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interactions

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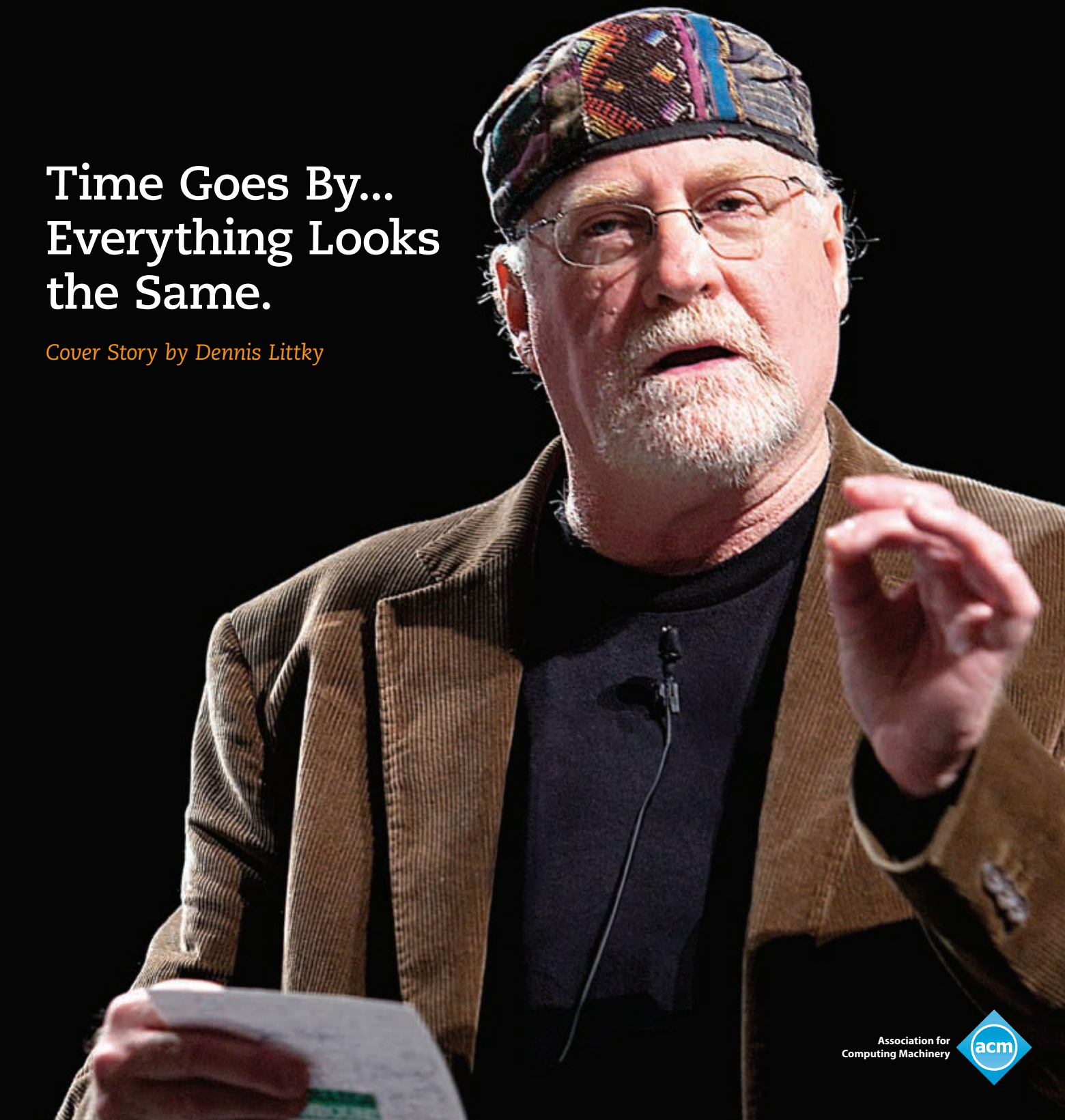

Time Goes By... Everything Looks the Same.

Cover Story by Dennis Littky

Association for Computing Machinery

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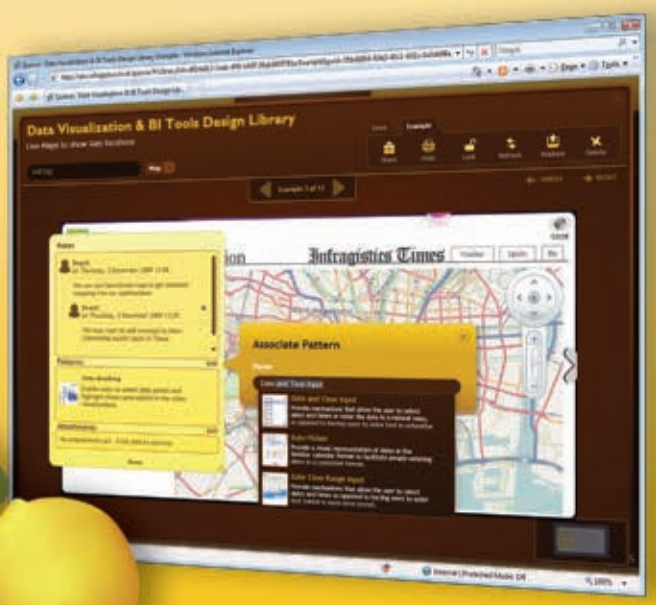

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Interactions: Subtlety and Change

▶ Richard Anderson

▶ Jon Kolko

There are some strange changes under way in our world. We constantly hear the refrain of the massive chaos around us, yet the allure of such a large, looming flux may distract us from something more important: the countless tiny, nuanced, and fundamental ways in which our culture and society are advancing. This issue of *interactions* describes these subtleties and teases them out of the greater topics that we've grown accustomed to discussing: environmental change, the role of education and government in a technological society, and the nature of behavior.

Jon Innes describes the idea of cultural acceptance as a theoretical requirement for exploring the coming future, and the need to better identify trends in the world around us. This relates to Don Norman's call for "translational developers"—those who are able to take research findings and articulate directional actions. And Katie Minardo Scott describes the challenge of synthesis—the relationship between a designer and the data that can be so overwhelming.

A similar investigative depth is found in the piece by Carl DiSalvo, Phoebe Sengers, and Hrönn Brynjarsdóttir, who explore the manner in which sustainability has impacted HCI and academic research. No longer a simple colloquialism of "reduce, reuse, and recycle," sustainability research and design now require an acknowledgment of the political differences involved in the discipline. This demands a more nuanced discussion of topics, as well as a more direct connection between research and practice.

The same political connotations are present in a conversation of education reform. Cover story author Dennis Littky—the co-founder and co-director of Big Picture Learning—describes the need for fundamental shifts in high school education in the U.S. As he ponders why drop-out rates average 50 percent, he describes a new model for learning, one that rejects traditions and begs a clearer understanding of the culture of our teenagers.

This issue brings these topics, along with Liz Danzico's discussion of the subtleties of timing in design and conversation, Fred Scharmen's thoughts on the intricacies of the social Web, and Nicholas Carr's reflections on the state of our technological culture. The topics are broad but the analysis is nuanced and sharp: The changes to our world can be unpacked from their unwieldy topical containers so we can analyze, discuss, and embrace the shifts taking place.

We hope you find value in these perspectives and can integrate them into your daily work—the work that is supporting these changes and helping drive them to fruition.

—Jon Kolko
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Everything I Know About User Experience I Learned From Jimmy Buffett

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Last weekend I had my first Jimmy Buffett concert experience. I've been a Parrothead for years but never thought about going to a concert. Since I turned 40 this year, I figured I would take the plunge, so my wife and I drove to Chicago to see him.

What a beautiful time! Our immersion into Margaritaville was so wonderful it caused me to reflect about a lot of things… including my passion for what I do at IBM. But how do I capture these revelations and apply them to user experience and the software we build? Turns out nearly every segment of our software design, from our marketing websites, planning and deployment software, install, user interface, help content, customer loyalty, consumability metrics, even functional prioritization and development passion can be made better by what Jimmy taught me.

It's All About the End-to-End Experience

Jimmy knows what his fans want. He also knows that the concert is just a piece of the experience—a whole series of events that can make or break the user experience must unfold before and after the show. His solution? Anticipate everything. From using the website to purchase tickets with parking included, to the Parrothead Coconut Telegraph newsletters that suggests how to "plan and get started," Jimmy wants his fans to get the most out of the concert. The hotels near the venue know you're a Parrothead because, well, everyone is dressed in Jimmy-inspired flowery shirts and hula skirts, even the ladies. Once you leave the hotel, you enter the tailgating experience. Jimmy knows how to overcome huge obstacles in order to elate his users: for instance, convincing the venue both to open up the parking lot at 9 a.m. and to allow in everything from portable hot tubs and grills to dunk tanks. Jimmy provides the best "install and setup" experience in the world. Not only that, but he also encourages his users to customize the experience to make it better and even more personal than he envisioned. The whole pre-show is like catching up with old friends you never knew you had in a familiar place you've never visited.

By the time the show wraps up and morning brunch is consumed, 20,000 of Jimmy's customers are loyal friends who will use word of mouth, money, and emotion (and maybe a tattoo) to promote his product.

It's All About the Performance

Jimmy can have all the promotional materials in the world, but if the performance doesn't rock it's a waste of time. He can fill the stage with glitz and glamour (and a 30-foot bottle of rum), but if he doesn't deliver a killer performance, the eye candy is worthless. Even worse, his reputation is tarnished. Users have a knack for seeing through impressive marketing and preview clips and anchoring onto what is promised. And if it is not delivered, or is delivered slowly and with awkward gaps, no amount of promotion will fix that. A poor first-hand experience is very hard to overcome.

That is why Jimmy works so hard to surround himself with the best talent he can find. He focuses the band on delivering a show that is fast, fluid, heartfelt, and that ends up elating his users.

It's All About Delivering the Basics… Flawlessly

Nothing gets more basic than a cheeseburger… or sailing… or a

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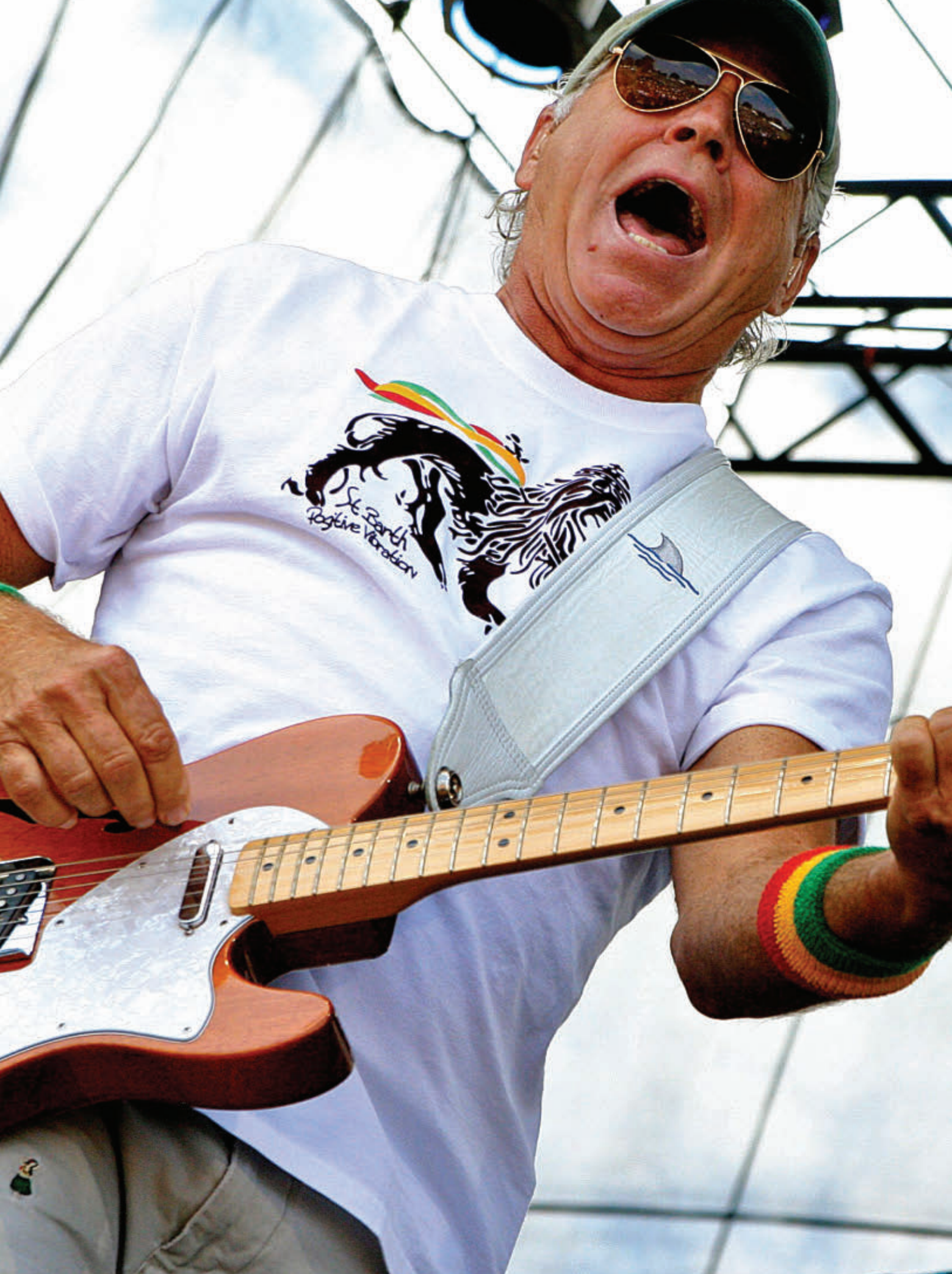
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boat drink. That's what Jimmy sings about because that's what his fans want to hear. He has played his classic hits probably 10,000 times and he still delivers them as if they were from his new album. If he didn't have that base of solid hits that draw in fans from around the world, he wouldn't have a foundation to sell his newer material.

That is why Jimmy constantly delivers what his users want, what his users expect, the basics that lay a firm foundation for his users to discover and explore newer and more robust products.

*"Changes in Latitudes, Changes in Attitudes," by Jimmy Buffett

**"Margaritaville," by Jimmy Buffett

***"One Particular Harbour," by Jimmy Buffett

It's All About Being Social

Jimmy excels at socializing his brand of music and fusing the music itself with the desire to have friends and family share the experience. His music makes his fans want to make more fans! To many, his music is the soundtrack to any great vacation. In fact, just hearing a Jimmy song can bring smiles and memories (like singing "Fins to the left, fins to the right!" while 20,000 fans wave their shark fin–shaped hands over their heads, or hearing 20,000 friends sing "Come Monday, it'll be all right, come Monday…" in unison).

That is why Jimmy's product is so consumable. His users identify with it, socialize about it, and socialize through it, which transforms everyone's individual experiences into a common shared experience.

It's All About Trust

Jimmy knows where his fans come from. He knows the investment in time and money his fans make to visit him and share an evening of peace and love in the tropics (even in Chicago). He has built up a level of trust that he will deliver amazing quality and wonderful performance. If he never had that trust, or if he broke that trust, his fans would not be loyal. They would look for flaws and post online about them. They would not entrust their time or money with his product. Jimmy would have a very hard time regaining customers if his fans could not trust him for a one-night tropical getaway.

That is why Jimmy reinforces the basics yet strives to share something new. He supports his fans through websites, media, news groups, and local user groups. He knows how to communicate to his fans so they can trust and depend on him for a consistently great experience.

It's All About the Attitude

Jimmy summarizes his attitude in one lyric: "If we couldn't laugh we would all go insane"* (well, maybe this one, too: "But there's booze in the blender and soon it will render that frozen concoction that helps me hang on"**). I think he summarized this Parrothead attitude toward the whole Jimmy experience with the line, "And there's that one particular harbor sheltered from the wind where the children play on the shore each day and all are safe within."*** Peace, safety, love, laughter. These are the core tenets of what all Parrotheads want. Knowing this, Jimmy spends a lot of time and money ensuring that what his fans want is delivered, undiluted. Everything he does and every product he makes is designed to maintain the attitude. Whether it's new music, a book, a Landshark lager, or a visit to his cafes, the attitude is there.

And it's not just fused in his product. It is fused into his daily attitude. He may have a $500 million business to run, but he has fun doing it. If he were to complain about the studio he recorded in, it would show. If he didn't take time for his family, it would burn him out. If he didn't treat his band and employees like family, they wouldn't pour every ounce they have into creating the best product they could. He makes everyone passionate about their piece of the product they are delivering.

That is why all who work with Jimmy in creating his experience constantly have the Parrothead experience in mind. From Mac McAnally, who co-writes many of his songs, to the merchandise people at the venue: Everyone focuses their job with one goal: How can I make what I do result in a better experience for our users?

And that is what I learned about user experience from Jimmy Buffett.

Attitudinally and latitudinally changed.

ABOUT THE AUTHOR

Greg Hintermeister works at IBM as a user experience designer and is an IBM master inventor. His user interaction can be found in IBM Systems Director, IBM Virtualization Manager, System i Navigator, mobile applications, and numerous Web applications. His heart can be found wherever his wife is. Fins up!

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The Research-Practice Gap: The Need for Translational Developers

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"Oh, East is East, and West is West, and never the twain shall meet."
(Rudyard Kipling, 1892. Barrack-Room Ballads)

There is an immense gap between research and practice. I'm tempted to paraphrase Kipling and say "Oh, research is research, and practice is practice, and never the twain shall meet," but I will resist. The gap between these two communities is real and frustrating. Sometimes the gap is deliberate. Some researchers proudly state they are unconcerned with the dirty, messy, unsavory details of commercialization while also complaining that practitioners ignore them. And some practitioners deride research results as coming from a pristine ivory tower—interesting perhaps, but irrelevant for anything practical. Sometimes the gap is accidental, caused by a misunderstanding on both sides of the requirements and goals of the other. I have heard researchers, who would like their ideas to impact practice, complain that when their ideas do get used, the practitioners do so incorrectly, omitting (or messing up) the most critical aspects. Practitioners, in turn, complain that research results, even if relevant, never exist in any form that can readily be translated into practice.

The gap between researchers and practitioners extends to the professional societies. The major societal home for many researchers is the Association for Computing Machinery's Special Interest Group on Computer-Human Interaction—ACM SIGCHI—the same group that brings you this magazine. Although CHI pretends that it is home for both researchers and practitioners, that is largely a delusion. In the major conferences, most especially its flagship conference, CHI proudly proclaims that it includes people from both universities and industry. Although this is true, the people from industry are seldom the developers and practitioners. Instead, they are primarily researchers who work for industrial research labs. Researchers in companies tend to be far more closely attuned to their academic brethren than to the people within the product divisions of their own companies. This close connection to research and separation from practice are a hallmark of the research community and the CHI conferences. *interactions* has made a valiant and reasonably successful attempt to bridge the gap, but the fundamental distinction remains strong. I know this problem well because I faced it when I headed a large research group in a product company (the Advanced Technology Group at Apple).

The gap between research and practice is fundamental. The knowledge and skill sets required of each group differ. Consider the research community within design: the area called design research. This community attempts to understand basic patterns of human and social behavior and how technology affects both. Most of the studies focus upon problems and difficulties, in part because they are far easier to study than benefits and changes in work and life patterns, but also because new technologies are mostly accompanied by problems, and most benefits do not show up for a long time, perhaps decades. Other researchers probe the technological boundaries, demonstrating new potential capabilities and new experiences. Both kinds of research are valuable. Both produce insights. But both are far removed from the intense attention to detail, reliability, and robustness that characterize products or the concern with how and what people actually buy, with the cost

structure of potential products and the resulting profitability. Practitioners do not have time to deal with debates about the problems and difficulties that people face with new technologies. They do, however, want to hear about the benefits and the new product directions to pursue. Studies of technology-induced alienation or concerns (or lack of concern) over privacy might be of great importance for society, but not for driving the next product cycle.

Even when some research demonstration excites the product side of a company, it is seldom ready for release. Transforming a research demonstration into a practical product that can be sold profitably in the marketplace is a complex and demanding job, a job for which the research community does not have the skills, patience, or interest. The skill sets that make for a creative, insightful researcher are very different from the skills required of development engineers to make something work reliably and inexpensively or of marketing teams who must determine not what people actually need (which is where researchers tread), but what they will actually purchase. Product people have to worry about sales and profitability, reliability and cost. These issues are seldom of interest to researchers and, moreover, are not within their normal skill sets.

I emphasize the difference in required skills between research and practice to ensure that these comments are not taken as criticism. They are meant to reflect the reality that it is rare for a single individual to have the breadth and depth of knowledge and skills to understand business plans and marketing strategy, to know how to lead a team of perhaps hundreds of developers to produce a reliable, bug-free set of code with millions of lines of instructions that can work across the many platforms and perturbations of equipment and applications found in the real world, who can simultaneously make use of all the advanced research learnings of the multiple relevant disciplines: the social sciences, business, and technology. This is why I think the research-practice gap is so universal and so difficult to overcome.

Reexamining the Basics of Design

The research-practice gap is only one of many problems facing the design profession. One other issue is that many of our basic beliefs about how to develop and design are built upon a shallow, insecure foundation. In the many years I have been writing this column, I have reconsidered some highly cherished beliefs in the practice of design and found many of the principles wanting. We know surprisingly little about how to do design. There is no science of the practice in the same sense that there is a science to the structural analysis of buildings and bridges, or to the building of circuits. Design is still an art, taught by apprenticeship, with many myths and strong beliefs, but incredibly little supporting evidence. We do not know the best way to design something. The real problem is that we believe we do. Beliefs are based more on faith than on data.

This is a problem that confronts all professional disciplines: law, art, music, business, medicine, and design. Each of these disciplines often has some scientific field behind it (e.g., art and music have perceptual psychology; interaction design has well-established psychological roots; many parts of business have a basis in decision theory, economics, and finance; and medicine has biology and chemistry). But even in the fields with a substantive scientific basis, the practical applications to the daily practice are very limited. Thus, although biology is important as a foundation for medicine, it gives no guidance regarding patient-doctor interaction, patient histories, or diagnosis, and it has nothing to say about patient empathy or best hospital practices. In business, finance and economics provide a rationale for investment decisions, but where do the best management principles come from? In law, what science underlies jury selection or presentations? There is a great deal of music theory, but very little is directly relevant to music performance. In the end, practical disciplines are all taught through apprenticeship, internship, residency, and long periods of training.

In science there are clear links among hypotheses, conclusions, and evidence. But in the practices of most professions, the links are tenuous at best. Instead, there is much reliance upon "best practice," where "best" is often defined by short-term measurements, usually of variables that are easy to measure as opposed to those that are the most significant. Long-term measures are seldom taken; methods are seldom compared. Note: It is not easy to figure out

how to do these studies or comparisons. Once again, this is not meant as criticism, but rather as a description of the current state of affairs. Scientists usually operate in what has been called "white room" conditions, carefully forming abstract characterizations of the phenomena under consideration and studying them in a controlled research environment or the clean precision of the laboratory. Similarly, the theories are of necessity simplified and abstracted to a pristine form of mathematical or simulation models. Science works best when all the variables are understood and controlled. But the real world is complex and messy, with uncontrolled variables, sometimes behaving in ways that contradict the neat, tidy, logical assumptions of the scientist. No wonder there is a gap.

