost related to communicating onto the recipient, rather than requiring the sender to carry the bulk of the cost. Some senders scatter emails as a sower scat-ters seed—transferring responsi-

bility for tasks, informing those who have little interest in the topic of current developments, generally filling up inboxes with impunity and with no thought as to the consequences for those who have to spend valuable time dealing with the emails. The phrase "the tyranny of email" is not so much humorous as it is tragic. Even worse are the senders who bully, terminate relationships, and deliver bad news by email. It is too easy to send email; it aids and abets the avoidance of independent thinking and problem solving. A commonly cited example in aca-demia is the case of the student who reaches for a staff member's email address before reaching for a textbook.

Many people have their email client running in the background while they work on other tasks. Anecdotal reports have sug-gested that growing pressure to send, respond, and manage increasing volumes of email has a potentially deleterious effect upon users. By tracking the onscreen application-related behaviors of six volunteers, we found that individuals switched between other applications and their email client continuously. In fact, what appeared to be happening was a monitoring of incoming email, which super-seded all other work. Continuous monitoring of emails reflects a high level of email-related thoughts, which may impact task performance. Unbidden email interruptions, on the other hand, make demands upon both limited memory and attentional resources and time. Famously, in 1956, Miller ascertained that people can hold only a little less or a little more than seven

separate items of information in mind (in what is termed "working memory," which is where information currently being used is temporarily held). Recently, Cowan has suggested that this number might be as low as four items [3]. Working memory, being so limited, is very vulnerable to interruptions. When an email interrupts an ongoing task, the person focuses his or her attentional resources in an either "alternating" or "simultaneous" manner to the email. These modes of operation are far less effective than focused attention. Just how aware are email users of the price they are paying?

When we asked people around the world about their experiences of email, the findings were revealing: a worrying mismatch between what we had seen happens (study one) and what users are aware of (study two) [4]. We concluded that while users believe themselves to be in control of their email, they appear to be in its thrall—mesmerized by the idea of incoming emails awaiting perusal.

We developed a typology of orientations to email [5]. Three dimensions emerged: relaxed, driven, and stressed. Those individuals with the orientation that we labeled driven also appear to have low self-esteem. In other words, those who suffer from lower self-esteem are impelled to engage with their email more than those individuals who have

higher self-esteem. Those with a stressed orientation find email more distracting than other forms of asynchronous communication such as letters or instant messaging, for example. This makes sense if we accept that the positive side of email is that we are in semi-continuous contact with other people, often like-minded, often geographically disparate. We are communicating. Now, human beings as a species need to communicate to survive, but, even so, communication is more important to some than to others. Those with low self-esteem often define themselves in terms of their acceptance by others; they desperately need the communication fix. Those with higher self-

[3] Cowan, N. "The magical number 4 in short-term memory: A reconsideration of mental storage capacity." *Behavioral and Brain Sciences* 24, no. 1 (2001): 87-114.

[4] Renaud, K.V., M. Hair, and J. Ramsay. "You've got email. Shall I deal with it now?" *International Journal of Human-computer Interaction* 21, no. 3 (2006): 313-332.

[5] Hair, M., K. V. Renaud, and J. Ramsay. "The Influence of Self-esteem and Locus of Control on Perceived Email-related Stress." *Computers in Human Behaviour* 23 no. 6 (2007): 2791-2803.

esteem are more self-contained; they can take it or leave it.

Solutions: Technical or Societal?
Solutions can be either technical or societal. In the case of email, we believe that both are required, that a two-pronged approach is the only viable approach to the problem. For example, current email clients such as Microsoft Outlook allow users to request notification upon arrival of every email. This appears to encourage and facilitate the monitoring behavior we observed, which, in light of our research findings, is detrimental. There is plenty of evidence as to the negative effects of continuous interruptions which cause stress and exhaustion and interfere with a person's ability to complete other tasks. On the other hand, a business-wide email policy could state that employees need not monitor their email all day but policy makers are likely to find that email is so enticing that this kind of policy is not adhered to, and might well prove counterproductive if enforced. So, for example, the implementation of email-free Fridays by companies such as Intel may simply result in most of Monday being spent catching up. Part of the problem stems from the fact that email is still an evolving communication technology. Unlike the well-established norms related to dealing with letters, memos, and phone calls, we are still in the infancy of developing email etiquette. This leads to people having their own idiosyncratic email behaviors. Some people archive every email, others delete religiously, still others let their inbox fill to overflowing. Some reply immediately, some when they get the chance, and others will purposely not reply so as not to seem too eager! Others deliberately delay opening emails when they suspect the sender receives "read receipts." This latter behavior is a clear case of the attempt to manage sender expectations, further confirming sender-recipient inequity. Moreover, everything and anyone can appear in your inbox, and at any time. No one inbox has the same traffic on any two days, meaning that we are constantly upgrading our email behavior.