The lack of scientific studies of practice is due to two things: First, practitioners are not trained in scientific research. They do not understand the need for experimental controls, nor do they understand statistical variability and experimental biases. Moreover, they don't wish to—they want to get on with their work. Second, even when researchers well versed in experimental methods attempt to study practices, they discover the very nature of a practical discipline throws in so many idiosyncratic variables that rigor is simply not possible.

In the field of design, many researchers end up studying the designers themselves. "How do designers think?" is a standard research question. I have seen many studies comparing individuals with groups, or people in one culture with those of another. All of these studies make for interesting reading, but I find them of little value in helping us know how designers ought to work or how they ought to think. As a result, we have many myths about the power of design research, brainstorming, rapid prototyping, iterative test and design, but zero evidence.

When researchers try to collect evidence, they often take a bunch of students, do some simple manipulations, and then try to state a general conclusion. The entire study lasts a few hours or at most an academic quarter or semester. I am continually amazed that the research community believes the study of naive, unskilled students tells us anything at all about the practical problems of design in a large company, with multiple constraints and requirements, working in teams, with highly practiced and accomplished skills. Moreover, real design projects take months and sometimes years. The difference between the researchers' notion of the design setting and reality is immense.

Misunderstandings: The Case of "Technology First, Needs Last"

In my March + April 2010 column, "Technology First, Needs Last," I stated that design research was quite effective at improving existing products both for their intended uses and also to move them into unexpected application areas, but it played little or no role in original invention. New technology occurred first, I argued, with inventors doing their thing without the benefit of any design research, with few people besides the inventors believing there was a need. This blind, research-free invention often fails, but it is also the source of our major innovations. This approach has led to such breakthroughs as the telephone, phonograph, radio, automobile, Internet, CD, portable music player, and camera. Design researchers had nothing to do with the initial developments. Instead, the researchers have come along afterward and sometimes made valuable contributions, demonstrating how the product could be improved for its intended usage and, more important, by noticing needs not satisfied by the existing product and identifying how it might serve a vastly different audience from the one for which it was originally intended.

The traditional folklore of research and development holds that there is a smooth, steady chain from pure, basic research to more applied research, to advanced products, to commodity products. As a large number of studies of research and development have shown, this nice, logical progression does not exist. Yet the myth persists.

Donald Stokes's book, *Pasteur's Quadrant*, provides a nice antidote. Here, Stokes argues the most effective research can be seen in what Pasteur did when he developed the smallpox vaccine. He started with a real, practical problem, realized it needed some fundamental scientific advances before it could be solved, did the science, and then applied it back to the problem. In other words, the research was done in search of a solution to a real problem: what Stokes calls "use-inspired basic research." Stokes argued that research can often be characterized along two dimensions. The

Stokes, D. E. *Pasteur's Quadrant: Basic Science and Technological Innovation*. Washington D.C.: Brookings Institution Press, 1997.

first dimension is about the kind of knowledge that is sought: fundamental or practical. The second dimension concerns consideration of use: whether it is a search for pure knowledge without consideration of use or whether it is aimed at some fundamental, practical problem.

The two dimensions give rise to four quadrants. Those who seek fundamental knowledge without consideration of how it might be used fit the general view of the impractical longhair mathematician or scientist. Inventors such as Thomas Edison fit the quadrant of searching for relevant knowledge to solve an applied problem, but without any attempt to expand our general understanding of phenomena. Hence, Edison's classic search for the material that would improve the already existing lightbulb, allowing it to function more efficiently for greater duration, is a classic example. Although he succeeded in his quest, he did not advance our understanding of science or engineering. Edison provides an example of someone who did not attempt to add to our fundamental understanding but was consumed with making sure his inventions were practical and useful. He did read the scientific literature, but he did not try to add to it. A third quadrant is filled with tinkerers who produce inventions that neither add to fundamental understanding nor have any use.

For Stokes, the most powerful quadrant is not that of the pure scientist. Rather, it is the quadrant occupied by Pasteur, the quest for fundamental knowledge within a specific use context. This is where the biggest payoffs lie, at least according to Stokes.

In the four quadrants formed by the axes of pure versus applied science, usages versus no use, researchers most often play in the fun quadrant, finding lovely problems to work on without regard for whether anyone cares outside of their fellow research in-group. This is one reason for the research-practice gap. I recommend aiming at Pasteur's quadrant—fundamental research geared to solving important applied problems.

But even if researchers aim at the solution to practical problems, they still face the fundamental differences in the knowledge and skill sets required by those who conduct the research and those who attempt to translate those results into practical, reliable, and affordable form.

Translational Development

Between research and practice a third discipline must be inserted, one that can translate between the abstractions of research and the practicalities of practice. We need a discipline of translational development. Medicine, biology, and the health sciences have been the first to recognize the need for this intermediary step through the funding and development of centers for translational science. This intermediate field is needed in all arenas of research, and it is of special importance to our community. We need translational developers who can act as the intermediary, translating research findings into the language of practical development and business while also translating the needs of business into issues that researchers can address. Notice that the need for translation goes in both directions: from research to practice and from practice to research.

Translational developers are needed who can mine the insights of researchers and hone them into practical, reliable, and useful results. Similarly, translational developers must help convert the problems and concerns of practice into the clear, need-based statements that can drive researchers to develop new insights. Neither direction of translation is easy.

Great innovations can come from anywhere, anyplace. Usually they come about when a new technology is unleashed upon the world and inventors and technologists scurry to find something they can do with it. Most of these attempts fail, but a few stick. The researchers come aboard after the technology has been unleashed. But this is precisely when they can be most effective, because it is now that they can play Pasteur's game: starting with a real need, figuring out what the scientific requirements are, doing the science, and then feeding the results back to a practitioner community desperately awaiting those findings.

There is a huge gap between research and practice. To bridge the gap, we need a new kind of practitioner: the translational developer. The gap is real, but it can be bridged.

ABOUT THE AUTHOR Don Norman wears many hats, including cofounder of the Nielsen Norman Group, professor at Northwestern University, visiting professor at KAIST (South Korea), and author. His latest book is *Living with Complexity*. He lives at jnd.org.

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Visible Synthesis

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In the words of Brenda Laurel, research makes design a "more muscular profession." [1] Design research provides the details that define the problem structure: whom a product is for, what purpose it serves, where it fits in a given context, when it is necessary, and why it is preferable. Formative contextual research provides the starting point for developing a solution.

But design research is a messy domain, with data coming from all directions, in all forms, and in all levels of fidelity. The data derives from a wealth of different research methods—interviews, ethnography, latent video capture, and participatory design methods—all with their strengths and weaknesses. Some of the data is from primary sources, first-person testimony and sessions we can shape to fit our current needs and questions. Other data is from secondary sources, culled from other interviews and earlier work, from clients themselves or the contractors they've hired. The resulting evidence takes as many different forms: graphs of demographic data, Post-it notes of customer anecdotes, tables of customer history, pages of interview transcripts, collections of photographs, drives full of video clips, drawings of work spaces, and so on.

As designers we're constantly filling information gaps to better understand the problem (deductive reasoning) and define potential solutions (generative reasoning). But there is very little information about how to make the leap from deductive ideas to generative ones, to convert the design-research questions into potential solutions. Said differently, "…because of the very nature of design problems, there is very often very little information about the problem, even less information about the goal and absolutely no information about the transformation function." [2]

That transformation function is the root of design synthesis: The conversion from design research to design ideas. Currently, in professional practice, design synthesis is treated like the magical step that happens between structured research protocols and organized design iterations. There's no explicit step in the project plan, just an expectation that the magic happens. Somewhere between the last interview and when the findings are written, the synthesis occurs. Up until now, the "magic" of design synthesis has hinged solely on the cleverness of the researchers—to collect, learn, organize, and synthesize the data in their heads and then blurt out meaningful design ideas. That weakness—that lack of an explicit step in which research becomes ideas—hinders us as practitioners and has a negative effect on the value we bring to clients.

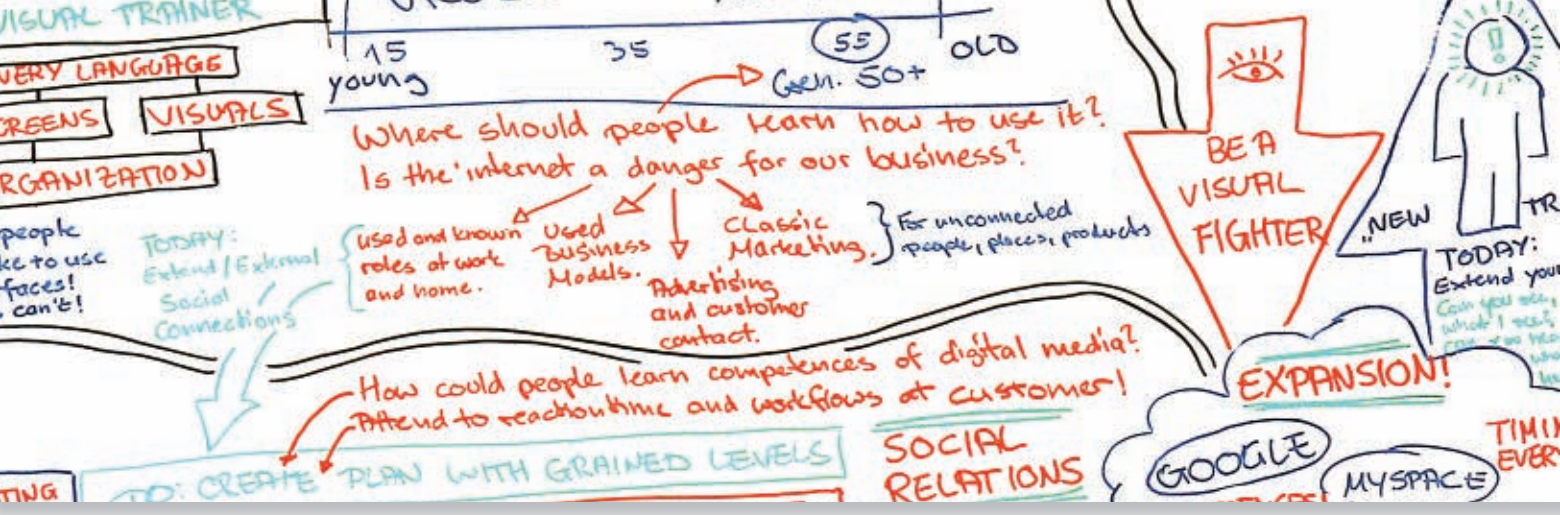
Why Synthesis Matters

Currently design synthesis is an invisible aspect of the design process. We pay lip service to the idea of synthesis, but without clear processes or methods for actually doing it. We write interview summaries, we create highlight reels and develop storytelling artifacts, but we don't provide actionable synthesis artifacts. By ignoring synthesis or cutting it short, we undercut the value of our design research. Certainly the research team that conducted the study has the deepest firsthand knowledge of the data. They remember nuances of individual stories, the inflection in a participant's voice, or the particular hot buttons they cared about. Those insights have to be transferable for efficiencies within the design team and impact beyond it.

As a consultancy, we help clients understand how to use design services to affect their projects and their bottom line. In a mechanical sense, this means defining a project plan for design research, design synthesis, and generative work within the feasible budget and helping clients understand the proposed approach. The projects are often driven by the need for generative work, but the clients now tend to recognize the importance of effective design research. Few clients, however, understand the need for synthesis to bridge the gap in between.

[1] Laurel, B. and Lunenfeld, P., eds. *Design Research*. MIT Press, 2003.

[2] Restrepo, J. and Christiaans, H. "Problem Structuring and Information Access in Design." *Journal of Design Research* 4, 2 (2003): 1551-1569.



Without synthesis, interested stakeholders have to immerse themselves in the research to understand its implications. Studying the data might suffice for other user experience (UX) professionals and perhaps even the broader design team. The ultimate audience of design research, however, is not the UX team at all. It's the engineers, VPs, or program managers who must make decisions based on the research and recommendations we provide. The synthesized research needs to be presented in an actionable way to enable design decisions.

To go a step further, skipping synthesis is a waste of money. The rough rule of thumb for design research is equal time for preparation, execution, and analysis. Without adequate synthesis time, the time spent preparing and executing the research itself is wasted. Without capturing those findings for later reuse, in a format in which they can be expanded and built upon, the other two-thirds of the budget is misspent. The research won't provide a clear goal for the design team, a true target to build toward. As consultants, we must make the case for why synthesis is needed, why it provides value to the rest of the research process, and why it's "worth" the time and money.

Why the Current Methods Fail

Occasionally clients mistake the research itself for its output. We worked with a consumer retailer to explore the shopping behaviors of their target demographic through a large set of interviews. The client stakeholders observed the research, identifying potential topics, discussing how they fit into other research efforts, etc. Once the interviews were finished, however, the client wanted to shift the project schedule and hold the wrap-up meeting the next day.

To them the research was already complete. We had to make a strong case for continuing as planned, with those next few weeks including: a detailed study of the data collected, flagging commonalities, quantifying observed behaviors, validating early findings, and identifying new ones. We had to explain what output would look like, how our value consisted of more than rough notes and a set of tapes. The resulting synthesis was presented in a visual report that organized the key findings by how they affected the existing product. It allowed the research team to compose recommendations for the client and, in turn, gave the client an actionable way to share the detailed insights with the product teams for implementation.

In this case, the report provided a synthesized representation of the research findings that was useful to the clients. It was not, however, an established process or known deliverable. Unlike a research task or a generative one, the client couldn't know what the output would be until it was created. Similarly, the research team is forced to define the deliverable anew each time, based on the situation, the topic and, often, the findings themselves. At worst, everything we do is a one-off, a mix of abstract models that fit the domain, a set of findings that work in the current situation, but no clear method that's focused and repeatable across clients, across groups, across industries. Currently we have very limited methods to make all the abstract work of design research visible to our clients. We are experts at the research and the analysis phases, but we don't do the synthesis and representation work that makes it shine.

The Problems are Clear

- How could we share the synthesis work in a meaningful way, to pass the insights from the eyes of researchers into the heads of designers? What would make the designers as versed in the data as the researchers?
- How do we generate an actionable summary without losing all the potential idiosyncrasies? How do we synthesize to find "important" parts of the data, without losing the rest?
- What should meaningful design research outputs be? What should synthesized artifacts look like, and what makes the research insights visible?
- How do we make the conversion process, from the research to the representation of it, repeatable? Can it be repeatable across industries, across projects, and across people?

Photograph by Birger Hartung

A Lack of Methodology

The goal of design synthesis is to translate the wealth of data into a meaningful framework that can guide design work. This is not as simple as an interview summary, a compilation of findings, or a highlight reel from the user sessions. Great research work and user empathy can get lost in the torrent of data. We can focus too narrowly during our analysis: counting the wrong utterances or focusing on the obvious solutions. Without a better methodology, we can easily focus our reporting on only the details we remember and miss the bigger picture. If we don't do it correctly, sensitively, with an eye on the eventual design questions, we can lose the signficant findings in a pile of merely interesting ones.

As a profession, we've formalized the design-development process and the research methods into a recognizable process that can be taught, adapted, and repeated. The steps themselves have an accepted set of inputs and deliverables. But the crossover between the two domains of design research and design development is still a no-man's-land. Our current best practice is to swim in the river of available data and generate models as well as we can.

Design synthesis relies on making the subtle patterns in the data set visible in a format that the research team, the design team, and client can understand, discuss, debate, and act on. In most cases the synthesis hinges on a set of abstract models that accurately represent the design space and provide hints at the detail below. The models can take many forms: concept maps, work-flow diagrams, personas, bull's-eye diagrams, or infographics. Those models form the artifacts for the design-discussion understanding, revision, and improvement. Rendering that knowledge visible makes it comprehensible and actionable for the rest of the team.

Developing a Process

In the most basic form, we post all the data we've found and "walk the wall" [3] of artifacts to generate a set of conclusions. The artifacts are still available as primary sources, to avoid losing the details, but they are often left in their primitive form. Even the vaunted affinity diagram gets us only so far, providing a basic categorization of topics without context or details. In most cases, we rely on the memory of the design researchers to knit together the key concepts and spark a set of findings.

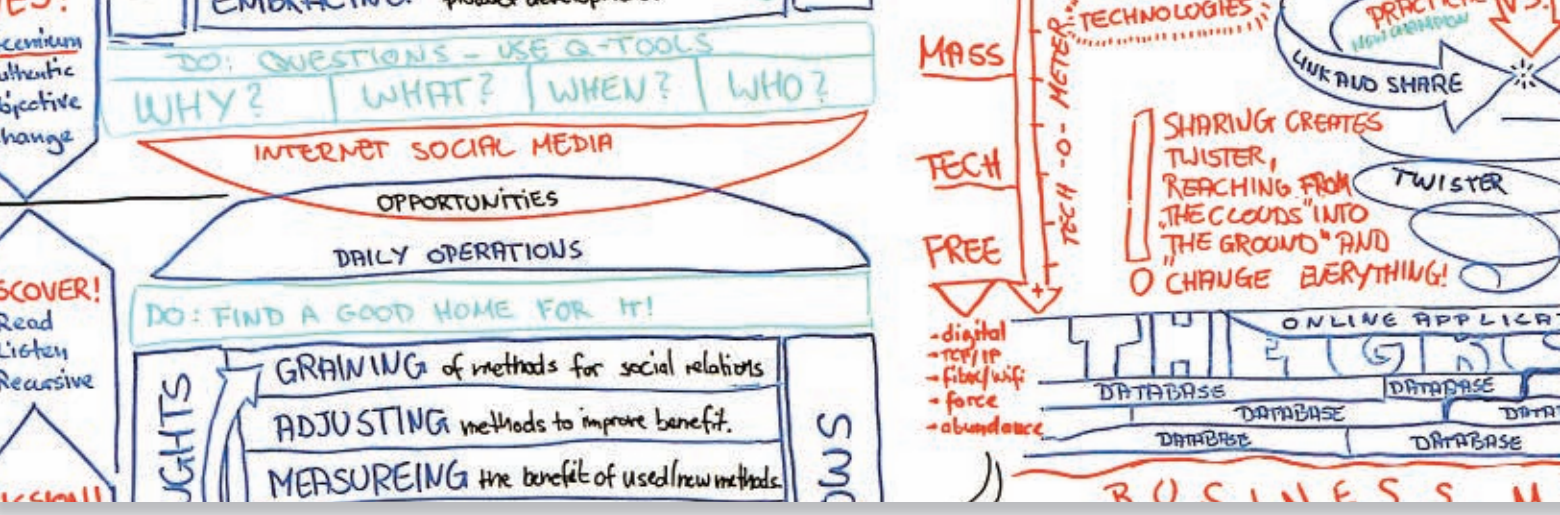
There are five key aspects that are lacking in the current approach to design synthesis. These "requirements" must be resolved, so that design synthesis can become a full partner in the design process.

1. The current state of design synthesis is not collaborative. Current working models basically require that the researchers are the designers, or that there is a clear carryover from one team to the next. It relies on each member of the research team and the design team to get up to speed using the raw data. The artifacts from design research must be accessible to the broader team: not just to the researchers who conducted the interviews, but also to the interaction designers, developers, content strategists, and visual designers who must translate those findings into a final product. That team must understand the details of the research at its core in order to infer requirements, understand gaps, and outline potential solutions. If we intend to practice true human-centered design, the synthesis needs to be both interdisciplinary and collaborative.

2. Similarly, the design synthesis must be iterative. As we continue to assimilate new data, new understanding, and new ideas, the synthesis must likewise evolve. New data must revise the findings, adjusting the average understanding and revising our knowledge of the domain, in an ongoing process of active understanding. Design synthesis must support iterative problem structuring, to continually define requirements and evolve our own design brief to address the problem. Likewise, the output of design synthesis must be iterative: to assume the model will flex and grow.

3. As our knowledge of the problem expands, we must be able to trace that synthesis back to the source data. This isn't solely for issues of pedigree and credibility, but also to ensure that we're adequately account-

[3] Beyer, H. and Holtzblatt, K. *Contextual Design: Defining Customer-Centered Systems*. San Diego: Academic Press, 1998.



ing for the idiosyncrasies and nuances in the raw data. That richness is critical to maintain—it's the reason we design toward a set of varied personas rather than the nonexistent "average user." To be clear, the synthesis can't simply average the data set into a homogenous, undifferentiated mass. We need a clear metric for making sure design ideas jive with the real variability and nuance in the source findings. We also need to ensure that research findings are appropriately weighted, accounted for, or addressed in the design iterations.

4. With our ever-growing data set, how do we address scale? It's reasonable when you have a small set of researchers, a homogenous set of interviews, or a narrowly defined topic. But that circle can quickly widen as you approach a well-trod domain, a large suite of products, or a longitudinal effort. We need to develop design synthesis to handle large-scale problems, broad data sets, or large teams, to ensure the methods are robust. How would synthesis work for the "wicked problems," or the longitudinal studies like the U.S. Census and the National Children's Study, where the notion of "relevant research" expands exponentially? How could we scale up our synthesis to work at the far end of the spectrum?

5. Finally, our current approach to design synthesis isn't accessible and credible to clients. The methods aren't standardized, repeatable, visible, and quantifiable. Certainly, this is a high bar to set, with the level of variability in design problems. At a minimum, design synthesis should have a set of repeatable processes that can be completed and verified. And we should have an accessible language for describing the synthesis process and its value.

Initial Steps Toward a Solution

While the problems and requirements can be outlined, the steps toward a solution are less clear. If we continue in the current process, we will slowly etch our own paths as individual practitioners, evolving our process toward synthesis artifacts that have served us in the past. We may find that a bull's-eye diagram or concept map has worked in similar situations, so we begin to rely on them, without explicitly codifying why those representations are needed or what problem they solve. While this allows synthesis artifacts to emerge organically, the process is slow, fragmented, and full of potential dead ends. As a community we're taking a generative approach to the problem, continuing to define new potential synthesis artifacts for each situation and hoping that some of the solutions stick more broadly.

I'd suggest we take the opposite tack, looking at the synthesis artifacts that do meet the requirements and working our way backward, to deductively identify the parameters of a solution. For better or worse, I would argue that most established synthesis artifacts are personas; personas are an anomaly among the other research methods as a labeled output, rather than a named process. While personas are equally lauded and demonized, a critique is peripheral here. At a minimum, they are a known, repeatable, recognized form of design synthesis. There are established methods of generating, leveraging, and extending personas. Personas generated enough buzz since Cooper introduced them [4] that they are accepted by a broader group of stakeholders. Regardless of their defects, personas have succeeded as a method of making design research visible to a broader community.

To provide an example, we recently worked with a large consumer company to help them understand the details of their user base of several million U.S. customers. The team had already conducted a series of contextual interviews, generating a lot of great anecdotes, quotes, and photos from the users, but failed to get any traction within their organization. The content was truly interesting, but nobody knew how to share and use it—it was too complex.

Without a data reference model for customer experience, the team often referenced their own personal and family habits as a lens for understanding the user community as a whole. There are problems with this: it is limited, personal bias looms large, and it is not shared by team members and other teams

[4] Cooper, A. *The Inmates Are Running The Asylum.* SAMS,1999

within the organization. The UX team had much richer data available but had limited ways to leverage it in their design meetings or expand its influence to other teams and other meetings.

When they came to MAYA, they explicitly asked for a set of personas. They were not as concerned about the number of participants or the type of research we needed to conduct, but they were adamant the results be a digestible set of personas. We interviewed 20 people and synthesized the results into a single persona document. The persona set included photographs, needs, goals and habits, plus charts that placed all the persona on a couple of spectrums to quickly show their similarities and differences across relevant axes. The personas were a wild success internally, allowing the UX team to lead a conversation with their stakeholders about the details of their user base, their needs, and potential trade-offs. The teams could discuss why a particular feature was critical for a certain persona, even if it was ignorable for the others, with clear data to back up their assertions. The accessibility of the personas gave the members of the research team and their stakeholders equal footing on which to make inferences on the data and the implications of the design ideas.

As this example illustrates, personas are a concrete, visual synthesis artifact that summarizes the available data in a shareable format. They are successful because they meet the aforementioned "requirements" of synthesis: They're collaborative and interdisciplinary, allowing the rest of the team to understand the research findings and nuances discovered. Personas can be iterative, either by evolving the existing personas in light of new data, or by adding personas as new groups emerge. The personas are traceable through quotes, stories, and behaviors that are included from the primary research. While the personas form an archetype, the details are rooted in the data collected. The personas easily address scaling issues by collecting a large set of data into a much smaller set of personas.

The personas aggregate the characteristics of a much larger group; working from a larger data set forms better or richer individual personas, rather than a larger set of personas. Lastly, personas are accessible and credible with a larger team of stakeholders. They're short, clever, and understandable to the extended team of stakeholders with limited explanation or training. The personas take the research out from the domain of the researchers and make it visible to the broader team in management, marketing, or technology that need to act on the research.

While personas are not the perfect method, they are an example of what an established synthesis process could look like. They reinforce the model we want to impart to our clients of what design research should be—research, synthesis, and representation—and how it fits in the larger design and development process. Similarly, personas provide a way to understand the client's needs and concerns: If clients ask for personas by name, we know they want to identify synthesized archetypes from a larger set of representative interviews.

To make research valuable, we need to make the synthesis process as visible as the research phase and make the synthesis output visible to stakeholders. Personas accomplish both of these goals, recognized or not. By working deductively, we can understand what works about personas for researchers and their clients and develop other synthesis artifacts that follow that paradigm. If personas meet those aforementioned requirements, that solution can be used as a model for others. And, conversely, personas can outline the potential faults of synthesis artifacts and provide an outline for improvements.

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Climate Change: A Challenge for Design

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Recent data shows that the release of CO_2 emissions is having a meaningfully disruptive impact on the climate of our planet. Although the totality of the consequences of climate change is still unknown, there are examples in regional ecosystems that raise serious environmental and economic concerns. Designers have an opportunity to make a positive contribution to the challenge of reducing emissions through research and innovation that helps affect the energy-consumption behavior of humans. Here, we discuss four domain-specific examples—driving, aviation, home energy consumption, and personal computer use—which help highlight opportunities in this area.

What Does Climate Change Have to Do With HCI?

Historically, our professional community has been proactive in identifying critical areas that can benefit from our expertise. Researchers and practitioners in design, human factors, and HCI have made important contributions in domains such as aviation, medical systems, the Internet, software development, and military applications.

Our planet's climate is an exceptionally complex system, and much like any complex system, it is difficult to discern the causal nature of its internal mechanisms. However, as the efforts of scientists around the world yield more data on this issue, there are emerging, abnormal trends in the temperature of the planet [1]. For example, on average, the planet has experienced unusually warm temperatures in the past 50 years, and especially in the past 10 (e.g., the two warmest years ever, as far as scientific records show, were 1998 and 2005). Also, records from Mauna Loa Observatory in Hawaii show that CO_2 levels have risen from approximately 335 to approximately 385 parts per million (ppm) or 1.6ppm/year over the past 30 years [2]. Comparatively, records from ice cores show that over the previous 6,000 years, CO_2 levels rose from approximately 185 to approximately 265ppm or 0.013ppm/year [3]. That is an increase of more than two orders of magnitude in recent history. Basically throughout the existence of humanoids, the planet has never experienced current CO_2 levels [4]. This accelerated rate of CO_2 released into the atmosphere is driven by the 30 gigatons/year that are currently generated by the burning of fossil fuels.

What Are the Solutions?

There are two ways to approach the issue of CO_2 emissions: generation and consumption of energy. On the generation side, the solution path needs to spur cleaner methods to produce energy. Some scenarios predict that by the year 2050, approximately 60 percent of the world's energy will come from renewable resources [5]. However, the amount of energy generated with coal is also expected to double by 2030, mainly as a function of the industrialization of China and India. Therefore, while cleaner energy generation is critical, it is only part of the equation.

The other side of the equation is lowering our energy consumption, while minimizing the impact on our lifestyle. One way to work toward less consumption is through technology solutions such as hybrid automobiles and energy-efficient appliances—basically, making technology more efficient. But the most immediate and highest-payoff approach in terms of tailoring energy consumption can be accomplished with the application of creative problem solving.

[1] Kaufman, D.S. "Recent Warming Reverses Long-term Arctic Cooling." *Science* 325, 5945 (2009): 1236–1239.

[2] Scripps CO_2 Program. http://scripps-co2.ucsd.edu/

[3] Monnin, E. et al. "Atmospheric CO_2 Concentrations Over the Last Glacial Termination." *Science* 291, 5501 (2001): 112–114.

[4] Zachos, J., Pagani, M., Sloan, L., Thomas, E., and Billups, K. "Trends, Rhythms, and Aberrations in Global Climate 65 Ma to Present." *Science* 292, 5517 (2001): 686–693.

[5] "Looking Ahead: Scenarios." Shell. http://www.shell.com/scenarios/

To date, an emphasis of the creative design communities has been the development of user-centered products, processes, and systems. Through research and innovation, HCI and human factors professionals have aimed to understand human behavior and interaction with technology to optimize the performance of human-machine systems and improve the user experience. Understanding how a technology works (i.e., how it uses energy) could become a key feature of the user experience with most technologies, especially if the economic consequences of energy consumption are easily accessible and intuitive. Energy consumption is not a variable that has been given much consideration in terms of affecting human performance and behavior in human-machine systems.

Consider the following research vignettes of subtle changes that illustrate the potential for design to make a difference in the study of energy usage.

Vignette 1: Driving behavior

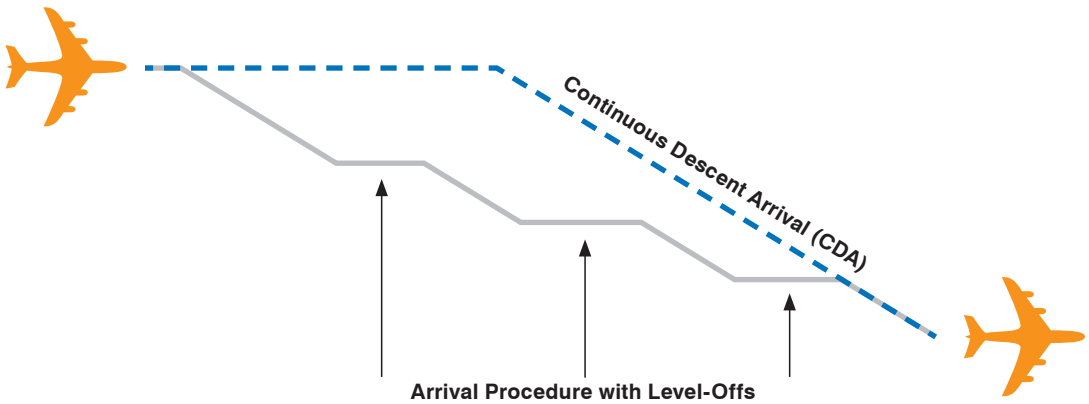
As gasoline prices were approaching record highs in the summer of 2008 ($4/gallon), we noticed several mainstream media features on how to alter driving behavior to save gas and money. The basic message was intuitive: Ease off the accelerator as much as possible, and use the brakes as little as possible. An automobile with a real-time, miles-per-gallon (mpg) gauge was used as the experimental platform to test the impact of driving behavior on fuel efficiency. For eight straight workdays (Monday-Thursday), our morning commute was conducted under "normal" driving behavior, and the mpg of each trip (15.1 miles) was recorded. The commute always began within the same 10-minute window in the morning, and total driving time was recorded. The process was repeated for the subsequent eight workdays under a gas-saving driving behavior, following the suggestions offered by media experts.

After four weeks, the average mpg under "normal" driving behavior was 25.5 (SD = 1.4), and it took an average of 21.6 minutes (SD = 2.5) to complete the morning commutes. Under the gas-saving behavior, the average mpg was 30.7 (SD = 1.2) and the average commute time was 23 minutes (SD = 2.8). An increase of 5 mpg, with an average delay of 1.4 minutes, was deemed as a positive trade-off. More important, having the real-time mpg indicator and coupling it with driving behavior provided valuable insight about the types of situations that have the most impact on fuel efficiency.

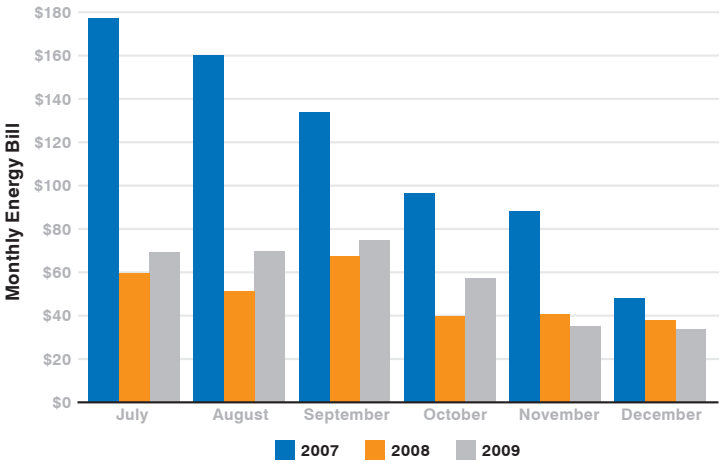
Vignette 2: Aviation

Imagine applying the same principle behind gas-saving driving behavior to flying airplanes. The space may be a lot more complicated, but the change is not unrealistic. Airplanes typically descend and ascend in a stepwise fashion to accommodate crossing traffic. Leveling off in the middle of a descent requires additional power from the aircraft, and therefore more fuel. However, a concept that is gaining traction in the aviation community is the design of arrival procedures into airports such that airplanes can execute Continuous Descent Arrivals (CDAs). During a CDA, the aircraft descends without leveling off (see Figure 1). The potential benefits of implementing these types of arrival procedures across major U.S. airports could amount to annual reductions in CO2 emissions of approximately 850,000 metric tons [6].

[6] Melby, P., and Mayer, R.H. "Benefit Potential of Continuous Climb and Descent Operations." *Proceedings of the 26th International Congress of the Aeronautical Sciences* (ICAS), 2008.



▸ Figure 1. Illustration of a Continuous Descent Arrival profile, and an arrival procedure with level-offs.



► Figure 2. Monthly energy bill for a 2,100-sq.-ft. home in a southern region of the U.S

Some CDA-like procedures have already been implemented at some airports, like Hartsfield International Airport and Louisville International Airport.

Admittedly, implementing CDAs is not trivial, and it requires a great deal of testing and evaluation to ensure that safety and efficiency standards are met. However, for CDA-like procedures to gain prevalence, a number of HCI and design issues require attention. Air-traffic controllers are accustomed to stepwise descents, which give them full control and awareness of the location of airplanes since they issue the level-off commands as necessary. CDAs introduce uncertainty and make it more difficult for a controller to estimate the future location of an aircraft that is continuously descending. This added uncertainty may affect the controller's performance, especially if there is a need to cross an ascending aircraft anywhere near the projected descent path of the CDA aircraft (the controller can ignore CDA procedure and level the aircraft off at any point). Therefore, it is critical to isolate the variables that lead to additional controller workload when managing CDAs and understand their impact on the controllers' performance. This will facilitate the development of interventions (procedural, automation, and/or training) to help controllers overcome the new workload introduced by CDAs.

Vignette 3: Home Energy Consumption

The formula for using less energy in our homes seems easy: Consume less energy. One could draw a parallel to dieting, where the formula for weight loss should be fairly evident: Consume fewer calories. However, medical research shows that by itself, motivation to lose weight does not predict weight loss [7]; while methods such as counting calories, tracking fat, and using a weight scale regularly correlate strongly with successful weight loss [8]. The relevance of these findings in the medical/nutritional field is that tracking and learning the high-payoff behaviors of consumption appear to be the catalyst for efficient consumption behavior.

Can counting watts have a similar impact on energy consumption to that of counting calories on dieting? Figure 2 shows an energy-bill comparison of three years for a three-person family living in a 2,100-sq.-ft. house (three bedrooms, two bathrooms, one story, no natural gas, southern region of the U.S.). The meaningful aspect of this chart is that in mid-June 2008, one of the house members measured the energy consumption of all of the electrical devices, along with the estimated cost of using each device per month. We shared this information with members of the house, and discussed and implemented behaviors for reducing consumption. The downward trend observed in 2007 is simply a function of the seasonal change, which always leads to a reduction in air conditioner use. The most compelling aspect of Figure 2 is the difference between 2007 and 2008 during July, August, and September.

This particular family took a fairly aggressive approach in their energy-consumption behaviors (e.g., air conditioner during summer went from 74°F to 81°F, water-heater breaker was turned on only for one hour in the morning, Direct TV/cable boxes were disconnected when not in use). However, their change in energy-consumption behavior reduced the electric bill by more than half in some months. This simple, anecdotal example suggests there is an opportunity to develop solutions that improve energy consumption awareness in homes. Much like weight loss, it may be a

[7] Elfhag, K. and Rossner, S. 2005 "Who Succeeds in Maintaining Weight Loss? A conceptual review of factors associated with weight loss maintenance and weight regain." *Obesity Reviews* 6, 1 (2005): 67-85.

[8] Kruger, J., Blanck, H. M., and Gillespie, C. "Dietary and Physical Activity Behaviors Among Adults Successful at Weight Loss Maintenance." *Journal of Behavioral Nutrition and Physical Activity* 3 (2006).

simple matter of having information that allows an individual to formulate efficient strategies of energy consumption tailored to their personal constraints. Consider the potential impact of a real-time meter that shows rate of consumption inside homes with data about the sources of energy usage, and decision-support information about opportunities for savings [9]. If someone is shown the monthly dollar impact of changing the temperature settings of their AC by two degrees, would the individual be more or less likely to implement that change?

Vignette 4: Personal Computer Energy Consumption

By the year 2020, personal computers (laptops and desktops with LCD monitors) will account for approximately 42 percent of the carbon footprint of all information and communication technologies [10]. One interesting fact about personal computers is they are designed with the capability to operate at higher levels of energy efficiency than their common/default configurations. For example, the city of Miami recently implemented a power savings initiative for approximately 2,000 desktops and 800 laptops, which was purely based on the power configurations of computers. This effort resulted in an estimated reduction of 828 tons of CO_2 emissions per year (equivalent to a midsize automobile's emissions over 250,000 miles). The city of Miami's solution automatically sent computers into a sleep mode when inactive for a specific number of minutes.

While conceptually simple, this solution took a significant amount of effort to develop since it had to account for a wide range of computer models, operating systems, etc. The results highlight the potential benefits of taking advantage of capabilities that already exist in most personal computers. There are potential "low hanging fruit" solutions, which include making energy-consumption settings more accessible and meaningful for users than they are today. For example, a user with the intention of saving energy might take the time to turn off his or her computer before going out for a one-hour lunch. However, rebooting a computer actually consumes the equivalent of putting it on sleep or standby mode for approximately three hours. It is likely that a considerable percentage of PC users do not even know there is a power options control nested in the control panel, and even if they know it is there, they would not get much value out of looking at it. As another example, most laptop users probably assume the brightness of their display impacts battery life, but by how much? Once again, the challenge for our design communities is to develop and research simple, intuitive solutions that can help users turn energy management into part of their interaction with a computer. Imagine an energy-management function that is easy to access and provides transparent information about the energy-consumption settings of the computer.

In Summary

The problem of climate change is real and serious. The approach to overcoming this challenge should be multifaceted but in many cases will not be simple or easy. Our creative communities can have a meaningful impact on this issue by investigating interventions to make technologies' energy consumption part of the user experience. The benefits are not just for the planet, but are economic as well. Perhaps the term "appropriate reliance" can acquire a broader meaning, one that encompasses an energy-efficient use of technology [11]. Concepts like automation transparency can also be expanded or adapted to represent technologies/automation that share their energy-consumption behavior with the human. To date, many of us may have dismissed ideas about energy conservation because we did not find them practical, or because we thought that not enough people really cared for such ideas to work. However, as we move forward, the issues related to climate change will start to become sobering realities. Now is the time to start working on solutions.

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[9] See http://www.google.org/powermeter/ for an example

[10] SMART 2020; http://www.smart2020.org/

[11] Lee, J.D., and See, K.A. "Trust in Automation: Designing for Appropriate Reliance." *Human Factors* 46 (2004): 50–80.

Navigating the Terrain of Sustainable HCI

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The scholarship of sustainable HCI has recently exploded. We have been struck by two things: first, the tremendous heterogeneity of methods, orientations, and approaches; and second, the remarkable lack of discussion about the relative merits of those different methods, orientations, and approaches—a debate that, we believe, would further the development of the field. This article, which is rooted in our presentation at CHI'10 [1], presents a map of the current landscape of sustainable HCI that differentiates and organizes the approaches that have emerged in the field and describes emerging topics of dissension. Initiated in August 2009 with 58 peer-reviewed, sustainability-related papers intended for the HCI community, our goal has been to provide a reflective lens for researchers in sustainable HCI allowing for principled discussion of how we have defined sustainable HCI—and how we should going forward.

[1] DiSalvo, C., Sengers, P., Brynjarsdóttir, H. "Mapping the Landscape of Sustainable HCI." In *Proc. CHI '10;* 1975-1984.

Genres

A first glance reveals a variety of research genres for sustainable HCI, i.e., frameworks that structure how researchers define the problem of and the solution for sustainability.

A dominant genre in sustainable HCI is persuasive technology: systems that attempt to convince users to behave in a more sustainable way. The design strategies employed include strong persuasion—in which user behavior is judged as sustainable or not—and passive persuasion, in which information about consumption, waste, or other broad impacts are presented to users. Within this approach, designers usually determine what constitutes "sustainable behavior," often generally defining it around resource usage and conservation. What counts as success is behavior change or decision making that aligns with the predetermined desired behaviors, although many papers in this genre do not evaluate sustainability.

Ambient awareness systems are intended to make users aware of some aspects of the sustainability of their behavior, or qualities of the environment associated with sustainability. The forms of these systems range from devices and physical artifacts to visualizations to instrumented environments and intelligent agents. Two primary design tactics employed in this genre are to make consumption visible in order to prompt awareness of use or to make desirable consumption patterns visible (and aesthetically rewarding). Ambient awareness and persuasive technology overlap, based on the idea that ambiently provided information will persuade users to behave in a sustainable manner.

Sustainable interaction design (SID) uses sustainability as a lens to rethink the role and outcomes of design. These works reference design research and are frequently philosophically and critically oriented. While the previous two genres take known approaches in HCI and apply them to sustainability, SID identifies a need to fundamentally rethink the methods of HCI in order to address sustainability. Some research portrays designers as complicit in the unsustainability of current interactive products, aiming to change design to encourage more sustainable effects. The work is often focused on material effects, such as reducing resource waste and pollution, especially due to the rapid obsolescence of current technologies.

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Formative user studies aim to understand users' attitudes to the environment or to (un)sustainable design. In contrast to the prior genres, which tend to focus on the designer's stance, this work analyzes how users approach sustainability as a first step to new design. Methodologies vary from large-scale quantitative studies to qualitative interviews and ethnography. While persuasive and ambient works tend to be based on a priori notions of right and wrong behavior, these works tend to legitimize differences in attitude toward sustainability and to show how individuals are embedded in social and cultural systems, which constrain their potential sustainability. Most of these works focus on users as consumers.

Pervasive sensing systems use sensors to monitor and report on environmental conditions, with the implicit goal of using the data collected to change these conditions. A lot of research uses participatory sensing, or involves non-experts in the technology in collecting data from sensing platforms. One catchphrase used in the literature for such work is "citizen science." Work under this label tends to emphasize the democratic potential of involving end users in data collection.

Axes of Difference

While the genre analysis suggests a view of sustainable HCI as noncompeting clusters of homogeneous research, we found that major disagreements underlie works in our corpus—including works in the same genre.

Differences arise around how to approach users and their lifestyles. Some research targets users as individual consumers—by understanding them, educating them, or changing their behavior—while other works look at users in groups or through the lens of other social roles, such as citizens of a democratic public. Many see user behavior as the cause of environmental problems, and therefore in need of change. While other attitudes prevail, notably the formative studies in which users are not the problem, the aim instead is to drive design primarily in line with needs and opportunities raised by users. Other areas of research involve preserving current lifestyles while increasing levels of sustainability, for example, supporting existing activities while reducing resource usage. Instead, many in sustainable interaction design emphasize the need for fundamental cultural change.

Other differences center on the role of HCI and technology design in addressing sustainability, such as technological solutions to the problems of sustainability. Some researchers, however, question whether a solution for sustainability can be achieved through technology alone, or perhaps at all. Although existing HCI methods and orientations are used to approach problems of sustainability, others argue that the structure of HCI as a field itself contributes to the problems of unsustainability by supporting a wasteful rapid-obsolescence cycle of IT products.

Finally, the overwhelming majority of research and design in sustainable HCI neither acknowledges nor addresses political differences as part of the research. There is, however, a growing contingent of research that reports on and, in some cases, engages the politics of sustainability and the environment in a variety of ways.

Emerging Issues

Despite these differences in orientation, a striking characteristic of the sustainable HCI literature is the relative lack of debate. Sometimes it makes sense to simply pursue different approaches in parallel, but different commitments may also reveal deeper issues that are important for the community to grapple with.

For example, for many within HCI, the development of technological solutions for social issues such as sustainability is a fundamental objective. But some within sustainable HCI and many in the broader discourses of sustainability raise serious issues about how belief in technology as a neutral solution itself may be implicated in the problems of sustainability. However, a move away from an emphasis on technology design raises this question: If technology is not the point, then what becomes the work of sustainable HCI?

Most persuasive technologies imply that users engage in problematic behaviors and should be directed toward more desirable ones. In many scenarios, persuasion begins to border on coercion, sometimes even evoking Skinnerian behavior modification. This is an issue of ethical concern for HCI. However, we also cannot be too quick to uncritically engage users. Questions of "the user" quickly become issues of expertise and hegemony. If we agree that fundamental change is needed and it might be change that users don't want, who gets to decide what change should happen and how?

► Solar energy will be a key resource in the future as technologies improve and more products are designed around it.

Whose needs are met, and whose values matter?

In addition to such conceptual issues, two key meta-level issues must be addressed in order to maintain a healthy research field: assuring that we are branching into new directions and building productive connections to other communities working in the area.

Knowns and Unknowns. In the subgenres of HCI, which have become sizable, there is a noticeable redundancy, with researchers frequently devising similar approaches and coming to similar conclusions. There is a need for the field to take stock of what is known and to identify major unknown questions that arise from what has been established as a basis for future work. It is important for the field to recognize that well-defined subgenres of sustainable HCI have become established and that in those areas work should be required to clearly extend, rather than replicate, already published works. For example, a significant body of research has documented the need to design products and services to which users develop greater attachments, so as to intervene in the cycle of rapid obsolescence. This leads to unaddressed challenges, such as how we might support users attached to software and hardware, which industry has declared obsolete. Similarly, it is a widely established design concept that ambient displays may support environmental behavior change, but few studies demonstrate actual changes in resource usage, especially over the long term. Current research overwhelmingly addresses individual consumers; this leaves an open area for research on producers and marketers.