What Can You Do About It?
Having considered our research evidence, we believe that the long-term solution will be a mixture of better business-wide communication policies linked to better software. However, in the meantime, how can the individual users take ownership of the problem, since they are the ones who are primarily affected? The first step is for users to acknowledge that communication technologies are not only a great and good thing but can also be a tyrant, and to understand that this can not only interfere with their ability to do their jobs, but also exacerbate their stress levels, increase their blood pressure, and cause them to be more tired and irritable than necessary. In the case of email, users should stand up (metaphorically) and admit "my name is Jo and I'm an email addict." Once they have acknowledged this, they need to implement a personal email management policy.

Communication technologies can work either for or against you—helping you to be more productive or fragmenting your day into tiny slices of activity, interspersed with frequent interactions with others, leaving you exhausted and unfulfilled by the end of the day. At the moment, only you can act to master your communication behavior and bring it under control. Communication technologies need to be tools, subjugated and made to work for you rather than being controlling tyrants, preventing you from enjoying your day and invading your leisure hours. Finally, linking with others is positive and conducive to happy and healthy relationships but it is very important for you to think before you link!

ABOUT THE AUTHORS
Dr. Karen Renaud is a senior lecturer in the department of computing science at the University of Glasgow. She has a strong software engineering background and has an interest in making technology usable and useful to end-users. She is particularly interested in the use of email within organizations and the effects of ubiquitous connectivity on individual employees.

Dr. Judith Ramsay is a lecturer in the division of psychology at the University of the West of Scotland. She is a chartered psychologist specializing in the psychology of human-computer interaction. At home in interdisciplinary teams, her research is driven by the need to understand individual differences in Internet-based communication.

Mario Hair is a statistics lecturer at the University of West of Scotland and is also an active researcher and consultant within the Statistics Consultancy Unit based at the university. He is a fellow of the Royal Statistical Society. His research interests include the use of mediated communication technologies and the psychology of survey response.

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HCI, Life and Death, and Randy Pausch

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When Carnegie Mellon University professor Randy Pausch passed away on July 25, 2008, millions of people—most of them non–HCI community members—knew and took inspiration from his story.

How is it that a teacher of computer science, usually a low-key position of little consequence to the general public, becomes such a figure of reverence? In the age of instant communication, of wide distribution of media in varying qualities, it's been said that everyone is famous to 15 people. Randy Pausch was famous to millions. On the morning that Pausch's death was announced, his Wikipedia entry was updated faster than his own website (maintained by friends and family). ACM TechNews distributed the news before noon. I learned of his passing from a Twitter post by Jared Spool, in less than 140 characters.

Word of mouth has become word of electrons: Twitter, FriendFeed, Facebook, instant messaging, texting, all make the world a smaller place and enable communities to rise and disappear as quickly as a few passionate observers can type or text. Thus it was that Randy Pausch's "The Last Lecture" to CMU students was recorded and distributed and became a phenomenon.

Pausch himself used the Web to communicate about pancreatic cancer, the disease that ultimately killed him, in gut-wrenching detail. And when the video "The Last Lecture" became popular, Pausch collaborated with a professional writer to record the lecture and additional stories in a book. That book, *The Last Lecture*, appeared for more than 18 weeks (at this writing) at the top of the nonfiction book charts and went through multiple printings, all the more remarkable in an age of shorter attention spans and declining sales. I will not speculate here on the book's appeal, other than to acknowledge that it includes heart-wrenching stories that are especially effective for those of us with spouses and small children, embellished with brief stories to illustrate numerous of Pausch's life lessons. For anyone who spends time at all contemplating their mortality, Pausch's approach to ensuring that his young children will feel connected to and instructed by their father is meaningful. But ultimately, the book's popularity must be evaluated in light of the exposure that YouTube, ABC News, and the Web provided for Pausch's story.