Open Areas, Potential Connections. Despite the interdisciplinary nature of sustainability as a topic and the vast amount of related research in many fields, connections to these fields by sustainable HCI have been fairly ad hoc, depending primarily on the disciplinary orientation of the authors. Ethnographic approaches, for example, frequently draw on anthropological and critical studies of the environment, while persuasive technology, which has a strong social psychology component, tends to draw on environmental psychology. Now might be a valuable time to step back and more systematically survey which areas have not yet been drawn on and what they could do for us. For example, there is a significant body of literature in science and technology studies that addresses the role of technology with respect to the environment, the politics of environmental information, and the history and problems of various stances to environmentalism, but this appears fairly unaddressed in sustainable HCI. (Please see our paper, "Mapping the Landscape of Sustainable CHI" [1], for a detailed account of the literature.)

Another area in which connections need to be built is professional design. Although sustainable interaction design is building strong ties to design research, a significant gap appears between the professional fields of industrial and interaction design and sustainable HCI research. While disconnect with the professional design community may be systemic throughout HCI, this lack of connection to sustainable design is increasingly problematic. For example, initiatives within most professional design organizations foster sustainable design practices, design exhibitions, and monographs; trade publications feature sustainable products and practices; and the design press explores this topic through public forums, articles, and online media. Yet, with few exceptions, this work is unaddressed in sustainable HCI. This disconnect is also present between sustainable HCI and architecture and urban design.

There is even a noticeable lack of connection between sustainable HCI and other technical fields. For example, with the exception of the genre of participatory sensing, there are few papers that span references across ACM and IEEE, even when topics overlap. We also found numerous examples of persuasive systems in both ACM and IEEE periodicals that seemed to conceptually replicate one another. Such redundancy illustrates a disconnect within related disciplines, resulting in the overproduction of knowledge and missed opportunities for advancing the contribution of technology development to sustainability.

These issues prompt questions of what the boundaries of sustainable HCI are or should be. We were forced to tackle this question in developing our corpus and chose to include only papers that were concerned with sustainability and oriented to the HCI audience. An unexpected consequence was that several genres that we expected to be relevant were poorly represented. For example, works on low-power displays are generally focused on maximizing mobile battery use rather than on sustainability, while research on environmental information systems tend to be geared toward non-HCI audiences. There is a clear need for sustainable HCI to draw on the expertise of researchers in areas such as hardware, environmental information systems, and community information systems, and there is also a clear need for HCI expertise in those areas. The question for us as a field is how to set up those conversations.

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"It Became Elvis": Co-design Lessons with Children

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When the children started playing the design game, we soon noticed that a boy was missing from one of the groups; he was crawling under the table while the rest of the group continued the game as if nothing had happened. Our strategy to support equal participation was obviously not working. We started to feel anxious. Suddenly the situation changed as the kids moved on to build artifacts. They all gathered around corners of tables; they were standing close to each other, touching the variety of make tools, starting to talk. Creative corners had emerged.

Children as Co-designers

The situation described above is from a co-design experiment that we organized with children. Co-design, or collaborative design, is rooted in the tradition of participatory design (PD); hence it typically refers to an activity in which potential users are empowered to bring their ideas into the design of new solutions. The notion of co-design is also conceived as a collaborative knowledge-sharing and creation process, in which the skills and experiences of various participants are brought together to reach novel solutions. In co-designing, the role of professional designers or design researchers may vary from that of active participant to almost invisible facilitator. However, regardless of the variations, two fundamental needs remain: to enhance participants' creative thinking and to support dialogue between participants. Thus, one of the cornerstones of co-design is facilitating creative, generative collaboration [1].

In the experiments discussed in this article, we refer to co-design in PD. Here the potential users, children, are designing in teams but without a professional designer's direct influence. Instead the setting, tasks, and design material were designed to enhance children's creativity, collaboration, and contribution to the design process. The aim of our study was to explore how co-design methods and tools developed mainly for adults were applicable when designing with children.

Our experiences in engaging adults as co-design partners have highlighted three guidelines for organizing co-design sessions: amplify participants' creativity; set the stage for constructive negotiations; and ground future possibilities in current situations. We have found make tools [2], design games [1], and in-situ ideation [3] helpful in achieving these guidelines. Make tools refer to tool kits including, for example, Velcro-covered building blocks and images. We have found them especially useful in enabling people to express themselves by creating artifacts from the given materials and giving a focus to the co-design activities. Design games, on the one hand, provide playful settings for multidisciplinary teams to explore design opportunities together. On the other hand, rules and game pieces create constructions to support the dialogue. By in-situ ideation, we mean placing co-design activities in a user's everyday environment to ground ideas to the user's context. In addition, the use context can facilitate the co-design by revealing design opportunities embodied in people, environments, practices, and tools.

In this article we compare how similar approaches and tools have worked with the children, and present our observations on co-designing with children and compare them with our experiences with adults. We implemented these tactics in design

[1] Brandt, E. "Designing Exploratory Design Games: A Framework for Participation in Participatory Design?" *Proceedings of PDC 2006*, Trento, Italy. Vol. 1, 57–66.

[2] Sanders, E. B.-N. "Scaffolds for Building Everyday Creativity." In *Design for Effective Communications: Creating Contexts for Clarity and Meaning*, edited by Frascara, J. Allworth Press: New York, 2006.

[3] Vaajakallio, K. and Mattelmäki, T. "Collaborative Design Exploration: Envisioning Future Practices with Make Tools." *Proceedings of DPPI07. University of Art and Design* Helsinki, 2007, 223–238.

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experiments with children ages seven to nine in 2007 and 2008, in a primary school in Finland [4]. Both experiments took place in a classroom, and the children worked in groups. Both experiments applied make tools. In the second experiment, design games were also applied.

The Joy of Creation

In our first experiment, we asked the children to create "a learning buddy" in groups of four. The make tools in this case included blocks, pre-cut pieces of cardboard, and buttons with various symbols (question marks, snowflakes, and words including "help," "error," etc.). The outcomes were robot-like creatures with imaginative functionalities such as wings for flying and "a spelling corrector." In the second experiment, make tools were utilized to build a magic tool that helps the children to save the planet from pollution (the school had a specific theme of environmental awareness, and we adapted it to our purpose).

When designing with make tools, children started to get inspired and to generate ideas through touching and building: We saw only one boy drawing his idea first and starting building afterward. Children also reshaped the given materials and crafted them into new shapes as they needed. This activity was something we had not observed among adults. Make-tools buttons with different symbols evoked associations. Children, similarly to adults, used them for new features in their designs. For instance, one group explained their design as follows: "When the picture of a gift box is pushed, the device says comforting words, and when the picture of a snowflake is pushed, it gives some information about the North Pole."

Even though children seemed easily engaged by the make tools, we found that the children maintained their focus on the building activity itself rather than using the creation to reflect on their everyday issues. We will discuss children's weak ability for reasoning in more detail later in the article.

Challenges in Facilitating Group Dynamics

The children were seven to nine years of age and not yet accustomed to teamwork at school. They worked based on personal intuitions and interests rather than collaborating with team members. In cases with adults, design games have been useful for facilitating group dynamics [1, 5].

Photograph by Demitri Wimalaratne

Children also reshaped the given materials and crafted them into new shapes as they needed. This activity was something we had not observed among adults. Make-tools buttons with different symbols evoked associations.

Thus, in the second experiment, we implemented a design game as part of the session to investigate if a gamelike structure with turn-takings and rules could support more equal participation than observed in the first experiment. The eco-game was designed for the children to build user scenarios of their everyday life related to environmental issues.

Children were guided to throw the dice and move their game pieces on the game board in turns. The playing cards had instructions on discussions and scenario building. In addition, there were several scene images with blank speech bubbles: When it was their turn, the children chose a scene image, told their own stories based on the image, and then wrote quotes on it. The image was then placed on the scenario board. When the board was filled with six scenario images, the children earned a key to open the "treasure box" (a locked bag with make tools in it) and moved on to the next step, the make session.

Contrary to our expectations, the game rules did not lead to equal participation among the kids. In some groups more dominant children kept throwing the dice and taking the scene images without waiting for their turn. Some groups skipped throwing the dice and focused only on filling the scenario board. Some children only added text and stickers to make images look more fun and nice.

These observations are quite opposite to the ones of adults; Johansson has claimed people are more willing to follow game rules than a facilitator's instructions during co-design sessions [5]. The kids' way of not following the rules may partly be the result of too complicated a task. We learned the children did not clearly understand all the instructions and the meaning of the game.

Although group collaboration proceeded more dynamically in the make-tools phase, we also observed some challenges: One girl took the make-tools kit under her arm and allocated the materials according to her rules. Sometimes collaboration was taken very literally. For instance, in one group the children took turns when opening the treasure box: The first child put the key in the lock, the next one opened it, the third opened the bag, and the fourth then took the make tools out.

In addition, we observed the children's basic skills, such as writing and drawing, varied so much that the game became an obstacle to equal participation. This resulted in frustration and lack of interest: For example, one boy preferred to stay under the table during the most of the game, as earlier described.

Less Reflection, More Improvisation

Design games are used to assist teamwork by guiding players to explicate their moves in the game; participants think aloud, negotiate, and justify different solutions. Design games also help in immersing participants into the topic and grounding ideas on their life. They usually pave the path for more generative tasks later on.

In our second experiment, the eco-game took place before the make session to help immerse children in the pollution issues in their everyday lives before building designs. However, we found this reasoning to be challenging for children. Children improvised while building.

Boy: "Give me some cotton wad… I will make ears for this… It became Elvis!"

Girl: "Add the music button to it … then if you push the button it will start to play songs by Elvis."

Linking everyday and imagined worlds in a meaningful way was challenging. The activities of playing a game and designing remained separate. When presenting their designs, the children had difficulty saying why they had included certain features. We infer that, for children, how their designs look and support imaginative figures in their heads, such as Elvis, is more important than how their designs provide solutions. Unlike when

[4]Vaajakallio, K. Lee, J. and Mattelmäki, T. "'It Has to Be a Group Work!' Co-design with Children." *Proc. of the 8th Intl. Conf. on Interaction Design and Children*. ACM Press, 2009.

[5]Johansson, M. "Participatory Inquiry–Collaborative Design." Ph.D. diss., Blekinge Institute of Technology, Sweden, 2005.

co-designing with adults, there was no need to allocate plenty of time in the end for discussions and reflections for the children. In fact, the building phase took more time than we expected and presentations less time.

Challenges in a Classroom Context

In our earlier experiences concerning in-situ ideation, the use context has proved to be a fruitful source of novel ideas. Moreover, by utilizing their everyday environment, users can be the experts in the situation, thus creating a more relaxed atmosphere. The classroom setting where the co-designing took place was a familiar place to the children, but at the same time the classroom rules inhibited a creative and collaborative mood. (This constraint has also been discussed in other studies [6, 7].) In normal learning situations, children should not talk freely and walk around without permission. In addition, the children were sitting too far away from each other for easy collaboration. In the make-tools sessions, we provided tangible design materials to be shared. This helped in provoking collaboration because the children moved and gathered in one corner of the table for better access to the materials.

In our first experiment, we chose the topic "designing a learning buddy," expecting the children to connect their design to the classroom context in which their everyday learning practices take place. Even so, children were not able to utilize the context.

Facilitator in a Flexible, Sensitive Multitasking Role

Facilitating a co-design session is often exhausting. Being in the classroom with 20 children makes it even more so. We should have been able to be in many places simultaneously to help with cutting and gluing, solving social problems, clarifying tasks, and following the planned structure (not to mention playing the roles of observer and researcher). What may be obvious to a primary school teacher surprised us: 20 children make an overwhelming amount of noise.

Organizing co-design with children demands greater flexibility from methods and researchers than with adults. Even among children of the same age, abilities—physical, mental, and social—differ significantly. There are also certain gender divergences: In our experience the girls tried to please us more than the boys.

A girl: "Attach that [Elvis thing] to that [the device] … this is group work … it has to be part of the group work. It has to be part at least when we present or they will get a bad image of us."

Conclusion

Our focus in the two experiments introduced here was not on the outcomes of the co-design efforts but on what happens during the process. This perspective came from our interest in learning about reasoning and discussions behind designed artifacts in order to better understand users' needs and desires. One of the main outcomes is that working with children is not so different from working with adults after all, but many challenges in creative collaboration—such as group dynamics or participants' differing personalities and skills—became more visible among children. Sensitivity toward what inspires and makes sense to different participants is even more critical with children. Kids have not yet built up a mature ability for constructive conversations and negotiations within a group, which are prerequisites in co-designing with a group of people. We believe our observations will be useful lessons for any co-design situation with some reservation: Every case and meeting is unique, depending on changing elements such as locations, people, tasks, and tools.

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[6]Druin, A. "Cooperative Inquiry: Developing New Technologies for Children with Children." *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems: The CHI Is the Limit*. Pittsburgh, Pennsylvania, 1999, 592–599.

[7] Jones, C., McIver, L., Gibson, L., and Gregor, P. "Experiences Obtained from Designing with Children." *Proceedings of Interaction Design and Children* 2003, ACM Press: Preston, UK, 2003.

Learning to Succeed at e-Government

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Most e-Government projects end either in partial or total failure [1]. When the reasons for this are investigated, we are told that systems have failed because they try to force unwanted or contentious change in organizational processes, or because the technology requirements, such as hardware and connectivity, did not exist or were not maintainable due to limited human, technical, and financial resources. In general the literature on information and communication technology failure suggests that failure occurs because some aspect of the system context—social, technical, or political—is inadequately understood.

While such reasons are valid, our view is that the stubborn persistence of this failure in the government sector hints at a broader systemic problem. The technological "ecosystem" in its current form—from technologies, implementation, and development processes to research and teaching—does not provide adequate support to public-sector projects.

As researchers, designers, and professionals how can we orient our work to promote success in e-Government? Our experience with two e-Government projects in South Africa—Cell-Life and Aquatest—may provide an answer.

Cell-Life and the iDART System

Cell-Life started in 2001 as a research collaboration between staff of the engineering faculty of the University of Cape Town and the Cape Peninsula University of Technology (CPUT). As the prevalence of HIV grew, it became clear that the primary health sector would need extensive support, particularly in under-resourced and rural areas. Cell-Life investigated the use of readily available technologies (particularly mobile phones) to support the provision and distribution of medication, continuous patient monitoring, and the communication of relevant administrative and evaluation data. Our research focus was the development of appropriate tools in new settings—for

[1] Heeks, R."Success and Failure Rates of eGovernment in Developing/Transitional Countries: Overview." eGovernment for Development. http://www.egov4dev.org/sfoverview.htm/

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example, a large-scale rollout of antiretroviral drugs, which have strict compliance and treatment-education requirements—as well as understanding work processes and information flow.

In 2006 Cell-Life became a not-for-profit organization and was spun out of the University of Cape Town. This coincided with a shift in focus from being primarily a research organization to a mix of research and implementation support, prompted partly by the growing number of sites using the software. For example, iDART, a pharmacy management system for government clinics dispensing antiretroviral drugs (ARVs), currently manages the dispensation of ARVs to approximately 110,000 patients, representing one-sixth of South Africans on state- or donor-sponsored antiretroviral treatment (ART).

Mobile Phones and Drinking-Water Quality: The Aquatest Project

Aquatest is an international collaboration to develop a low-cost water test for the developing world. Our work in the project involves investigating the potential uses of mobile phones in drinking-water quality monitoring, including communicating test results and providing emergency warning and follow-up in case of water-quality problems. Like the earlier projects at Cell-Life, this is undertaken as a participatory action research, with functional prototype software being developed, used, and evaluated in iterative and incremental process.

Particular emphasis has been placed on supporting evaluation and design by software users themselves. To do this, we are using unstructured narrative interviews ("tell me a story of how you have been using the system") and actively and opportunistically soliciting input into the concept and design of software features. Currently there are four local municipalities participating in the project, with about 35 municipal foremen, environmental health professionals, and community borehole caretakers reporting water-test results on a regular basis.

E-Government Projects as Communities of Practice

To sustain momentum through the entire life cycle of public-sector projects, diverse groups need to be involved from an early stage. In addition to immediate target users, multiple levels of government must be involved to ensure the current project is understood in relation to other systems and likely policy directions. Where aspects of the system are new, or where stakeholders' exposure to implementation of technology is limited, a research group may be better placed than a private company to initiate the design process. Even so, early engagement with the private sector is vital to establish support and viability beyond the exploratory stage. Business, government, and academia operate on differing assumptions, often with quite different worldviews and ways to work together.

The concept of communities of practice—groups whose common interest and regular interaction result in shared learning—provides a lever to understanding success in multistakeholder e-Government projects. Productive engagement takes time; relationships must be built, and trust

Developing communities of practice in e-Government requires a far wider range of expertise than is found within the disciplinary boundaries of information systems and computer science. The notion of expertise is in itself limited. Rather, our role as researchers is to engage with other stakeholders in a continuously evolving process.

is established slowly in diverse groups. Thinking about e-Government projects as communities of practice rather than as individual contracts acknowledges the necessity of long timelines. It also guides us to prioritize activities that help members develop a shared understanding of their goals, and the work they must do to achieve them. Crucially, we need to move away from a situation in which the reality of financing is based on delivering a one-size-fits-all system, which assumes a homogeneous user base.

Research in a Learning Community

Academic work on failed e-Government projects is often highly critical, particularly where questions of expenditure and returns are concerned. This may be useful in terms of accountability (although perhaps not, given the persistence of expensive and contentious failures), but it does little to promote mutually influential relationships between researchers and policy makers. Researchers' interpretations of cases can be unhelpful in the constricted world of government policy, which in turn fosters negative perceptions of the potential contribution of academic research. Long-running projects that build relationships, and in which the researcher has a stake in delivering a solution that works for all participants, may provide more useful incentives in this regard.

To accomplish this, a shift is required: away from a closed system of expertise, with the researcher as the expert and research participants as subjects, to open collaboration and co-ownership of the research process. In the same way that participatory design democratizes the design process, our aim is to democratize the setting of the goals in the first place. Instead of setting the agenda, deciding on the survey methodologies and post-processing research data using analytical tools, the emphasis would move to a shared learning approach—this fundamental shift results in any one party giving up control and becoming a facilitator rather than a "principal investigator." It also requires that the attitude of extracting information from a research subject becomes an engaging attitude that results in benefiting both the researcher and the community.

Just-in-Time Design and Development

Working as part of a community is an unusual experience. Developers, schooled as technical experts, must accept guidance by people whose perspectives are often profoundly different from theirs. Users, whose previous experience with ICTs has usually been as passive recipients, need to work with concepts that are often poorly defined or explained. They must also balance their involvement with existing work responsibilities.

In resource-strapped government departments, there is little time for dedicated user-feedback sessions. This has led us to use a technology-probe approach in which we create working prototypes that allow users to form opinions based on actual experience of the system. These in turn can feed into iteratively revised design. Where software users experience the system as malleable, they are more likely to provide constructive feedback on changes to the initial design. For many of the pas-

sive users, it comes as a shock just how malleable the technology can be.

In providing high-fidelity technology probes, we find that interesting solutions are given space to appear. For example, one of the borehole caretakers involved in the Aquatest project is visually impaired and has difficulty sending test results via SMS. His solution is to ask his school-age daughter to type the messages for him. In the same project, supervisors initially used a Web interface to view results but elected to start collecting data directly—preferring to simply receive an SMS with the results of tests taken at the boreholes. This system has worked so well that the SMS system, initially an interim measure at best, is now seen as the more important data output. Without a "just in time" technology-probe approach to system design, these kinds of solutions are almost always overlooked.

Similarly, designers and developers who have spent time with system users, soliciting feedback with a mandate to respond to and explore their needs, have become an important proxy for users in prioritizing problem areas. This is a balancing act and can be difficult to maintain against considerations of scale. In the iDART project, for example, pressure to make small, individually requested changes to the system to protect personal relationships combined with the need to maintain the technical integrity of the code base and to align development priorities with funding all places significant strain on the development team. At the same time, relationships have immense value in building and maintaining communities of practice, which can sustain learning far beyond the software itself. In short, building the community of practice can be more important than software-engineering imperatives.

Teaching for e-Government Success

Developing communities of practice in e-Government requires a far wider range of expertise than is found within the disciplinary boundaries of information systems and computer science. The notion of expertise is in itself limited. Rather, our role as researchers is to engage with other stakeholders in a continuously evolving process. Accordingly, we need to reconsider the skill set of researchers and practitioners. This means reviewing what is currently taught, as well as taking critical consideration of areas in which disciplinary boundaries are limited in their ability to promote socially responsive approaches.

A dose of realism is important here. Attempts to redefine curricula based on local needs face immense barriers, not least in the attitudes of students. The term "world-class" epitomizes the pressure on educators to keep up with global advances, regardless of what is most appropriate in the local context. Accreditation processes, which specify fixed requirements for curriculum content, impose additional limitations. Fortunately, our experience has been that students who are exposed to socially responsive research, even in a small way, often continue to incorporate a development orientation in future work.

Conclusion

E-Government projects are prone to fail, and do so expensively. It is the shared responsibility of ICT professionals and governments to cultivate an environment that promotes success. Doing this requires taking a broad view of the ecosystem, encompassing but also looking beyond issues of design and implementation. The model of an e-Government project as a community of practice can help us to think differently about who should participate and how a supportive environment for a system develops. Expertise, whether as a researcher or designer, is not always an appropriate mode of engagement, and finished products are less likely to reveal interesting local adaptations than malleable ones. If the role of universities is to serve the public good, sensitizing students to the development potential of their field is also extremely valuable, and an investment for success in years to come.

ABOUT THE AUTHORS Ulrike Rivett originally studied land surveying in Munich. She has been in South Africa since 1995 and is today an associate professor in spatial data management in civil engineering at UCT. She was one of the founders of Cell-Life and is the principal investigator of the Aquatest team in South Africa. Rivett has learned the assumption of e-Government research should always be that the government is not necessarily responsible for its failure.

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Time Goes By... Everything Looks the Same.

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Most of us went to school. The path is similar for the majority of those in the U.S. and abroad: grade school, high school, some university-level course work. Some of us even go on to complete graduate school. If you are reading this article, you probably finished high school and college—you likely even completed an advanced degree from a respected university. School was okay for you. It got you a degree and a profession. It did what it was supposed to do.

So why would someone want to change schools? In the U.S., we've all accepted a formulaic method of education, which generally includes a self-contained classroom in elementary school, the 52-minute classes in high school, and the big lecture halls in college. We've accepted that school is a certain way, and if you can't make it in that environment, it's your own fault. Dropouts aren't noticeable or even worthy of notice. Yet no one ever would admit something could be wrong with the design.

The System Doesn't Work

The dropouts are now very noticeable. In fact, high school dropout rates in the United States run as high as 70 percent in some cities, averaging out at 50 percent. Dropouts are made to feel stupid, and the media and educators just say these predominantly low-income students don't have the skills, motivation, or family support to succeed.

The college situation is even worse. Of the low-income students who don't drop out of high school and graduate with good enough grades to actually go to college, only 11 percent will make it through the process. Eighty-nine percent of first-generation college-going students in the U.S. drop out. Could 89 percent of the students be that wrong? And how come no one knows these statistics? Again, educators and policy makers say it is the student's fault, and that the students have come to college unprepared. Some even say low-income students of color shouldn't go to college.

We've blamed the media, the parents, and the kids themselves. Perhaps it's time to start blaming the design of the education process—the design of the institution of education itself.

Schools were originally designed to be like factories, to put content into students' heads in a rote and repeatable fashion. But those intending to participate in modern society need

▸ The Met high school is the model of what schools in the future should look like.

critical-thinking skills and need to be able to solve problems, collaborate, communicate, and use advanced technology. These are new skills, abilities, and methods. But schools are still just trying to confer old content to students. No wonder businesses are saying students are not preparing to work in the real world.

There is all kinds of data telling us K–12 education is not working and college is working only for the middle class—and not really for them either (there is an average 50 percent dropout rate across colleges in the U.S.). We are less and less able to compete in the global economy. Our college-completion rate has gone from No. 1 to No. 15 in the world in the past 10 years. For the most part, the innovations and the changes in education consist of small tweaks around the edges, trying to make an outdated system a little better. Some high-school educators are trying 104-minute classes (double periods), a slightly more interesting curriculum, and an online course here and there. States have developed charter-school laws giving educators the right to start new schools, and most of these schools are smaller and more personal than those in the system they left. I appreciate that low-income parents have a choice in picking a school for their children, yet even charter schools maintain the outdated design of education and repeat the same old pedagogy.

I also appreciate that everyone is trying. President Obama putting big money into a few states. The Gates Foundation realizes the problem, and after 10 years of working on the K-12 system, they are expanding to college. But it is not enough. The ideas that are being supported are not different enough; they don't go far enough to make the necessary changes. Our educational system needs a complete overhaul.

An Answer

In 1995 my colleague Elliot Washor—a successful and innovative educator—and I had the opportunity to think about the following question: "If we didn't know what high schools looked like, what would we design to educate our youth?" We knew we wouldn't have 52-minute classes and ask the students to memorize a certain body of facts. We knew we would try to personalize education, take advantage of intrinsic motivation in the youth, and create a design that would match our 21st-century world. And we would engage our students in real work that was important to them.

Working at the Annenberg Institute at Brown University, Elliot and I set up a small nonprofit, Big Picture Learning. Working with the commissioner of education in Rhode Island, we had the opportunity to start a high school, The Met, as a model of what the schools of the future should look like. We started with a simple concept: one student at a time and what's best for kids?

The school was broken down into advisories, with a teacher and a group of students who spent four years together. Each adviser, parent, and student developed an individual learning plan. The school had broad goals of reading, writing, applying math, empirical reasoning, communication, and personal qualities. Every student would have his or her own way of reaching those goals with high standards. The teacher—also acting as adviser—would help the student identify his or her interests and then find a mentor and workplace to help make the learning real.

Students start in ninth grade at an internship two days a week that is matched to their interests. They spend the other three days back on campus, using their interest and their work at the internship to learn additional skills.

Consider these real-world examples. Anita is a girl from a low-income family on the south side of Providence whose mother is mentally disabled and is constantly moving from apartment to apartment because of lack of funds. She developed a math formula to help figure out the profit in a boutique she is working in. Or take Jimmy: His uncle was shot and killed at a bar, and the assailant was never apprehended. Jimmy wrote a law to have security cameras in all bars and took it through to the legislature—as a ninth grader. All the projects have real meaning to the students. The students had to work with adults, and they had to present their work publicly.

Four years after creating our school, the first 50 students were ready to graduate. Our first graduating class had a dropout rate of 3 percent, compared with the 41 percent dropout rate in the city. There was a 97 percent attendance at The Met versus 77 percent in the city. Ninety percent of our students went off to college. These students were all low-income, first-generation students (50 percent were Hispanic, 30 percent African American, 15 percent white, and 5 percent other).

On top of that good news, the Bill and Melinda Gates Foundation had been watching The Met's progress. After a visit to see for themselves, they asked Big Picture to set up 12 schools like The Met around the country. Three years later, after successful starts in Oakland, Detroit, San Diego, and other large cities, we were awarded a grant to start 40 more schools. Ten years later there are 70 of our schools in the U.S., as well as 22 in the Netherlands and Australia. The results have continued to be excellent. The schools throughout the U.S. average 95 percent graduation and 90 percent attendance rates, all in cities where dropout and attendance fall below 50 percent.

We continue to observe our students after they graduate from high school. The students from Big Picture Schools are holding their own, with college completion rates that are much better than those of other students with similar demographics. But when we looked more broadly and observed the 89 percent college dropout rate in the U.S. among first-generation students, we knew something had to be done at the college level.

In 2010 students need more than a high school degree to be successful. They need technical training and skills, and they need to become greater thinkers and doers. Big Picture Learning has decided to turn college education on its head, just as we did with high school education. In the fall of 2009, in partnership with Roger Williams University and with support from the Lumina Foundation and the Nellie Mae Foundation, we started a college. The college is being built around student interests, real work, and a personalized curriculum. The goals of Roger Williams remain the same; the methods of engaging students are different. The work and learning is positioned as "life to text" rather than "text to life." One of our students is working with a design/architecture firm, doing drawings, presenting at conferences, working in the field, and helping with actual building, all while being mentored by brilliant designers in the field. Back at campus, seminars are set up to broaden the students' thinking through readings, discussions, and writing. Each of the students is at a different internship and brings with him or her that specific knowledge to the liberal arts seminars. Our program—"College Unbound"— is a three-year, year-round program.

It will be an interesting next few years as we see if colleges are willing to redesign their curricula to meet the needs of their first-generation students who are failing. Slowly, colleges have started inquiring about our model and how it can be applied at their university. Time will tell. We don't have to accept schools as we knew them and as we experienced them. I encourage you to ask tough questions and help change education.

ABOUT THE AUTHOR

Dennis Littky is co-founder and co-director of The Big Picture Company, The Met School, and College Unbound. He is nationally known for his extensive work in secondary education in urban, suburban and rural settings, spanning more than 40 years. Littky holds a double Ph.D. in psychology and education from the University of Michigan. His work as a principal at Thayer Junior/Senior High School in Winchester,NH, was featured in an NBC movie, "A Town Torn Apart", based on the book, *Doc: The Story of Dennis Littky and His Fight for a Better School.* He also published a book, in collaboration with Samantha Grabelle, on The Big Picture's philosophy, *The Big Picture: Education is Everyone's Business* (ASCD, September 2004). Just recently, Littky founded, a new college program, College Unbound in partnership with Roger Williams University, which challenges the way colleges work with first generation students.

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CSCW: Time Passed, Tempest, and Time Past

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Place a frog in a pot and slowly heat the water, it was said, and the frog will not notice what's happening and will thus let itself be cooked. Reportedly—I have not done the experiment—this is not true; the frog will actually jump out. But I'll stick with the myth. It is an appealing metaphor, because we know that our species is often not as smart as the frog.

Twenty-five years after its founding, the CSCW community concluded that it had been boiled. Its name no longer reflects the group's activity. Each word in "Computer Supported Cooperative Work" has lost its relevance.

C: *Computers* are no longer the only digital devices of interest.

S: Digital technology is no longer confined to a *support* role; it is integral to many activities.

C: The focus was initially on small groups [1] for which *cooperation* was the norm, but today's digital world features hacker attacks, spam, privacy concerns, conflict, and competition.

W: In 1985 systems capable of supporting groups were mainly affordable in corporate *work* settings. It's different now.

Recent weeks saw a spirited debate over how to address this. An informal discussion moderated by Loren Terveen grew to 30 participants, then moved to cscwname@googlegroups. Before running its course (or at least pausing), it generated several possibilities:

1. No change. With a journal, two conference series, a book series, courses, and a quarter century of literature, CSCW has some external recognition. It is hard to give up an established name. Case in point: ACM has maintained "Association for Computing Machinery."

2. Big change. Find a name that better reflects current CSCW research, such as "Social Computing."

3. Preserve the acronym, but change what it stands for. The Springer CSCW book series was rechristened "Collaboration, Sociality, Computation, and the Web." Another possibility would be "Collaboration, Social Computing, and Work."

4. Add a tag line. "CSCW (ACM Conference on Social Computing, Collaboration, and Work Technologies)" was suggested by analogy to "CHI (ACM Conference on Human Factors in Computing Systems)." Of course, the latter is more an obsolete legacy than a current description.

5. Climb out of the box? Turn the decision over to the younger generation, who might come up with something altogether different.

Given the degree of disagreement and the lack of a governing body, inertia favors 1 or 4. The latter could be enacted by a single conference committee and would let European CSCW and subsequent conferences choose their own paths.

[1] Irene Greif's report on the workshop for which the term "Computer Supported Cooperative Work" was coined was titled "Computer Supported Cooperative Groups: What Are the Issues?" *Proceedings of the AFIPS 1985 Office Automation Conference* (OAC'85).

CSCW: Whence, Wither, and Whither?

The brief history that follows is marked by profound changes, which happened just slowly enough to escape the notice of frogs, such as myself, who were in the pot. Underlying the changes was Moore's inexorable law, which transformed the impossible first to the possible, then to the commonplace. Attempts to build even rudimentary theory on such shifting sands were abandoned. For example, real-time awareness of distant user activities on inexpensive machines was initially impossible, and later a major technical achievement. The first CSCW paper heralding this capability and celebrating its revolutionary potential was published in 1992. A quickening stream of papers on awareness followed, but within several years they were more likely to focus on how to limit awareness to ward off the demise of privacy. Other phenomena attracted media attention but proved to be short-lived—a "productivity paradox" in which IT did not deliver benefits was determined to have ended shortly after it garnered attention; a report of ill effects of Internet use on

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youths was contradicted by a replication of the study a few years later.

CSCW arose as the office automation (OA) research and development effort of the early 1980s screeched to a halt. OA was centered on minicomputers—cabinet-size computers that supported small groups and thrived between the mainframe era and the PC era. CSCW initially attracted psychologists, software engineers, sociologists, anthropologists, and researchers from management information systems (MIS), organizational theory, and artificial intelligence (AI) who shared an interest in workgroup collaboration. Despite this disciplinary diversity, most early participants were from software development and telecommunications companies. Having succeeded with word processing and spreadsheets, these companies sought shrink-wrap "killer apps" to support millions of small groups. The design and use of electronic mail was one focus.

The spread of the ARPANET and other national networks led to a focus on networked individuals, whether they were using minicomputers, PCs, or workstations. This subtly but effectively differentiated CSCW from the OA conferences (subsequently called Office Information Systems, then Organizational Computing Systems, and now GROUP), which maintained an organizational focus. For example, the design and use of database systems was a major focus of the latter, but not of CSCW.

The CSCW conference grew for a time, but it became less heterogeneous. It then declined in size from the mid-1990s, just as computer-supported collaboration blossomed and the numbers of relevant practitioners and researchers increased. Most likely this was an indirect consequence of computer science shifting its focus from journals to conferences in the late 1980s and 1990s. To motivate or demonstrate quality, conference rejection rates increased to 75 or 80 percent. Polishing work to clear that bar did not appeal to practitioners or to researchers from MIS and other journal-oriented fields. They shifted to conferences more interested in community building, such as HICSS (Hawaii International Conference on System Sciences). The small-group emphasis left little room for organizational theorists, who were in demand elsewhere when, in the mid-1980s, most study of team behaviors shifted from social psychology to organizational psychology. AI contributions disappeared, victim of an AI winter. CSCW conferences settled into two tracks: one for computer scientists who built prototype systems and applications, one for behavioral studies of technology use.

Europe was different. It had fewer influential mass-market software-development companies. The European CSCW conference series that began in 1989 drew almost entirely from academia and government research centers. It focused on issues germane to large organizations that developed software in-house or contracted for it, such as government agencies. Such projects had longer time spans and focused more on functionality, less on initial usability.

Over time the North American and European threads converged. Organizations that had built software from scratch began making more use of commercial software. People developing small-group software found that organizational context mattered—so much so that killer groupware apps never really materialized. The organizational behaviorists and theorists did not return to CSCW; instead, ethnographers studying industry practices, who were marginalized in traditional anthropology departments, were welcomed by CSCW on both continents. Computer science departments and informa-

Photograph by James Lee

The brief history that follows is marked by profound changes, which happened just slowly enough to escape the notice of frogs, such as myself, who were in the pot. Underlying the changes was Moore's inexorable law, which transformed the impossible first to the possible, then to the commonplace.

tion schools hired leading industry CSCW researchers, yielding a North American CSCW that was as academic as Europe's. GROUP, which was the descendant of the OA conferences, lost much of its distinctiveness as well.

Demonstrating selectivity by rejecting most submissions helped CSCW researchers parlay their conference papers into academic jobs, but it prevented the conference from becoming a big tent. Other groups, including many in Europe and Asia where computer science retained a journal focus, left CSCW to form community-building conferences such as CollaborateCom, Collaboration Technologies and Systems, CollabTech, and later WikiSym and ICWSM (International Conference on the Web and Social Media).

On the surface, the current discussion about renaming CSCW suggests some of the divisions of the past endure. North Americans are quicker to focus on the social uses of technology outside of workplaces uses that are of intense interest to product developers; many Europeans are reluctant to move away from the "big W" work focus. But this gulf is likely to be short-lived: Barriers between work and non-work activities are ever fuzzier. Technologies bleed from one to the other more rapidly. The ultimate manifestation of this is the current spread of "serious games" or "productivity games."

Predicting the future can be a profitable endeavor but rarely an accurate one. CSCW has a quarter century of literature and a firm academic foothold, but there are no CSCW departments. Many leading figures have drifted from computer science to information schools, and its core subject matter appears almost wherever one looks, but rarely labeled CSCW. GROUP is fading—its SIG disbanded several years ago and its conference is unlikely to survive a shift of CSCW from a biannual to an annual conference in 2011.

An experiment is under way that might reverse CSCW's drift toward homogeneity and papers by a set of usual suspects, one that might put it on a path back to a larger tent. CSCW 2012 was asked to shift its submission date two months earlier to reduce proximity to CHI 2012, inspiring plans to introduce a true revision cycle for submissions. Some people from related fields who submit papers will get feedback on what needs fixing instead of a rejection. If enough people respond, both the quality and the breadth of the conference could increase.

A different initiative might be required to bring industry back to CSCW. Today, designers and developers are most likely to find useful research at the CSCW conferences if they work in a domain of interest to graduate students. This includes social networking sites, medical settings, ICT4D (Information and Communication Technologies for Development), sustainability, and education. Past CSCW proceedings can be accessed through the ACM Digital Library (http://portal.acm.org/proceedings/cscw) and the proceedings from the European Conference on CSCW are also online (http://www.ecscw.uni-siegen.de/).

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Driving Transportation Policy Through Technological Innovation

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Over the past few years, the issue of distracted driving has gained the attention of the public and of policy makers. As a safety concern, distracted driving is an international issue. Tragic accidents attributed to texting while driving have flooded the media, leaving in their wake families and friends devastated by the consequences. Recently, in Anderson, S.C., a car accident occurred when the driver of a minivan suffered a head-on collision with another car. After the accident, the driver of the offending car admitted that she was texting and crossed the center line. The driver of the minivan died at the scene.

A study by Virginia Tech's Transportation Institute found that operators of commercial vehicles participating in texting while driving were more than 20 times more likely to become involved in a safety-critical event. Another study shows that 80 percent of all crashes and 65 percent of near crashes are due to a driver not paying attention. Additionally, a study conducted at Clemson University by psychology professor Johnell Brooks found that drivers using mp3 devices, such as iPods, or participating in texting while driving were 10 percent more likely to swerve from their lanes. The results of this study were later presented at the January 2008 Annual Meeting of the Transportation Research Board in Washington, D.C. Policy makers have taken notice and put into action steps to eliminate the number of accidents resulting from distracted driving.

In 2009 President Obama signed an Executive Order that banned texting for federal employees while driving government-owned vehicles or with government-owned equipment. In 2010 U.S. Transportation Secretary Ray LaHood announced a federal ban on texting by drivers of commercial vehicles, such as large trucks and buses. Currently, 19 states, the District of Columbia, and Guam have passed laws that ban all drivers from texting while driving. However, nearly all 50 states have some type of partial ban on the use of handheld devices while driving. In addition at least 52 countries have bans in some or all areas. Fines are the major penalty for most of these countries, but in some countries, such as Britain, texting while driving is also punishable by a jail sentence. Despite these bans, the num-

Photograph by Kendra Sundvall

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TASK	ODDS RATIO
Complex Tertiary Task	
Text message on a cell phone	23.24
Other complex (e.g., cleaning side mirror, rummaging through a grocery bag)	10.07
Interact with/look at a dispatching device	9.93
Write on pad, notebook, etc.	8.98
Use a calculator	8.21
Look at map	7.02
Dial a cell phone	5.93
Read book, newspaper, paperwork, etc.	3.97
Moderate Tertiary Task	
Use/reach for other electronic device (e.g., video camera, two-way radio)	6.72
Other moderate (e.g., opening a pill bottle to take medicine, exercising in the cab)	5.86
Personal grooming	4.48
Reach for object in vehicle	3.09
Look back into sleeper berth	2.30
Talk or listen to handheld phone	1.04
Eating	1.01
Smoking-related behavior	0.60
Talk or listen to CB radio	0.55
Look at outside vehicle, animal, person, object, or undetermined	0.54
Talk or listen to hands-free phone	0.44
Simple Tertiary Task	
Put on/remove/adjust sunglasses or reading glasses	3.63
Adjust instrument panel	1.25
Remove/adjust jewelry	1.68
Other simple (e.g., opening and closing driver's door)	2.23
Put on/remove/adjust hat	1.31
Use chewing tobacco	1.02
Put on/remove/adjust seat belt	1.26
Talk/sing/dance with no indication of passenger	1.05
Smoking-related behavior (cigarette in hand or mouth)	0.97
Drink from a container	0.97
Other personal hygiene	0.67
Bite nails/cuticles	0.45
Interact with or look at other occupant(s)	0.35
Secondary Task	
Look at left-side mirror/out left window	1.09
Look at right-side mirror/out right window	0.95
Check speedometer	0.32

▸ Table 1. Report of Commercial Vehicle Naturalistic Driving Study conducted by the Virginia Tech Transportation Institute.

bers of accidents have not decreased. Although the dangers of distracted driving are apparent, the practice remains a problem. The reality is people break laws, and despite the known dangers and risks, they will continue to text while driving. This article discusses the text-driving epidemic and the societal response and introduces an alternative approach called voiceTEXT.

Background

The issue of distracted drivers can be tied to recent research that shows attention sharing generated by phone use while at the wheel appears to increase the driver's mental workload, thereby overloading the driver's cognitive capacities and impairing driving performance [5]. Behaviors such as impaired gap judgment, reduced sensitivity to road conditions, poor lane maintenance, and the increase in reaction times to driving-related events (e.g., brake lights, etc.) can all be tied to distracted drivers. Straye et al. found these behaviors as profound as those associated with driving while drunk. In addition, research suggests that when using secondary in-car devices such as cell phones, the risks associated with driving increase considerably as the amount of interaction with the device required of the driver increases [4].

Newer generations of phones have adopted touch-screen technology. With such technology and with the absence of physical buttons, constant visual scanning of the screen is necessary to navigate a phone application. Phones not equipped with touch screens often include a physical keypad that is used to help navigate different tasks on a mobile phone. Previous research suggests this type of tactile feedback is important to measure usability, performance, and user experience. With physical keys a user is often able to learn how to use the device without having a visual scan. It was found that a novice user is able to improve their learning curve after using a typical Dual-Tone Multi-Frequency (DTMF) keypad for calling or texting many times. A user can remember center keys such as "2," "4," "6," "8," and/or "0." If a user was texting with this layout, it was found that he or she keeps count of how many times a button is pressed to reach the desired letter. Such tactile feedback is necessary once a user obtains a visual memory of the layout. Touch screens, on

the other hand, are not equipped with physical feedback. Several cutting-edge mobile phones have large touch screens that are unequipped with physical buttons. Instead, other verification responses such as vibrations or sound are used. These responses, however, verify only that a button has been pressed, not that the correct button has been pressed; therefore, visual scanning of the screen is necessary to ensure correct navigation—increasing a driver's distractions.

A report on commercial vehicles found that texting increased the likelihood of a safety-critical event more than 23 times, followed by other complex tasks such as rummaging through a grocery bag (See Table 1). In addition, studies have been conducted to gauge the effects of hands-free devices on cognitive load while driving. One study found that the use of a hands-free device was similar to that of having a conversation with a passenger; however, this was dependent on, among other factors, the complexity of the conversation (low demanding to high demanding).

Many of the distractions in Table 1 have been around for some time, and there are few policies that specifically cover many of them. Like texting, many are seldom noticed unless one of them leads to some other infraction. Additionally, it's difficult for law-enforcement officers to notice many of these behaviors. The findings on texting while driving, however, have directed governments into action to enact policies. But research shows they have not had as much of an impact on texters. Bruyas et al. suggests that banning legislation has a substantial short-term effect that wears off over time [5]. A driver study showed that 84 percent of drivers believe they drive in a less safe manner when engaged in other tasks. Yet 71 percent of people between the ages of 18 and 49 admit they text or talk on the phone while they drive. Texting while driving has become a dangerous habit that is widespread and socially acceptable. Although bans on texting while driving have been implemented, catching someone texting and driving is not an easy task.

To Catch a Texter

Laws being passed intend to discourage texting while driving, but these laws may prove to be a major challenge to enforce. Texting is often an unseen activity concealed by the size of the cellular device and privacy mechanisms, such as window tint. In some cases law-enforcement officials must have other forms of just cause, such as speeding, before issuing a citation for texting. And finding ways to catch perpetrators prior to an accident may not be as easy as catching those who violate other moving-vehicle laws (i.e., speeding, not wearing seatbelts, DUI, running a red light, etc.). Current methods of enforcing moving-vehicle laws were not designed to catch a texter.

Radar detectors are useful for catching drivers who break speed-limit laws but are limited in their ability to catch someone texting. Similarly, traffic cameras placed at strategic locations are useful for identifying someone not wearing a seat belt or someone who runs a red light, but this method would not be as effective for identifying someone texting while driving: Texting is sporadic and may happen at other times. Additionally, people text with their phone in different positions: An upward texter, someone who positions the phone above the steering wheel, is easier to catch than a downward texter, someone who holds the phone below the dashboard. Direct observation allows law-enforcement officials to identify persons driving under the influence, although other tests are usually conducted once the driver has been stopped. This method may be the most viable for catching someone texting while driving, but it can be ineffective given that texting is not as easily detected. For example, how do you determine the driver was texting and not dialing a phone number? Besides, if law-enforcement officers were to seize a driver's phone, this could violate the individual driver's privacy given the personal information contained on a phone—photos, contacts, etc. Other methods for catching someone texting while driving, such as a volunteered statement from the driver, or accessing phone records, would likely transpire after an accident has occurred, and in addition would require more time.

What Can Be Done?

So, what are the alternatives? One of the major challenges in developing in-vehicle systems as this market continues to expand is to design them in a way that will not take a driver's attention from the primary task of driving [2]. Therefore, one very apparent alternative is to convince people to abstain from unsafe behavior.