A few statistics help tell the story:
• 10 million views on YouTube
• 2 million-plus books in print, translated into at least 17, possibly 30, languages
• 18-plus weeks on *Publishers Weekly* non-fiction bestseller list, at no. 1 since it appeared April 21, 2008
• ABC's rerun of the Diane Sawyer interview and profile, presented the Tuesday after Pausch's death, scored a 2.4 rating, 7 share, with more than 7 million viewers—the third-best ratings of that evening.

"Don't tell people how to live their lives; just tell them stories, and they'll figure out how the stories apply to them," Pausch said in the lecture. So his book is all stories, some brief, some longer, all making a point. Maybe that's part of its appeal: The reader can digest it in bits and pieces, pausing when a passage hits a little closer to home. Likewise, the video clips ("The Last Lecture" excepted) can be viewed in chunks, out of order, rewound and rerun.

ABC's story and interview billed it as a love story. Pausch himself revealed at the end of "The Last Lecture" that it was not about his audience, it was for his children; and ultimately, it was not about living your dreams, but living your life in a way that allows your dreams to come to you: karma.

At first contact, Pausch frequently came off as proud and arrogant; perhaps these impressions derived from the passion Pausch brought to teaching, to the study of HCI, to life. Randy knew that but didn't let it slow him down. In a *Time* magazine

interview published April 10, 2008, a reader asked:

"From your lecture, you seem like a very modest person. How are you handling the adulation?" —*Vernon Hines, Columbia, Md.*

Pausch: "First off, I reject the premise. Anyone who knows me well will tell you that arrogance is one of my flaws. . ."

Information architect Keith Instone took a stab at writing this review and found himself immersed in the emotion of Pausch's story (see sidebar). It's hard to be clinical and scientific—looking at it as an "engineering problem," as Pausch puts it—when the subject himself chokes up on camera.

If Pausch's story in all its forms achieves anything for the field of HCI, it can be seen to humanize computer science, to reveal the passion at heart of our work. We wouldn't be doing this if we didn't believe that we could make living in this world better, easier, more rewarding; that good design can make technology less intimidating (see Pausch's VCR-smashing story), can ensure that the research we perform makes more usable products, that the products we create are useful, usable, and desirable. Because we believe, like Randy—with deep and authentic passion—that ultimately it's not things that make life worth living, it's the people on whom we have some impact.

Keith suggests that the answers to his questions go something like this: "I had some suggestions for future issues of *interactions* showing how popular culture views our designs and vice versa. A call to action for us to stop paying so much attention to selling more widgets on the Web and instead put our collective might into helping to solve the energy crisis, AIDS, or even developing better user interfaces for scientists searching for a cure for pancreatic cancer. How we as a profession should do more story-telling, to touch our stakeholders at an emotional level. How we are neglecting our duty to leave a legacy to the next generation of user experience professionals."

I couldn't say it any better myself, so that's the review. Your experience will vary, but you will not go away unmoved. We encourage you to translate that emotion into action; don't let Randy's story be just about the passing of one life and his legacy for his family. Passion pays huge dividends.

ABOUT THE AUTHORS Fred Sampson is a staff information developer for the content management and discovery team at the IBM Silicon Valley Lab, where he helps user experience designers create self-documenting user interfaces; he dreams of growing up to be an information architect. Fred is vice-president for finance of ACM SIGCHI, a senior member of the Society for Technical Communication, and a member of the Information Architecture Institute and the Usability Professionals Association.

Keith Instone is the information architecture lead for ibm.com, where he works on strategic projects (like personalization), day-to- day navigation (with a story behind every link), and many things in between. He has been an active member of the user experience community for more than a decade—receiving service awards from both SIGCHI and UPA—and is now devoting his volunteer time to the User Experience Network.