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[5] Bruyas, M.P., Brusque, C., Tattegrain, H., Auriault, A., Aillerie, I. and Duraz, M. "Consistency and Sensitivity of Lane Change Test According to Driving Simulator Characteristics." *IET Intelligent Transport Systems Journal* 2, 4 (2008): 306–314.

Although the dangers of distracted driving are apparent, the practice remains a problem. The reality is people break laws, and despite the known dangers and risks, they will continue to text while driving.

There is, however, no clear answer for why people text while driving even though the dangers are known, so laws that ban texting while driving will not completely eliminate the activity, a claim that research supports. Ultimately, there will be people who continue to text behind the wheel.

One common approach is to prevent a phone from being able to text while a vehicle is in motion. There are several variations of software available that either block cellular phone signals or block calls and messages when a vehicle's speed is above a certain point. Other such software may lock the cell phone's keys, allowing only emergency calls. Aimed at parents with teens, these software applications allow parents to control their teen's texting behaviors when driving. These implementations are not met without controversy. If you are a passenger in a vehicle, these applications will disable your phone as well. Then there is the issue of emergency calls. If a parent gets an emergency call while driving, some of these applications would send the call directly to voicemail.

With the rise of mobile phone applications, voice applications such as voice memos and voice dialing are becoming standard on mobile phones. Using the Apple iPhone's voice-control features, a user can make phone calls, play music, and control GPS navigation systems using their voice [1]. In addition, other companies have the means to perform voice-activated searches. ShoutOut, Dragon, and VLingo offer speech as a means of sending text and email messages. From a policy viewpoint, such features are praised for offering alternatives to drivers. However, there are caveats: These features can still lead to cognitive overload and provide additional distractions as drivers engage in continuous dialog with their systems. In addition, a novice user may seek visual confirmation of their request.

Even so, these voice-activated applications exist as a viable alternative. There are several applications available that read a recipient's text message aloud, while others allow voice-activated text conversations. Some applications also transcribe spoken text messages. Voice-to-text applications installed locally on your phone typically transcribe your speech into text, give you the option to review the text, and then send it as SMS text or email. Given that speech recognition for transcribing text isn't 100 percent accurate, users tend to look at the text and read it before sending it. They want to make sure the voice-to-text application gets the transcription correct; otherwise the user could send an incorrect—and potentially offensive—message. The fact that the user or driver can not completely trust speech recognition for transcription ultimately forces the user to look at the phone, defeating the purpose of going hands-free. Public policy is likely to look favorably upon voice-to-text applications if they can be used in a hands-free, eyes-free mode. Additionally, we recommend that anytime a text is transcribed and sent via SMS or email, the message should include a disclaimer that the text may be incorrect or incomplete due to inaccuracy in speech recognition. In testimony before the U.S. House of Representatives Committee on Transportation and Infrastructure, Thomas A. Dingus, director of Virginia Tech's Transportation Institute, suggested a well-designed "true hands-free" device, such as voice-activated systems, may be the answer to the issue of texting while driving.

voiceTEXT

voiceTEXT is a tool that sends voice messages instantly over a phone line. voiceText was implemented using VoiceXML (Voice eXtensible Markup Language) and CCXML (Call Control XML) by researchers in the Human Centered Computing

Photograph by Mike Mertz

Lab at Clemson University. It is a voice-activated system designed and developed to offer a safe, hands-free, eyes-free alternative to texting while driving. It allows people to stay connected, while eliminating the need for a driver to take his or her eyes off the road. The process begins when the sender establishes a connection with the server using a phone (cellular, land-line, Internet, e.g., voice over IP). After the connection has been established, the sender is prompted to compose a message, which is recorded and saved on the server. The sender will verbally specify the recipient by name, and the voiceTEXT system then places a phone call to the recipient. When the recipient answers the call, the voiceTEXT message is played to them and the recipient is prompted to perform an action. The recipient may end the call using his or her voice, replay the message, forward the message, or reply to the message. Using this system, two drivers can voiceTEXT each other without ever taking their eyes off the road.

In addition, voiceTEXT provides SMS texting and email services. The recipient of a voiceTEXT will receive a voiceTEXT message as well as an email and SMS text. The body of the email or SMS text will contain one or more of the following:

- *Phone number* where the recipient can retrieve a voiceTEXT,
- *Hyperlink* to an audio file of the voiceTEXT that can be played from the phone or browser,
- *Attachment* of the voiceTEXT audio file,
- *Transcribed text*; that is, the sender's message transcribed using speech-to-text technology.

These options provide for a broader expansion of the concept of texting services while differing from other instant-messaging techniques in that:

1. They use call connections or voice-over-IP to deliver the message versus SMS texting.
2. The primary message is an audio stream versus text.

Because voiceText was designed to be an alternative to texting, it is different from voicemail or participating in a voice call with a hands-free cell phone. Voicemail, in which a user must call the recipient, wait until the voicemail prompt plays, and leave a message, was not designed for the

immediate exchange of short voice messages. The recipient of a voicemail must access the voicemail system by calling a number or by some other means, search for, and play the message. With voiceText the sender's message is recorded and sent via a phone call to the receiver, not requiring any intermediate access on the receiver's part.

As mentioned earlier the complexity of the conversation has some effect on a driver's cognitive load. Whereas a hands-free phone conversation allows participants to interact continuously, voiceText allows only for short messages just as traditional texting. In this case the interactions are different. In a hands-free phone conversation, the rules of conversation apply: Each participant is expected to listen, understand, respond appropriately, respond in a timely fashion, pay attention, etc. However, the conversational rules of texting differ in that texting requires only that the recipient of the text read and respond when possible. voiceText was designed specifically for these interactions, not a full conversation.

For complete reference list, visit our website:

http://www.voicetextingresearch.org/DrivingPolicy.pdf

Moving Forward

Distracted driving is not a new issue, but as the number and variety of communication devices increase, so will the number of potential distractions. One key to mitigating these distractions will be to design technologies for safe driver interactions. Although bans may discourage some, others will continue to text and drive despite the dangers. Current research indicates that the number of accidents has not decreased. Previous research suggests asynchronous messaging like voiceTEXT results in less distraction than having a phone conversation. Additional studies are planned for voiceTEXT at Clemson University as well. The results of these studies will have the potential to provide additional information to lawmakers on texting while driving and provide direction for executing future policies.

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Stepping Out of the Shallows

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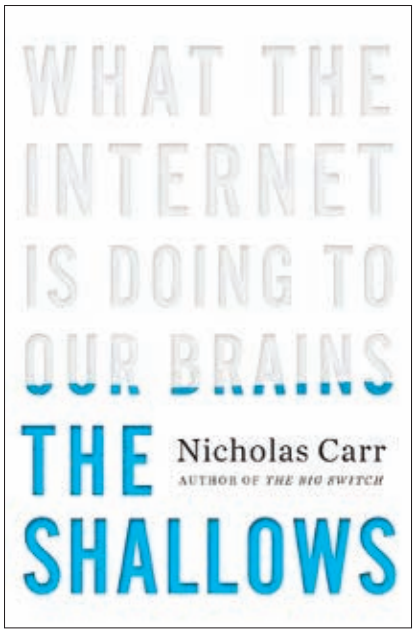
Ever since the Internet first heaved into the public consciousness in the mid-1990s, it has prompted occasional broadsides from writers who have argued the network poses a mortal threat to traditional literary values. Early Internet Cassandras like Sven Birkerts and Clifford Stoll paved the way for more recent skeptics like Lee Siegel and Andrew Keen, all of whom have collectively demonstrated the paradox that for all its putative threats to the culture of the book, the Internet turns out to be a nearly perfect rhetorical foil for selling books... over the Internet.

Over the last few years, Nicholas Carr has carved out a role for himself as one of the Web's most eloquent resident curmudgeons. A former *Harvard Business Review* editor and author of provocatively titled books like *The End of IT* and *The Big Switch*, Carr has leveraged his popular blog *Rough Type* to establish a coherent body of work that casts a jaundiced eye on the seemingly inexhaustible boosterism of the Internet industry and its journalistic enablers.

Carr's reputation finally transcended the blogosphere with his much-discussed 2008 piece for *The Atlantic*, "Is Google Making Us Stupid?" a rhetorically titled essay that provided the seed for Carr's latest book, *The Shallows*, in which he expands on his original argument to take a broader look at how the Internet is affecting our brains, our thought processes, and the culture at large.

Grounding his argument in Marshall McLuhan's famous prophesy that electronic media would eventually lead to "the dissolution of the linear mind," Carr marshals a wide array of sources to make his case, drawing on such diverse realms as neuroscience, cognitive psychology, and the history of technology to buttress his thesis that our "intellectual technologies" shape the trajectory of human thought and culture—and not always for the better.

After the obligatory reference to Plato's *Phaedrus* (the famous dialogue in which Socrates questions whether the invention of books will lead to a weakening of human memory), Carr introduces his core premise: The human brain is far more "plastic" than previously thought, and highly susceptible to the influence of external technologies.



The Shallows: What the Internet Is Doing to Our Brains
Nicholas Carr
Norton, 2010
$26.95

For centuries, biologists believed the brain was essentially fixed from childhood on. Recent research suggests otherwise. For example, researchers at the NIH conducted brain-scan studies of people learning to play piano, discovering that their brains physically changed as a result of the process. Similarly, a study of London cabbies suggested that their legendary ability to

For centuries, biologists believed the brain was essentially fixed from childhood on. Recent research suggests otherwise. For example, researchers at the NIH conducted brain-scan studies of people learning to play piano, discovering that their brains physically changed as a result of the process.

memorize maps correlates with physical changes in their brain structures.

While neuroplasticity may have conferred significant evolutionary benefits by equipping human beings to adapt to their changing environments, it does not necessarily follow that every change to the brain is an automatic step forward for the species. "Plastic does not mean elastic," says Carr. "Bad habits can be ingrained in our neurons as easily as good ones."

Having laid the foundation for his argument that human brains adapt in response to external stimuli, Carr goes on to survey the cultural history of humanity's various tools of the mind—like maps, clocks, and the printing press—tracing the impact of these technologies on the evolution of human thought. For example, he suggests that the rise of the clock and standardized timekeeping "began to stress the methodical mental work of division and measurement," leading in part to the rise of the scientific method and the beginnings of the Renaissance. Similarly, he argues that the printing press ushered in an era of unprecedented human literacy, with corresponding changes in neural function governing the processing of visual information, reasoning, and memory formation. Those transformations ultimately reverberated in the culture at large, as the rise of the printing press altered scholarship and created a new intellectual world where the practice of solitary reading and reflection became the foundations of a broadening literary culture.

After surveying the history of information technology, Carr brings his argument up to the present day, considering the mounting body of research suggesting that the rise of the Internet is literally rewiring our brains. Marshalling a wide range of evidence—drawn from cognitive science, educational studies, and even usability research (citing eye-tracking research by Jakob Nielsen and the work of Irene Au's team at Google)—Carr explores how scientists are starting to develop frameworks for tracing the impact of the Internet on the human brain.

For example, a study at UCLA revealed clear differences in brain structure after as little as five days of regular Internet usage: specifically, growth in the dorsolateral prefrontal cortext. The study also found that while experienced Web users display strong activity in brain regions associated with decision making and problem solving, book readers show far more capacity for language, memory, and visual processing. Carr also points to a number of studies demonstrating that readers of online texts retained significantly less information than readers who consumed equivalent information in print.

Carr closes his argument by exploring the mechanics of memory (with a brief digression into Miller's Law), comparing the process of transferring information from working memory to long-term memory as akin to filling a bucket with a thimble. For most of human history, people have accumulated knowledge by filling one thimble at a time—reading a book, for example, or memorizing a poem. But in a world where the Internet continuously amplifies the volume of incoming data, he suggests, the thimble of short-term memory runneth over.

The Internet's constant division of attention weakens our ability to parse and digest long stretches of text, imposing a "switching cost" that badly compromises our ability to process

information into our long-term memories. The act of deep reading—difficult even under ideal conditions—is rendered even more difficult on the Internet by the constant demands on our prefrontal cortex.

Writing wistfully of a bygone era when "quiet, solitary research became a prerequisite for intellectual achievement," Carr argues that the always-on cacophony of the Internet assaults our ability to read, reflect, and internalize what we learn. While earlier forms of electronic media—like radio, movies, and television—may have provoked similar fears about the degradation of traditional culture, these technologies never directly threatened the book because they did not intrinsically involve the distribution of written text. The computer, on the other hand, is revolutionizing the way we relate to text. "A new intellectual ethic is taking hold," he argues. "The pathways in our brains are once again being rerouted."

What is the effect of all this neural rewiring on the culture at large? It may be too early to know, but Carr points to studies suggesting a degradation of scientific research, as researchers come to rely on Web search engines in lieu of traditional indexes and other scholarly research tools—raising the possibility that internal changes in the way people process information will likely reverberate in the culture at large.

Carr's argument makes for a compelling read, but his strident rhetorical disposition occasionally veers toward self-aggrandizement. For example, when he proclaims that "rarely have we paused to ponder, much less question, the media revolution," he seems to be placing himself on rather a high pedestal, either dismissing or ignoring the substantial body of criticism that precedes his work.

Carr's historical analysis has a few conspicuous holes as well. Like many apostles of the printed book, he takes a rather Panglossian view of the Gutenberg revolution, neglecting to consider the tumultuous and occasionally violent social transformations wreaked by the advent of the printing press (see Leonard Shlain's artful treatment of this topic in *The Alphabet and the Goddess*). And while he cites Walter J. Ong's work at some length, he neglects to consider Ong's theory of secondary orality, which points to the limitations of interpreting the rise of electronic media solely through the filter of traditional literate culture.

These criticisms aside, Carr shows an admirable fearlessness in crossing disciplinary boundaries to make his case. While reading the book, I kept feeling the impulse to put it aside and open up a Web browser to start exploring the myriad trails that Carr lays out for the reader. That impulse went unfulfilled, however, as I had chosen to read the book in one sitting on a seven-hour plane ride, fully untethered from the network. The urge to plug in may have stemmed not just from the plasticity of my own brain, but also to some extent from the structure of the text itself. Reading the book feels a bit like accompanying the author on a long, sustained Google binge. With its dense web of interconnected references and long list of citations, *The Shallows* seems fundamentally a product of the same Internet it sets out to critique.

In the end, I found myself hoping Carr would hold forth with a deeper, more personal rumination, an uninterrupted stretch of meditative prose that would crystallize the kind of sustained reflection he eulogizes. Instead, we are left with a few fleeting glimpses of the author sitting on the far side of his word processor, wishing for the man behind the screen to step out of the shallows.

When Carr brings his rhetorical powers to bear on his central thesis, however—that the Internet may, indeed, be making us stupid—the book shines. Carr is a gifted polemicist, adept at synthesizing a coherent argument from many disparate sources. His thesis will almost surely draw readers in to engage with the text, poke holes in his arguments, question his assumptions, and check his references: in short, to give this book the close reading it deserves.

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Q&A With Nicholas Carr

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Alex Wright: In your book, you argue that the Internet has lured many of us into a state of constant distraction that is degrading our capacity for deep thinking and reflection. Do you see "switching off" as the only practical antidote, or can you envision a role for technology in trying to ameliorate these effects?

Nicholas Carr: I think that new information technologies could, in theory, help to promote attentiveness and deep thinking, countering the effects of the networked computer as it's currently designed and used. But I doubt that will happen. There are already a lot of PC applications designed to promote focus by disabling multitasking or networking—like Freedom for the Mac—but very few people use them, so far as I can tell. A long time ago, we made a decision that we wanted our computers to be multitasking, message-streaming, multimedia interruption machines, and I don't see any indication that we're going to reverse that decision. Indeed, if you look at the direction of personal computing, particularly the recent rise of social networking services like Facebook and Twitter, you see a strong bias toward providing ever more interruptions and distributing information in ever smaller chunks. People seem to be willing, even eager, to sacrifice the depth of their thinking in return for a greater sense of connectedness. Chatter seems to be valued more highly than contemplation or reflection, sadly. Technologies tend to do what they're uniquely good at, and computers are good at processing lots of bits of information very quickly. I don't think they're going to slow down, and I don't think they're going to slow us down.

Alex: Many of our readers are designers and researchers involved in creating interactive systems. How could a better understanding of brain plasticity help design teams improve the lives of people who rely on Internet-based software and services?

Nicholas: The most important lesson is simply that decisions about the design of information and communication systems have enormous ramifications—they can literally change the way our brain cells connect and our minds function. And, as many recent studies of neuroplasticity reveal, those cellular and functional changes don't go away when you turn off your computer or close out of an application. Our brains are very good at strengthening the mental functions we exercise and pruning away those we don't. So there's a deep ethical dimension to software design, and it's a dimension that, unfortunately, has rarely received much notice. When we program computers, we're also, in a very real sense, programming the minds of the users of the computers. The ethical dimension is particularly salient when it comes to designing educational applications and services, particularly those geared for use in elementary or middle schools. The brains of younger kids are particularly malleable. There's been a lot of research into how interruptions, multitasking, and even hypertext can hinder comprehension and learning, mainly by overloading people's short-term working memory, and I really think programmers and Web designers would be wise to familiarize themselves with that research—and maybe even take it into account in their work.

Alex: On several occasions, you cite the work of the late linguist Walter J. Ong. I was surprised that you didn't give more consideration to his notion of "secondary orality": that is, the evident similarity between certain forms of electronic media and ancient patterns of spoken-word communication. From your research, do you see any fundamental differences in the way we process "oral" electronic text versus more traditionally literate forms of online writing?

Nicholas: You're right; Ong pointed out certain similarities between modes of communication in preliterate, oral cultures and those promoted by modern media, from telephones to computers. Both put an emphasis on communal conversations and on immediacy. But he also pointed

out how our new "secondary orality" differs from primary orality in fundamental ways. Communication in true oral cultures is always embodied in a whole person—it comes through direct, face-to-face contact—whereas conversation today is increasingly disembodied, mediated by machines and networks. One thing that shift suggests is that we're moving away from thinking of ourselves as members of local, physical neighborhoods and toward a sense of ourselves as participating in abstract communities, groups of disembodied avatars. The emphasis on immediacy is also growing ever stronger, I think—as we see Internet companies increasingly stress "real time" messaging. You could argue the constant flow of real-time information replicates the conversational communications of oral societies. But what's missing is the longer, more narrative, more immersive forms of communication that in the past characterized both oral and literary cultures. The Net provides no space for Homeric discourse and no incentive for the kind of deep attentiveness that such discourse demands.

Alex: Umberto Eco once drew a distinction between "books to be read" (like novels and poetry) and "books to be consulted" (like dictionaries and encyclopedias), arguing the latter will inevitably be subsumed into the Net, while the former may persist in printed form for a long time to come. What is your take on this argument: Do you believe all books are destined to "go digital," or do you see a continuing place in print for long-form narrative?

Nicholas: I don't think printed books, or even printed newspapers and magazines, are going to disappear anytime soon. New media displace old media, but they rarely destroy them immediately. Because the old media have certain attractive properties that the new media lack (not to mention sentimental attachments), they tend to live on for a long time, sometimes indefinitely. So while we tend to focus today on whether the Web will kill the newspaper or the e-book will kill the book, I think the most profound changes are taking place at a deeper level. Our reliance on computers and the Net is training us to take in information in a certain way—fast, distracted, in small bits—and that training will, in time, alter our general reading and thinking habits. In my own life, I've found that, as I come to use the Net more, it becomes harder and harder to sit down and immerse myself in a book or, for that matter, to engage in any prolonged act of concentration. There are two huge intellectual and cultural implications to that kind of mental reengineering. First, while the form of the book will live on, the printed page will increasingly be pushed from the center of our cultural life, where it has stood for some 500 years, to the periphery. That process is already well under way, I would argue. Second, writers will change the way they write in order to accommodate the new reading habits promoted by the Web, so even the content of books will come to resemble the content of the Web. The line between "books to be read" and "books to be consulted" will blur, with the latter becoming ever more dominant.

Alex: During the course of writing your book, you recount the experience of "unplugging" for long periods of time to concentrate on your work. Yet eventually you seem to resign yourself to a return to the networked world. What advice would you offer to readers trying to moderate the influence of "always on" networks in their own intellectual lives?

Nicholas: Popular technologies tend to become deeply embedded in social processes. Look at the automobile, for instance. For many people today, the networked computer is so thoroughly entwined with their work and social lives that "unplugging" is not a practical option—and, in fact, is not even an idea that they'd consider. So, being something of a fatalist, I don't think the intellectual trends I describe in *The Shallows* are going to be reversed. That said, each of us still has a choice. Each of us controls how we focus, or fail to focus, our attention. That control over our mind, you could argue, is one of the things that makes us human. If you cherish the more contemplative, reflective, quiet modes of thought, which I personally believe are essential to a rich intellectual life, you have to begin to disconnect. That's very hard, but I see no other option.

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Adding By Leaving Out: The Power of the Pause

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We tend to think of the pause as awkward. In speech, pregnant pauses connote uncomfortable silence; we veil silence with fillers. As professional communicators, we're trained to deliver smooth speech, censoring out "um" and "ah." Public-speaking groups, such as the well-known Toastmasters, fine every member who utters an "uh" or "um" during a speech. This distaste for the pause—and the inverse, seeking an always-on state—is a battle we face at school, at work, and in industry at large.

I propose that we're too impatient with the pause, and as a result, we're missing out on a great deal. What would happen if, as communicators and designers, we became more comfortable with the pause? Because it turns out we can add by leaving out. The pause has power.

The Presence of Pauses

The oldest recording of American umming comes from Thomas Edison, who in 1888 presented the perfected phonograph when he recorded and played back his voice. The transcript contains verbal pauses: "And then to, uh, Bombay," and his sign-off, "Uh, goodbye, Edison." A technical perfectionist, Edison wrote, "We shall know now for the first time what a conversation really is. The phonograph, in one sense, knows more than we do ourselves" [1]. The relay of this first conversation was, in fact, demonstrating what is natural—the pause. Why edit it out? Even the verbal filler has historical power.

Stammers are not uncommon. The average English speaker makes as many as seven to 22 "ums" and "ahs" per day. Because we have a tendency to want to hold the floor as communicators, we'll use a number of fillers—"ums" and stammers—to avoid pauses in conversation. These sounds, in fact, deny an audience the chance to process what's been said. When too much information is given, it's called interference, and it prevents audiences from retaining information. With pauses in speech come increased comprehension and retention. Pauses can increase relevancy and enhance the content surrounding text. "White space is to be regarded as an active element, not a passive background," wrote Jan Tschichold in 1930 [2]. Like Tschichold's white space, silence is often an active element in our discourse. It can indicate that productive thinking is in progress.

Discourse is not the only space where the presence of pauses is powerful. In public space, pauses in the urban landscape can be important characters, contributing to new meaning. Walter Benjamin reminds us "architecture is experienced habitually in the state of distraction" [3]. Thus, when a routine structure that has always been present on your daily walk suddenly becomes an empty lot, your definition of space and flow changes—there is a pause. The surrounding environment takes a new form; you may see the surrounding structures for the first time. Like a pause in discourse, a pause in the urban landscape lends meaning to its surroundings, creating opportunity for new value to emerge. Negative or non-spaces formed by the creation of others play an important role in a passive by-product of creation. There is presence in absence.