Objective? Not When it Comes to Randy Pausch

As distanced as I was—I met Pausch once, found him to be both passionate and arrogant—I found that sections of the book raised my own emotions: about children, about love, about living one's life, about disease and death and loss, and about life being what happens while you're making other plans.

How do we, as a user experience community, make the world a better place? How do we make sure the products, services, and solutions we design improve people's quality of life? How do we leave a legacy of work that enables the next generation to solve humanity's problems? How do we affect the changes necessary to really solve our most difficult social, environmental, and economic crises?

With those questions in mind, I tried to take an objective, scientific review of the "Randy Pausch story," that of a CS/HCI professor whose campus lecture was watched by millions, who appeared on national TV, lobbied Congress, and authored a best-selling book. All while battling one of the most severe forms of cancer.

Go watch the videos, read the book, find the TV segments. A clinical clipping of Randy's story does not do it justice—you should experience it yourself. Just realize that if you run into me at a conference and start to talk to me about Randy's story, I will not be able to retain my composure. Give me a hug and help me through it.   —*Keith Instone*

On Mobile Communication, Cultural Norms…

Jon: Late this summer, we met up in New York City to discuss *interactions*. We spent a bunch of time in an office and a bunch of time wandering around the city. While we certainly got a fair amount done in the office, I can't help but feel like the time spent in pubs, shops, galleries, and cabs had more impact on the future of the magazine.

Richard: Though those office meetings, some with several other people and all facilitated by invaluable whiteboards, were critical, I feel the same as you.

To me, this was due, at least in part, to our in-person "mobile communication," facilitated and fed by a richness of the shared experience of NYC. That differs from the mobile communication described so nicely by Rich Ling in this issue and in his books. However, it too is an important part of our mobile society, though one not always adequately acknowledged or supported.

Jon: But it was something more than that—it was the feeling of technical culture intermingling with the traditional analog spirit of a big city. For example, I was astounded to see how omnipresent LCD panels have become; they are, for example, not just in cabs but on top of them too, and it seems like even an elevator ride up three floors can't be complete without a Fox News feed.

Yet at the same time that the city has become overcome with technology, the culture of the city was alive with more traditional human interactions: Sixth Avenue, closed to automobile traffic; a "pay what you want" art exhibit; people playing chess in Washington Square Park. This combination—the old and new, digital and analog—is, I think, what Christine Satchell is talking about when she alludes to the periphery.

Did you feel this sense of "seeing culture" in the periphery, as I did?

Richard: I enjoyed watching the staff of the old neighborhood Italian restaurant we ate in one evening as you and a former student of yours exchanged text messages with other former students of yours, inviting them to join us. Some of those other students eventually arrived to share our table, but did so at different times such that everyone's ordering and dining was staggered. This is a part of the

mobile society that Ling does discuss, but as reflected in the changing faces and moods of the restaurant staff, it was not within their cultural norm.

Jon: But what is in their cultural norm is a sense of a community and sharing, and a large, boisterous, drawn-out dinner—which we certainly enjoyed. The technology enabled it, and like it or not, that technology is now a part of their restaurant culture and a part of the dining experience. This same technology is firmly embedded in the museum experience, where text messages help coordination within a seven-floor building, even while the security guards frown in displeasure, and in the hotel experience, where the check-in counter has more screens than people.

Ben Bederson's work embraces technology as inevitable; the work of Karen Renaud and her colleagues suggests we are killing ourselves with email.

What about you, who worked happily for a few hours in a pub on your laptop but rarely touched your mobile phone?

Richard: As we interact here in our magazine's cafe, many thousands await a text message from Barack Obama to be "the first to know" the identity of his running mate. While some smirk at this, I think that says all sorts of positive things about the candidate. But for Barack to include me among the first to know, he might need to send me an email for me to read via my laptop.

My phone sits in my pocket, mostly ignored. Perhaps I have more in common with the restaurant staff and the museum security guards than I might like to admit.

Jon: And so do I. To be completely honest, I despise my cell phone, and not just because the interface is awful. I cringe from how the phone forces a life of haste, and introduces a lack of personal space, and pushes demand to be always in the know.