When the Army Corps of Engineers "de-watered" the American Niagara Falls in 1969 due to fears that erosion was destabilizing them, a temporary walkway was installed near the edge of the dry falls [4]. This pause in the otherwise watery landscape gave way to tourists, who began to explore an otherwise inhospitable territory. A pause in routine begat new meaning and value. "Recognition," Dewey says, "is perception arrested," and here gave new meaning to a place transformed for a brief time [5].

The value of pause need not be so intangible; its use in retail

[1] Erard, M. *Um: Slips, Stumbles and Verbal Blunders and What They Mean.* Pantheon Books, 2007.

[2] Burke, C. "Faith in Asymmetry." *Eye Magazine,* Autumn 2007.

[3] McCullough, M. *Digital Ground.* The MIT Press. 2005.

[4] Holmes, R. "Absent Rivers, Ephemeral Parks," Mammoth. March 2010. http://m.ammoth.us/blog/2010/03/absent-rivers-ephemeral-parks/

[5] Dewey, John. "Having an Experience," *Art as Experience.* The Berkeley Publishing Group, published by the Penguin Group. 1934.

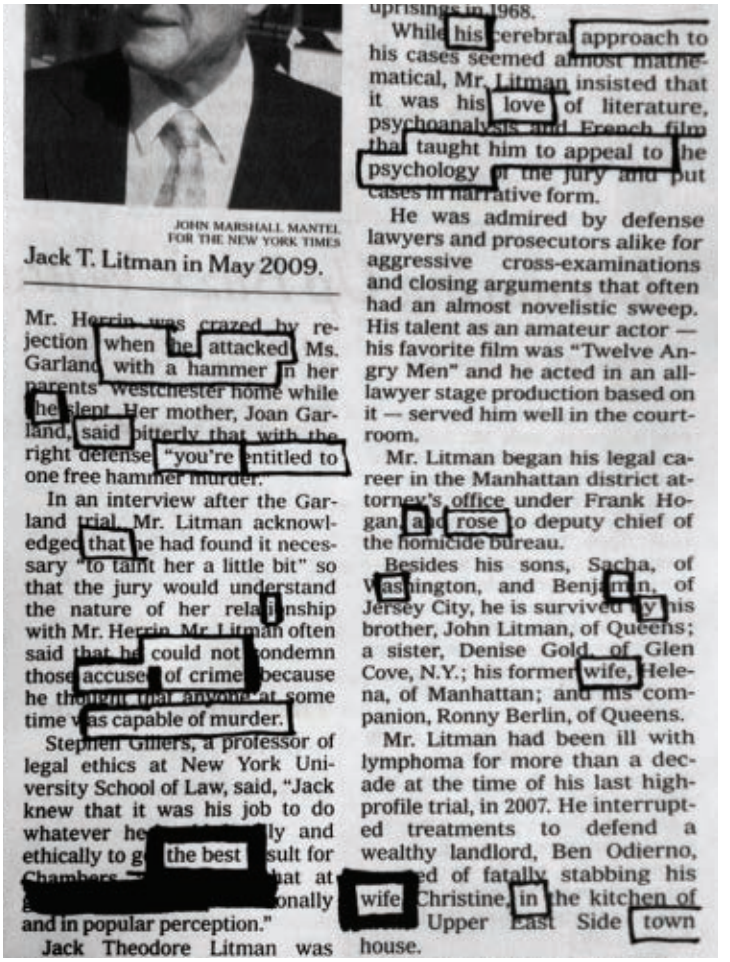
as an orientation and transition device has been proven successful in grounding customers. In his book, *Why We Buy: The Science of Shopping*, Paco Underhill demonstrated why "landing strips," the transition zones inside of retail environments, were invaluable in getting customers to pause. Referring to customers entering retail environments, he noted, "These people are not truly in the store yet. You can see them, but it'll be a few seconds more before they're actually *here*. If you watch long enough, you'll be able to predict where shoppers slow down to make the transition from being outside to being inside" [6]. The transition zones were blind spots; knowing that, retailers could plan appropriately, allowing for a pause before the commerce experience began.

[6] Underhill, P. *Why We Buy: The Science of Shopping.* New York: Simon & Schuster, 2000.

[7] Lehrer, J. *Proust Was a Neuroscientist.* New York: Mariner Books, 2008.

[8] Denk, J. "Chopin's for Dummies," Think Denk. 30 November 2009. http://jeremydenk.net/blog/2009/11/30/chopins-for-dummies/

[9] Porter, J. "Designing for the Social Web: The Usage Lifecycle," Bokardo. 14 May 2008. http://bokardo.com/archives/designing-for-the-social-web-the-usage-lifecycle/



JOHN MARSHALL MANTEL
FOR THE NEW YORK TIMES

Jack T. Litman in May 2009.

uprisings in 1968.

While his cerebral approach to his cases seemed almost mathematical, Mr. Litman insisted that it was his love of literature, psychoanalysis and French film that taught him to appeal to the psychology of the jury and put cases in narrative form.

He was admired by defense lawyers and prosecutors alike for aggressive cross-examinations and closing arguments that often had an almost novelistic sweep. His talent as an amateur actor — his favorite film was "Twelve Angry Men" and he acted in an all-lawyer stage production based on it — served him well in the courtroom.

Mr. Litman began his legal career in the Manhattan district attorney's office under Frank Hogan and rose to deputy chief of the homicide bureau.

Besides his sons, Sacha, of Washington, and Benjamin, of Jersey City, he is survived by his brother, John Litman, of Queens; a sister, Denise Gold, of Glen Cove, N.Y.; his former wife, Helena, of Manhattan; and his companion, Ronny Berlin, of Queens.

Mr. Litman had been ill with lymphoma for more than a decade at the time of his last high-profile trial, in 2007. He interrupted treatments to defend a wealthy landlord, Ben Odierno, ...ed of fatally stabbing his wife, Christine, in the kitchen of ... Upper East Side town house.

Mr. Herrin was crazed by rejection when he attacked Ms. Garland with a hammer in her parents' Westchester home while he slept. Her mother, Joan Garland, said bitterly that with the right defense "you're entitled to one free hammer murder."

In an interview after the Garland trial, Mr. Litman acknowledged that he had found it necessary "to taint her a little bit" so that the jury would understand the nature of her relationship with Mr. Herrin. Mr. Litman often said that he could not condemn those accused of crimes because he thought that anyone at some time was capable of murder.

Stephen Gillers, a professor of legal ethics at New York University School of Law, said, "Jack knew that it was his job to do whatever he ...ly and ethically to g... the best ...sult for ... at ... and in popular perception."

Jack Theodore Litman was

The Sound of Silence

While verbal fillers may not add value to our discourse, in music, the sequence of fillers and pauses must be harder to detect—it should play hard to get with the brain. Music excites us only when it makes the brain work to detect its order. The longer the pattern our brains expect is absent, the greater the emotional release when the pattern returns. It is this tension in music that is the source of music's feeling. "Music is only interesting when it confronts us with tension, and the source of tension is music," says Jonah Lehrer [7].

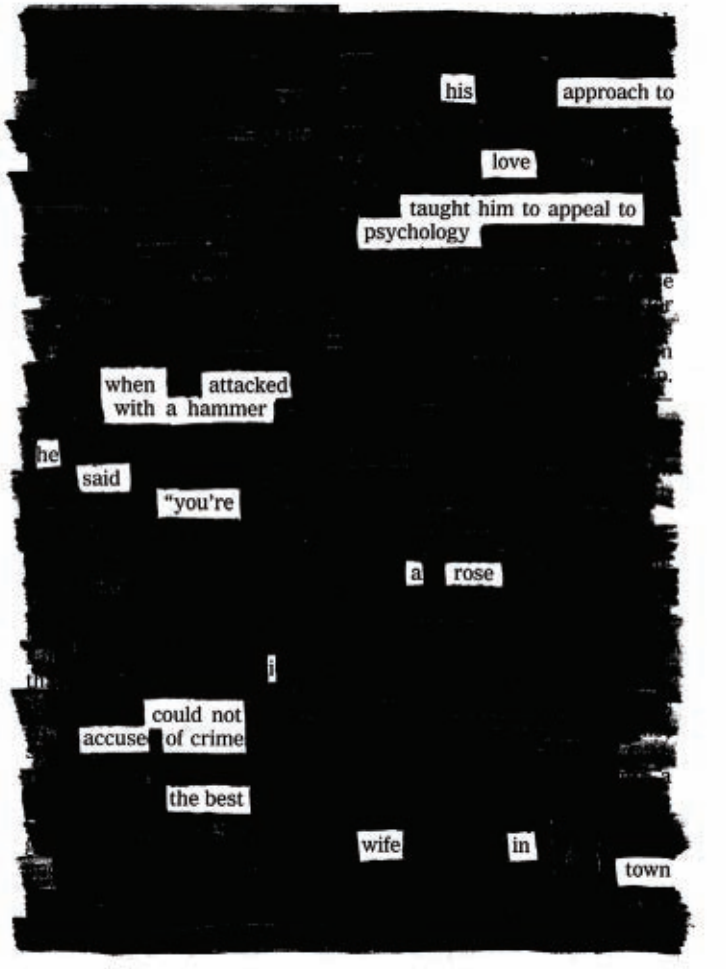
Chopin must have known that the structure of his music's story, much like the story designers want to tell with their products and services, is dependent on listening. So in his "Polonaise-Fantasie," he wove in what classical musician Jeremy Denk calls "enforced listening moments." Because the structure is inherently dependent on the listener paying attention to the story, Chopin assures that listeners do just that. By writing in long, arresting notes—such as an F-sharp major held so long that it's disconcerting, or a pause in an otherwise complex piece—the composer forces the listener to attention. These intentional pauses woven into the experience (here music, but elsewhere they could be websites, products, service experiences, architecture) make people "act, stop, listen" as Denk describes them [8].

For all the simplicity designers intend in their work, for all the intentional moments they craft, what enforced listening moments are they creating? What rhythms are they designing?

Pauses Abound

Each of these instances, for its participant, adds meaning to the surrounding content, giving momentum to what comes afterward. Designer Joshua Porter of Bokardo might refer to the stages before and after the pause as phases in a service "usage lifecycle" [9]

- Unaware: Most people are in this stage, completely unaware of your product.
- Interested: These people are interested in your product but are not yet users.
- First-time Use: These people are using your software for the first time, a crucial moment in their progression.
- Regular Use: These people are those who use your software regularly and perhaps pay for the privilege.
- Passionate Use: These people



▸ "The watchdogs," a sample of a newspaper blackout poem by Austin Kleon, who blacks out words in order to compose his poetry. Instead of starting with a blank page, he uses a marker to eliminate the words he doesn't need. http://www.austinkleon.com/

are the ultimate goal: passionate users who spread their passion and build a community around your software.

The hurdle between "unaware" and "interested" may be considered a pause, as it's the designer's goal at this stage to make people aware of a product or service (e.g., getting people over the sign-up stage in Web-based software).

Ommwriter from Herraiz Soto & Co. is a recent example of a product that embraces a pause wholly as a metaphor. It is a simple text processor that aims to deepen the relationship between writing and paper by pausing all other interactions on the desktop. By stopping other media, the company's goal is to heighten concentration.

Beyond Practice

The value of the pause doesn't stop with practice; it refers to the way we interact with our environment as well. Strolling in nature, as compared with urban environments, improves cognitive functions, through what's called Attention Restoration Theory. When we stroll in urban environments, much of our attention remains directed toward stimuli such as avoiding traffic and advertising—yet it's less restorative. Nature, filled with interesting stimuli (e.g., sunsets), allows for directed-attention mechanisms that encourage us to replenish. Taking time to walk in the woods is good for us [10].

Interactions, both public and private, can be enhanced by a bit of a pause:

Intermission
The drumroll
The halftime show
The landing strip
The pause button
The semicolon
The window
Interstitial ads
Syncopated beats
Hadrian's Villa
A moment of silence

If we start considering the pauses all around us, both designed and unplanned, we begin to see the patterns, in that they both increase meaning and enforce attention.

Designers seek to contribute through meaningful additions. Great contributions, it's often thought, are meant to be seen and heard, rather than not. Yet what if designers were more comfortable with the presence of absence? It is through pause that value is sometimes found. In a culture where we're racing to fill each moment with content and connectivity, we might consider what we can leave behind. And instead of racing forward, we pause for a moment.

[10] Berman, M.G., Jonides, J., Kaplan, S. "The Cognitive Benefits of Interacting With Nature," *Psychological Science* 19, 2 (2008).

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evolve, Adapt, THRIVE!

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Mankind has always been shaped by technology. From the harnessing of fire and the invention of the wheel, to the spread of the steam-powered locomotive, technology and innovation have continually redefined our lives. This rate of change continues exponentially.

Think about how many disruptive technologies were introduced in the past century—cars, television, containerized shipping, cell phones, the Internet—and consider how widespread their impact has been. Is it any surprise we are in the midst of today's economic upheaval? While one could argue that greed and lack of government oversight got us into trouble in recent years, I'd suggest that technology enabled the greedy, via mass production, efficient transportation, and modern communications technology, and that governments are struggling to keep up with societal changes fueled by technological change. What part do designers play in all this, and how will that change?

As noted before in *interactions* (and elsewhere), science fiction writer William Gibson once sagely said, "The future is already here; it's just unevenly distributed." The best futurists are science fiction writers, and one of them, Cory Doctorow, has an interesting take on the new world order (what I would call the "the post-post-industrial era"). In his novel *Makers*, Doctorow describes a world where open innovation reigns free, and individuals have little need for large capital investment to move product from design to realization.

The Industrial Revolution was about the power of technology advancing the power of a few select members of society who could afford it—the aristocracy. What we are witnessing today is a different economic paradigm shift, again induced by technology, but instead empowering vast numbers of individu-

▸ The design evolution of the Apple Macintosh mouse from the 1984 M0100 (right), up to the Magic Mouse released in 2009.

als—the common man. Moore's Law now allows vast numbers of the global middle class (and increasingly the poor) to have access to enormously powerful technology. With the Internet, they now also have the world's knowledge at their fingertips. In the digital era, they can create and sell things of significant value without a large capital investment. Unlike the industrial barons of the last economic revolution, they require no large factories. The implications of this shift are profound: We are moving toward meritocracy.

If you can take your idea from napkin drawing to design, via the next generation of tools like AutoCAD or Axure, to selling it via an online market in a matter of weeks without a lot of money, things change. We saw what happened to software in the late 1990s when Web technology hit. All of a sudden things like "the virtual store," seemingly limitless in its inventory, and more convenient than the shop down the street, became possible. Imagine what might happen when it becomes feasible for anyone to produce custom-designed physical items leveraging highly flexible offshore manufacturing facilities taking bids via the Internet. Or when anyone can (re)produce items in their neighborhood or home via advanced 3-D printers—which is increasingly becoming an affordable reality. As for software, open source has similar effects. It becomes much easier to create complex software standing on the shoulders of others.

All this means that design becomes more important. As always, design will be about recognizing a need and creatively proposing a solution within the constraints, but many of yesterday's constraints will vanish.

In this new order, creative ideas trump deep pockets and entrenched market players. The cost of trial and error is minimized, so data-driven design, via rapidly collected market insights and user feedback, is everything. Quality becomes key, as does brand, because user feedback via social networks will be public and nearly instantaneous (consider Twitter, Yelp, blogs, and Google). Brands will not stand for long based on myth, as they often do today. In a world where information flows freely and rapidly, every product release or site update will matter, and consumers will be fickle. A pervasively networked consumer base will let no flaw go unnoticed or unpunished. Last year's "Operation Chokehold," where disgruntled iPhone users threatened to shut down AT&T's network and coordinated the effort via Facebook, is an example of the future. Another example is how fast consumer sentiment turned

Photograph by OsaMu

on Toyota. Consumers have more power when they can easily communicate to everyone on the Internet when they are unhappy, putting them on a level playing field with corporate marketers.

Efficiently and effectively incorporating user feedback will become even more critical than it is today. Evolving the design faster than the next guy will increasingly mean owning the market in the long run. Large companies will no longer have an edge based on sheer financial resources; rather, they will need to open their minds to outside ideas and intelligently embrace acquisitions and open innovation in order to keep their edge over smaller and more nimble startups that no longer face the financial, cultural, or logistical hurdles of old-world financing, marketing, and sales models.

Those who identify and meet the needs of niche (including localized) markets (a.k.a. "The Long Tail") will thrive. Hyperefficient markets, cheap manufacturing, and open source models will enable specialized products beyond what we have today. Megabrands selling one-size-fits-all solutions will no longer have as big an edge due to mass production (and marketing) economics. Large corporations will have to adopt mass customization as first envisioned by Joseph Pine in 1992 or they will become obsolete. You can already order personalized jeans from IndiDemin or shoes from Puma at near off-the-shelf prices. This trend will only accelerate as more companies embrace the underlying technology.

Possibilities are becoming limited more by our imagination and knowledge and less by the technical or financial wherewithal needed to achieve it. The design community will need to extend or adapt our methods in several ways if we want to thrive in this new world.

First and foremost, we'll need to continue to position ourselves more as futurists and strategy partners. While there's plenty of talk about this, how many of us are really doing it, or are even ready to assume this role? I'd bet there are many readers who are still content to work comfortably defining the details but who shy away from strategy definition and vision setting. Unfortunately, mass personalization will eliminate many mundane jobs, such as picking colors and forms for mass-production goods. As my longtime collaborator Liam Friedland and I have emphasized in our tutorials on user experience strategy, successful designers of the future will be those who can map and prioritize the outputs of the user experience team based on the needs of the overall organization, deliver innovation predictably, and deliver for the customer. Yes, there will still be "traditional" design work, but with fewer entry-level jobs and higher quality standards.

To succeed in this new world, we'll need to participate in defining the vision, and not just draw it for others. We all know that good design is based on shared visions of what could be. With executives now reading books by Tim Brown and A.G. Lafley, they will increasingly be willing partners in design. How we respond to these aspiring Steve Jobs types is critical. More firms are following the lead of Apple, Coke, and Samsung and hiring design leaders. If we wish to avoid this becoming a passing fad, we must emphasize—as a community—how to run brainstorming and design-facilitation sessions to constructively engage senior leaders to do more scenario-based planning and less micromanaging of pixels and features. One of the best ways to do this is to spend more time leading teams to envision the future using scenarios (as popularized by the famous strategist Pierre Wack) to explore the design space. Here are some examples of these types of scenarios taken from recent technology events:

- What if we repositioned our computer company as a consumer electronics company?
- What if we made it easy and cheap to buy music and videos online?
- What if the price of a laptop dropped to $200?
- What if instead of selling software, we hosted it on servers and leased it out over the Web?

But as we all know, coming up with the right scenarios before they happen is the hard part. Here are some proven methods for identifying emerging trends for input into scenario planning that we should all consider in our work:

- Prediction markets (both corporate and market based)
- Online trend (content) analysis of social media and the Web
- Delphi method panels and customer councils

• Formalized studies of lead users (who extend our products or use them in strange ways)

• Field studies of existing users *and* targeted users

Each of these methods should be in your toolbox. You're going to need to know when and how to leverage them soon. Remember idea generation and evaluation must feed scenario-based planning methods in a methodical way for long-term success. Otherwise all you are doing is reinforcing group think. As Silicon Valley engineers often say about corporate marketing, "Don't breathe your own exhaust."

It's important to leverage techniques such as those listed here to overcome the first person-perspective problem in design. It's difficult enough to think like someone else; it's even harder to think like someone outside your realm of experience. That's the key contributor to what Clayton Christensen calls the "Innovators Dilemma." This is all the more true when entering new markets, such as those in emerging economies, which are often outside the immediate team's prior experience.

Part of the challenge is that today's multinationals have grown so massive they are too big to live, and arguably incapable of innovation.

The top-down management style we inherited from the Alfred P. Sloan (GM) way of thinking may have reached an evolutionary dead end. No matter how many committees you create (Cisco has 59), and no matter how good your communications infrastructure is, at a certain point things break down and companies become dysfunctional dinosaurs. People create silos and lose touch with the external world and their customers. While methods to capture customer input are evolving, one has to ask if the days of mega corporations are numbered if they cannot adapt. What are the other options?

There is significant speculation that the large organization will morph into something different from Sloan's centrally planned and managed organization composed of functionally specialized departments and product divisions. Technology companies such as Cisco and Intel have been experimenting with decentralized organizational models for years. Google is also a highly visible example. While the idea of having a dedicated innovation organization as part of a traditional organization is still considered feasible in some circles, many point to examples like Xerox's famed PARC and its failure to transfer research ideas into revenue.

One theory is organizations need to evolve into self-organizing superorganisms modeled after insect colonies like beehives. The father of management science, Peter Drucker, predicted this in *Post Capitalist Society* as the outcome of the rise of the knowledge worker. More recently, Daniel Pink has described this as "the conceptual age," while journalist Michael Malone has prescribed a solution, "the protean corporation." Malone and others claim such self-organizing, bureaucracy-free structures are inherently more capable of innovation, as they can rapidly adapt to changing markets and customer needs to successful deliver products.

As designers we should be inciting these new, swarm-like organizations to move toward adopting open-innovation strategies, inviting outside experts in, and feeding our leaders (note: these may not be our managers) with our analysis of the customer data to drive this change. If you believe in science, the days of accidental design are numbered. There is no question that the role of personal insight and eureka moments will continue to provide key advances. But the long-term winners of the game will be those who efficiently spot opportunities and rapidly evolve concepts into optimized solutions. Just consider what one pretty smart student of design once said about the complex systems he was studying and think about how it applies to you and your company:

"It is not the strongest of the species that survives, nor the most intelligent that survives. It is the one that is the most adaptable to change."—Darwin

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Today's *Flâneur*: From HCI to Place-Based Interaction and Human-Place Interaction

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Location, location, location. It's the new thing. Well, at least for the interactive-technology industry; for real estate agents it has never been about anything else.

Location-aware devices and applications that filter and deliver content based on physical location are all the rage right now. You can get a map with a "you are here" marker, or reviews for nearby restaurants, or notices about traffic bottlenecks up ahead, or bus times based on proximate stop(s). And this is my favorite: a nap alarm that's triggered by a specific stop on a commuter train. You can blast your location to some or all of your friends in a social network, prompting people to meet you or just to stalk you: At this year's South by Southwest Music and Media Conference & Festival (SXSW) in Austin, Texas, social, game-like location-broadcast applications like Foursquare (http://foursquare.com/) and Gowalla (http://gowalla.com/) stole the show. You can also end up a willing or unwilling target for all kinds of advertising and marketing; walk by a chain restaurant and you may be offered a coupon for a free martini.

Determining location can be more or less accurate, as I discovered when I was wandering around New York City recently. Apparently, tall buildings and AT&T's sketchy coverage meant that my location updates were not happening in as timely a way as they should. Usually some kind of triangulation between GPS satellites, cell towers, and wireless positioning using access points does the trick. And using accelerometers, gyroscopes, and electronic compasses plus machine-learning algorithms that detect patterns in an individual's peregrinations, it is possible to start disambiguating location and even predicting and prompting paths.

The market for handsets that support location services is increasing. Berg Insight (http://www.berginsight.com/), a Europe-based marketing intelligence and forecasting company focused on the telecom industry, forecast that shipments of GPS-enabled handsets are estimated to reach about 960 million, or 60 percent of total handset shipments in 2014. The most commonly owned consumer-level, location-enabled, personal devices are smartphones, which can support installation of native third-party applications. While historically these have been expensive, Berg Insight predicts they will be below 100 euros (about $135) in 2010 and likely to drop to 50 euros (about $67) in 2014. These devices are increasingly offering much better performance in terms of sensitivity and power consumption and are available in smaller, more aesthetically pleasing packages. The obvious impetus for this major push has been the wild success of the Apple iPhone.