In a way, I agree with Renaud, and Satchell, and Ling too. I wonder if our focus on a small screen has pushed us to lose sight of the vast periphery and richness of culture?

—*Richard Anderson and Jon Kolko*
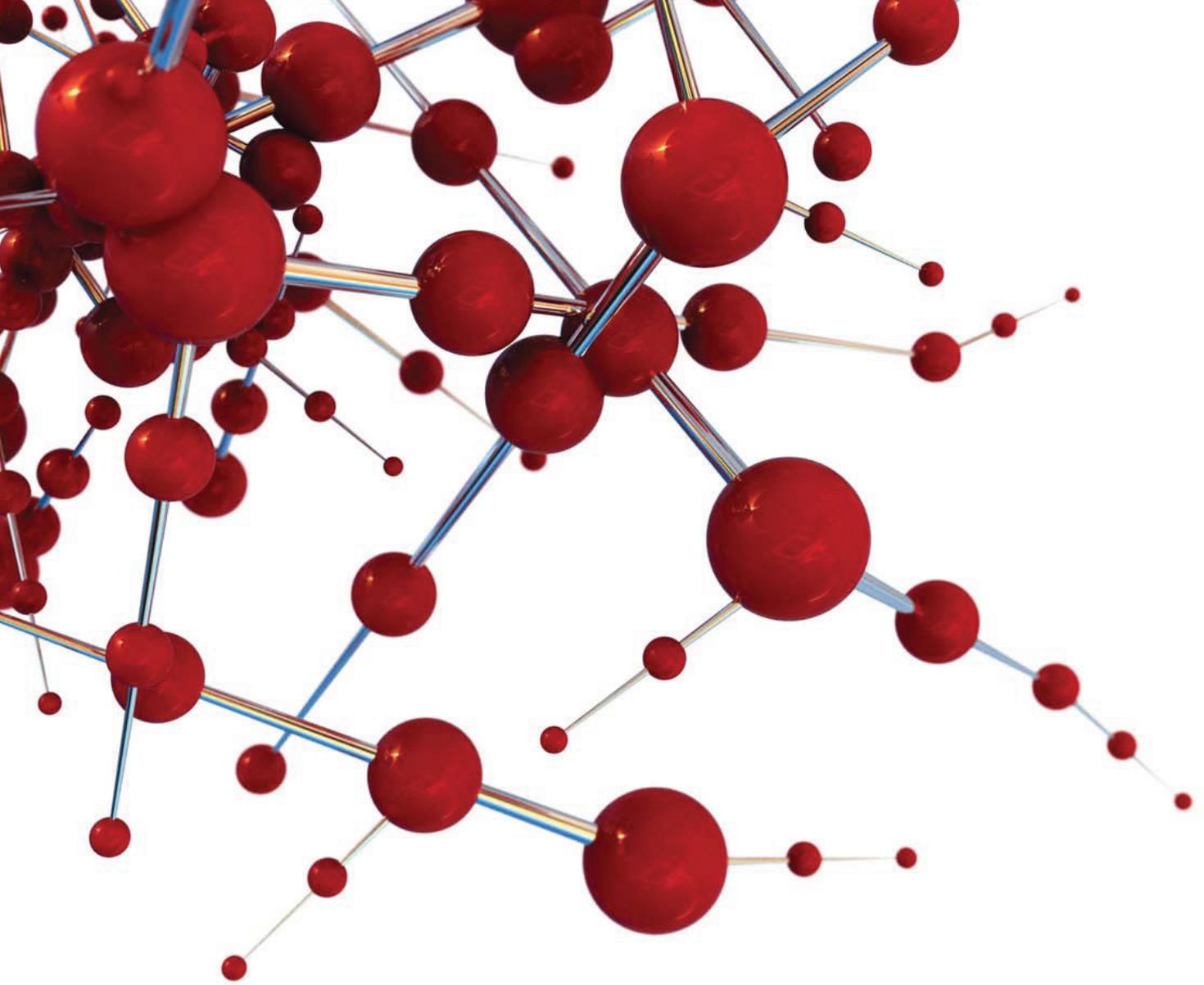
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