Of course it is not just handsets; service infrastructures are also getting better. For example, SimpleGeo is making it easier and easier for developers to create new experiences within a short time frame (http://simplegeo.com/). And these services are piquing people's curiosity. The iPhone application store (better known as the "app store") reports 1,190 applications that are tagged with location. I mentioned some above, but there's more: With applications like Graffitio (http://graffit.io/), you can "air post" notes on the nearest handy geolocation wall (the digital equivalent of burying a time capsule in the garden, perhaps); you can bookmark and tag locations; you can play location-based games with others; you can

look for services like hotels, parking, and public toilets near you; find out when the next train is coming (having identified the station closest to you); get active in mobile dating and literally bump into the partner of your dreams; and of course get maps of any kind for navigation. Having spent the past few days trying some of these out, I can tell you the possibilities are endless—once you start exploring these applications, you can't help but start dreaming up "needs" you never knew you had. For example, I don't often lose my car in a garage, but when it happens, it is most annoying; I started browsing the app store, and sure enough there is an application called My Car Park. Being British I am obsessed with the weather, and liking clothes, I am always keen to know what to wear. So, if you tend to wake up wondering "What's the weather going to be today?" and "What should I wear?", then Stylecaster (http://www.stylecaster.com/) has an app for you. There's also an app called Primospot for finding a parking space in New York City, but as of yet (as far as I know at least) nothing for advertising (or perhaps auctioning) available or about to be available parking spaces. I'm thinking of calling it Toot 'n' Tweet—you can let your friends and Twitter followers know you are about to leave a parking space, and anyone who is in the vicinity will be directed to that space.

Location is more than here and now of course. The geotagging of blogs and websites and embedded geolocation information in photos, email, or Twitter posts could revolutionize how we search and organize our content—sorting not just by time, but also by place. And what is more interesting than the specific utility the applications provide is how they are changing our relationship to the places we find ourselves in, and to how we find those places to begin with. Just as the railways changed how people perceived distance and time, these applications are adding a dimensionality to place that was previously the purview of faeries, grues, gods, and goblins. They can fundamentally change how we see the world and how we interact with it—and how it interacts with us. Here are some examples, from the mundane to the somewhat phantasmagoric.

Navigation. Going from point A to point B has never been easier. Technical glitches notwithstanding (see my earlier column on when automobile GPS systems break down [1]), no one need ask for directions ever again. Simply plug in a destination and follow the instructions. Replanning based on approaching obstructions is of course possible too—for example, traffic. The upside is obvious. The downside is that we may end up engaging with the world like zombies, not actually taking note of landmarks for later retracing. Worse, we may feel a profound angst if the battery runs out or the service fades or the road that we planned to take has recently been closed. There was the (possibly apocryphal) tale of a woman driving off a bridge, so blindly following instructions that she did not believe her eyes when the road simply ended. Her faith was off balance; she sadly put more faith in the misinformed mediator than in what her eyes were telling her.

Things to do. Pushing suggestions to my personal device based on where I am and on the preferences I have set is on the increase. These applications have a long way to go, but they are a start. Yesterday I tried pulling up recommendations based on my location for what to do next and was intrigued to find a dive bar listed on the same page as a swanky restaurant and a less than swanky cafe. Not so good. Had I not known the places that were being recommended, I could have been in for a surprise. I found there was just too much work to be done in sifting the good recommendations from the bad along dimensions I perhaps did not even know I should consider. My conclusion was that this is not like asking a concierge in a hotel for advice, but perhaps it should be. For example, concierges tell you: "Oh, that's a nice bar, but the neighborhood is not the best. I would recommend getting a taxi home if you leave after 11 p.m."; "Do you have a car? Taxis don't drive by there much, so if you are not driving you may want to book one ahead or take a phone number"; or "Will you be changing for dinner?" while sizing up your outfit. These elements of places may seem extraneous but are fundamentally important to a good social recommendation. So event recommendation increases serendipity and exploration, but it may also, as currently implemented,

[1] Churchill, E. "Maps and Moralities, Blanks and Beasties," *interactions* 15, 4 (2008).http://interactions.acm.org/content/?p=1125/

lead to some faux pas, both minor and monumental.

Sociality. I have already talked about people finding and tracking in the form of applications like Gowalla and Foursquare. I have yet to have a compelling use case for myself, but more often than not, my friends who are on these services have given me useful information regarding someone else's location. So while I see the cost-benefit trade-off of publicly "checking in," I also see that having others in my social network informed does help me—even if you don't use the services yourself, the knowledge is in your network for distribution by the people who do. When spending time with those who have a location-app fixation, the replanning I mentioned above becomes social ("Can someone look up whether to take 280 or 101 home? What is the traffic like?") and navigating new cities similarly expands, when suddenly our devices act as, albeit somewhat simplistic, concierges in the conversation, prompting suggestions and discovery of likes and dislikes that may otherwise have never been discovered ("I didn't know you were a rodeo fan!").

Spatiotemporal dimensionality. From traces others have left in geocaching to mobile games and more content-intensive historical applications, the location you are in right now can tell you all the places it has been. There have been numerous interesting projects published on devices-as-docents in museums, but

Photograph by Ethan Bagley

these docents are now staged outdoors. Researchers at Duke University are mapping old tobacco warehouses, textile mills, and churches and providing location-specific information as a narration of the lives of city residents from the 1870s through Prohibition. They are adding audio tracks and geotagging photographs of the mapped locations. Similarly, Banff's Locative Learning Project (http://banff-mobilehistory.ca/) offers a tour of Banff, Canada; as you slowly perambulate, you can learn about what happened in historical hot spots, bringing the ghosts of people and things past to "life." I have also been told there are applications where you can "visualize" what is below your feet; a kind of boring into the skeletal structure of the city. Coupled with historical elements, one could stand stock still in one place and have the place talk back to you about the depth of its present and past. Which brings me to my next point.

Places speak back. I am much taken with the idea of "citizen environmentalism" and how location services can help us become more involved in sustainability issues such as air quality and green practices. I am also very interested in how, as these services connect us more to each other and to aspects of the places we move through that are perhaps not visible to us, we can empower those places to speak to us. Places are talking back to us, and we can help them tell us

what we need to know to enter more fruitfully into a relationship of give and take, rather than use. Just imagine if the park near me could communicate that it has been littered or vandalized and implore me to support my local public services. I realize I am slipping out of rational utilitarianism, which is the usual mode of discourse around technology, but I am much taken, as I said, with the opportunities that location-centered technologies offer us for being better informed and taking more responsibility for the environmental results of our actions. This is, at least in part, why I am shifting from using location to using place. Location is Cartesian; it is that which computed. Place is what is experienced, it is a living thing.

While hyperbolic enthusiasm characterizes this emerging technical landscape, we do need to tread carefully. High expectations can lead to deep disappointments; accuracy is still a little off; and as with all technologies, there is a risk in overreliance on systems that can cause serious problems when breakdowns occur—I refer to the tale of the unfortunate woman I mentioned earlier. I also recognize that I have avoided discussion of the security and privacy aspects of these technologies, not because I think these issues are unimportant—that would simply take a whole other column to unpack. For the current context, I am satisfied with making the point that talking places and enriched place/time meta-data are upon us. There is much we can do, and this will really need to be a hybrid venture between art, science, and technology.

In the way that a well-designed urban treasure hunt can literally make you see the city differently, pointing your eyes up and down to find grates and placards, and taking you down alleyways and side streets you never knew existed, with location services one can see a potential shift where the taken for granted becomes the object of interest, the familiar becomes curious, and the possibilities for a different kind of interaction with place become possible.

What comes to mind is a French literary character, the *flâneur*. The flâneur is typically portrayed as a well-dressed man, strolling leisurely through the Parisian arcades of the 19th century. He is a shopper with no intention of buying; he is educated and wealthy, walking and surveying the city to pass the time. The flâneur came to rise primarily because of infrastructural—that is, architectural—changes in the city of Paris. This change was the creation of passageways through neighborhoods called arcades, which were covered with a glass roof and braced by marble panels, allowing for a comfortable wandering with little interruption from inclement weather or sounds of traffic.

In Susan Sontag's text *On Photography*, the street photographer is cast as a technologically enhanced, 20th-century version of the flâneur. I wonder, are some of us 21st-century flâneurs? I speak of those who lyrically and playfully adopt new location-based technologies, engaging in dialogues with each other and with places themselves, not those who simply navigate from A to B. Further, are new location applications with their digital flows that connect and guide me from one place to another, the new passageways of the arcade? On a darker note, I also should point out that the flâneur is characterized as someone who objectifies people and objects alike, indulging his own sense of intellectual superiority as he probes his surroundings for clues and hints that may go unnoticed by others. Just as critiques of the flâneur focus on his distanced, objectifying perspective, his privileged status and superior stance, should we worry about the provenance of the algorithms and services that underlie our location-based recommendation systems and the value systems that are embedded therein?

As I continue to muse, I suppose I should also ask who is the actual flâneur: Is it me or is it my trusty iPhone companion? Or are we so much a networked cyborg hybrid that it is not worth making the distinction?

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Adaptive Reuse: Things, Containers, and Streets in the Architecture of the Social Web

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From at least the advent of the homepage, the words used to describe online places have been explicitly architectural and urban. If online organizational structures and real-world architecture have anything in common, this set of similarities has nothing to do with the qualities of form, space, and material that are usually appreciated in buildings. To speak in terms of information architecture, or cyberspace, is inadequate to describe the ways in which all of these structures, built or unbuilt, are produced and sustained by the social and economic systems that surround them. Yale School of Architecture's Keller Easterling calls such space "organization space," and says, "architecture, as used here, might describe the parameters and protocols for organizing space" [1]. A way of talking about buildings and cities in terms of protocols, relationships, and parameters—all borrowed by architectural theory from computer science—can be returned to a conversation about online systems in order to rejuvenate our methods of understanding and designing places.

"No ideas but in things." [2] —William Carlos Williams, poet

The ease of networked cultural production on the Internet and elsewhere provides endless artifacts, seemingly for nothing, like food growing from fertile soil. As the real average cost of media production crashes, the value of things in isolation falls toward zero. These cultural surpluses are valuable only in relation to each other, when collected in aggregate and sorted by people. The fruits of amateur production are harvested and then presented by amateur curators as logs, streams, favorites, and lists.

There are other, even accidental, modes of production. Things are inadvertently created online by anyone who uses the Internet in almost any way: visitor IP addresses, email caches, chat transcripts, and view counts. The basic act of being on the Web leaves traces everywhere. These traces, when collected, sorted, and filtered, become a valuable asset, supporting the more obvious cultural curation with saleable marketing data. Paradoxically, media is free, but media is also currency—a source of social and financial capital.

Both types of collection—the arrangement of cultural things into categories or narratives, and the aggregation of data into buying patterns—take the same condition for granted: There is a personality behind the artifacts that is expressing itself and is worth understanding, either as a collector of links and favorites, or a generator of saleable marketing data.

Henri Lefebvre writes: "Social space is not a thing among other things, nor a product among other products: rather, it subsumes things produced and encompasses their interrelationships" [3]. Places, online and off, don't exist apart from the people who generate and sustain them in this way. People don't use these places; they make them, along with, and out of, the things they make, and share, and leave behind. Instead of naming these people "users," writer Kio Stark has proposed the word "constituents," in recognition of the active, creative role they play [4].

"Containers are made for things, not for people." [5] —Shigeru Ban, architect

There is a type of place that exists in order to sort, store, present, and capitalize on these collections of artifacts. Blogs, aggregators, and social networking and sharing sites are all members of this category, along with built places like muse-

[1] Easterling, K. *Organization Space: Landscapes, Highways, and Houses in America.* Cambridge, MA: MIT Press, 1999.

[2] Williams, W.C. *Paterson*. New York: New Directions, 1958.

[3] Lefebvre, H. *The Production of Space*. trans. Donald Nicholson-Smith. Oxford: Basil Blackwell, 1991.

[4] Stark, K., Personal Communication, Baltimore, 2008.

[5] Ross, M. F. "A Conversation with Shigeru Ban." arcCA 8.1 (2008).

ums, galleries, concert halls, clubs, and theaters. For all their internal organizational methods—their loops and centers and support systems—this kind of place is, at its most basic, a big room. These rooms, and the things within them, are there to facilitate some kind of social interaction. Artist and designer Eric Leshinsky calls these places "cultural containers" [6].

The people in these places are visible by way of the things they watch, make, and use—in commentary, fashion, fads, and affinity. If there is a stage in a venue, it is a stage that anyone, with enough virtuosity and time, can access; and if there is an audience, it is composed of people who are also, subtly or not, performing. We go to the museum in order to have a conversation. The things are there only to enable the constituents to engage each other through presentation, curation, and mediation. Facebook has recently redesigned its interface so that the primary element is a blank text field, with a button that says "share."

A container can be partly neutral and partly specific; it can shape its content without defining it. The 140-character limit on Twitter is a constraint that encourages new behavior from the people who use it. The @name and #hashtag conventions were both developed as an attempt to add more organizational information to messages; they are significant because, in the strict boundaries of the Twitter text field, they act as structural elements invading and using space usually reserved for content—like columns and partitions in a room. These are both now adopted and supported by the service itself: The structure of the place is being changed by the things inside it.

The white box of a gallery and the black box of a theater accommodate different kinds of innovation, subversion, and misuse. There is a blurry line between an intervention that expands the possibilities within a container and an attack on the institution itself. Myspace allows CSS to be inserted into any text field, enabling broad profile customization. This feature also lets members accidentally slow down the loading of the page with large objects. Moreover, it allows them to intentionally obscure advertising or incorporate bad code that crashes the browser.

The continuum between reuse, misuse, and abuse has a long history in the art world. In the 1970s, Gordon Matta-Clark, working as an artist but trained as an architect, transported pieces cut from vacant houses in Brooklyn to galleries in Manhattan and Berlin. These were supplemented by photographs of the original sites, and sometimes with new cuts in the gallery walls. "Window Blow Out," a piece for the *Idea as Model* show at the Institute for Architecture and Urban Resources in lower Manhattan, involved mounting photographs of broken windows from the South Bronx. Late at night, after the opening, Matta-Clark returned with an air rifle and shot out the windows of the gallery itself. The resilience and adaptability of cultural containers can neutralize and even assimilate such attacks on the institution. Doris Salcedo's Tate Modern installation, "Shibboleth" (2007), made a 550-foot crack in the concrete gallery floor of the Turbine Hall. Filled in, it remains a permanent scar across the museum.

London's Tate Modern was once an oil-fired power plant; the Turbine Hall held the station's generators. It is common to convert unused industrial structures from basic production and storage to more complex cultural use. MySpace began as a data-storage service; existing as a way for people to archive and access files remotely. Banner ads generated revenue, and users could receive additional space in exchange for filling out marketing surveys. In architectural terms, MySpace was a warehouse with billboards. Like warehouses converted to artist's studios, storage sites undergo adaptive reuse. Contemporary remote server systems like Google Docs acknowledge the collaborative aspects of online storage: Myriad digital things become social.

"The street finds its own uses for things." [7] —William Gibson, author

Every container has both an inside and an outside. If containers are places, then the street is the leftover space between them. It is only in these gaps that a collection of buildings becomes a city, and it is in these same gaps that a collection of many social places can be seen all at once—linked, moved between, and compared. If a diagram can be made of online cultural containers and the spaces between that simultaneously link and separate them, it might look something like Giambattista Nolli's plan of Rome, engraved in 1748.

[6] Leshinsky, E., "Cultural Containers," Lecture, Baltimore, 2008.

[7] Gibson, W. *Burning Chrome*. New York: Harper Collins, 2003.

Photograph courtesy of The Museum of Modern Art, New York. ©MoMA http://www.moma.org

► "Taglioni's Jewel Casket" (1940). Joseph Cornell, a pioneering artist of boxed assemblages, honored 19th century ballerina Marie Taglioni with a velvet-lined wood box housing small glass cubes positioned above blue glass, removed to expose a collection of sand, crystal, and rhinestones resting on a mirrored surface.

The Nolli plan draws all of the pilgrimage churches in Baroque Rome. These structures, public places filled by the richest families with paintings and sculptures to commemorate their social status and wealth, are shown embedded in the twisted and complex network of medieval streets. This gnarled cracked-mud pattern had been clarified and opened up by Pope Sixtus V in the 16th century to allow the religious pilgrims, so important to the city's economy, to more easily circulate from church to church.

In individual places, capital is generated by people interacting in terms of things and by people leaving behind other things that can be collected and organized. At the scale of the container, individual cultural artifacts are less important than the organization of them into aggregate collections, where they can be sorted and compared. At the scale of the street, it is these places themselves that are compared with each other, laid out flat, like a map or an interface, so that they can be seen all at once and moved through.

Each individual cultivated presentation is, like one of Joseph Cornell's boxes, always composed of incomplete, imperfect, even broken things—the empty shells and husks of presence. Through the constant comparison of multiple sets in multiple contexts, accident, intention, and artifice cancel each other out, and something like a higher order pattern becomes apparent. This is, as Michel Foucault says, "our epoch [as] one in which space takes for us the form of relations among sites" [8].

If a kind of richer presence and interaction can be approached by way of this comparison between multiple venues, then the attempts to capitalize on this self-expression are also trying to scale up to this next level. Things are cheap, but understanding is expensive, and few things are more valuable than an understanding of the ways in which people and groups produce culture. The street is too unpredictable, and containers need to process patterns into commodities, so the tendency is to take all outbound links and enframe them, to collect any and all flows or patterns from the APIs of other sites and re-present them, and to limit, whenever possible, the outward flow of valuable information to anywhere outside the container.

As designers and architects, we have an implicit responsibility to the public realm, the outsides of the places in which we exercise greater, but still limited, control. Every design brief contains the implicit context that surrounds the project, and every project interrelates with other projects through this context. To neglect or damage that connection to the outside is to close down the difference and friction that generates cultural change. This is the tendency, for instance, for cities to turn a street into a mall. Any place that tries to internally re-create the experience of the street, to substitute an inside for an outside, will fail because it is exactly this between-ness of the street that makes it necessary for interaction, as a space where places are compared. The street is interstitial, and urbanism, whether online or off, is about organizing the interstices.

There is an aesthetic here, but it's less a visual aesthetic than an enacted, functional one, an aesthetic of use and organization. The container is understood through its activation: To know it, it must be occupied. The street is understood through navigation: To know it, it must be traversed. This is the space that Manuel Castells refers to as "the space of flows"—"the technological and organizational possibility of practicing simultaneity without contiguity. It also refers to the possibility of asynchronous interaction in chosen time, at a distance" [9]. When the discussion moves from form to relationships, distinctions between different architectures—whether built, information, or experience architectures—give way, and common modes emerge from these different disciplines.

ABOUT THE AUTHOR

Fred Scharmen is an artist, designer, and researcher interested in the overlap between formal composition and organizational strategy. Scharmen's work in architecture, drawing, photography, and installation art aspires to themes of collaboration, authorship, and interconnectivity. In 2009 he, along with two collaborators, was selected to create site-specific work for the 2010 Evergreen Sculpture Biennial. Scharmen is a co-founder of D:center Baltimore, a design advocacy group dedicated to changing the ways in which people inhabit the city. He has a master's degree in architecture from Yale University. He has taught at Yale and at the University of Maryland School of Architecture, Planning and Preservation. Scharmen has worked with Greg Lynn FORM in Los Angeles and Singapore, and Keller Easterling Architects in New York City and Inner Mongolia. He currently designs buildings with Ziger/Snead in Baltimore, Maryland.

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[8] Foucault, M. "Of Other Spaces, Heterotopias." *Diacritics* 16 (1986): 22–27.

[9] Castells, M. *Communication Power.* Oxford: Oxford University Press, 2009.

INTERACTIONS CAFE

(continued from page 72)

tion, educators will be empowered to draw from a wide assortment of content repositories, sources, and mediums.

4. Reject the delivery limitations prescribed by technology. The majority of software intended to support online learning is abysmal. Blackboard, one of the most popular tools for online delivery, is described as a "horrendous monstrosity and the people who created it should be ashamed" [1]. As a result, the experiential qualities of online delivery may suffer for reasons entirely out of the educator's control. During the educational revolution, we'll see educators actively refuse to use subpar products, and we'll witness an increase in hybrid approaches to teaching—models that combine a digital component with in-person, collaborative sessions augmented by traditional tools like whiteboards and Post-it notes.

5. Create a safe environment for learning experiences. Perhaps the most important aspect of successful education is the idea of empowerment: creating an environment where failure can be explored, instead of simply trivialized, and where students can learn to be more effective learners. The educational revolution will bring a change of project-based learning, where the cycle of rote memorization, test, and pass/fail is replaced by an iterative approach of informed trial and error.

I've started the Austin Center for Design [http://www.austincenterfordesign.com] to help drive this revolution; similar programs are creeping up all over the country and the world. Technology is enabling a number of these ideas, but they are fundamentally human. It is interaction design, and behavior, that will act as the driving force behind the educational revolution of the next century.

—Jon Kolko

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On Education

Recently, an article by Anya Kamenetz, author of *DIY U: Edupunks, Edupreneurs, and the Coming Transformation of Higher Education*, in which she paints a picture of how much education has changed, was featured on the cover of *Fast Company*. First graders use proprietary software and hardware; curricula self-adjust to the pace of the students; and the massive amounts of content presented on the Internet have democratized—at least on the surface—the challenge of access.

Large companies like HP are offering integrated packages like TeachNOW (designed in cooperation with frog design), which gives teachers a bird's-eye view of the classroom and allows them to directly connect to packaged content sources. Connexions offers a similar content repository, in open-source fashion, of more than 16,000 reusable models with names like "serial port communication," "the biopsychosocial model of health and illness," and "Indian classical music: tuning and ragas."

We are seeing a fundamental restructuring of delivery mechanisms, and a similarly rich restructuring of content (along with a healthy rejection of the age-old autocratic state content mandates). Yet until quite recently, we hadn't seen the same scale of change in the pedagogy—the instructional styles used to impart knowledge and utilize the delivery mechanisms. And while study after study has rejected rote memorization and the homogenized learning encouraged by No Child Left Behind, alternative models of education are still characterized as "fringe."

In this issue, Dennis Littky offers a provocative new model of K–12 education, one that emphasizes learning by doing, realizes individual differences in learning styles and approaches, and encourages apprenticeship learning over textbook learning. Fundamentally, Littky is arguing for the experiential learning promoted by John Dewey—and this is nearly identical to the process of design research and synthesis described in this issue by Katie Minardo Scott.

Designers use synthesis to quickly learn new things and integrate new perspectives with their existing worldview. They are, to some degree, experts in learning, and the critical ingredients seem to translate to a strong pedagogy of education. These ingredients include primary and generative research, active participation, critique and coaching, and the ability to take risks (and potentially be wrong) without negative consequences.

The similarities between the process of design and the process of learning in Littky's school are striking, and he's not alone in pursuing a new, designerly approach. His educational model is one of several, which may form a zeitgeist: We may, in fact, be perched on the brink of an educational revolution. And so, I offer a series of predictive recommendations about the evolving nature of education and how to best structure both pedagogy and content to succeed in the coming educational shift:

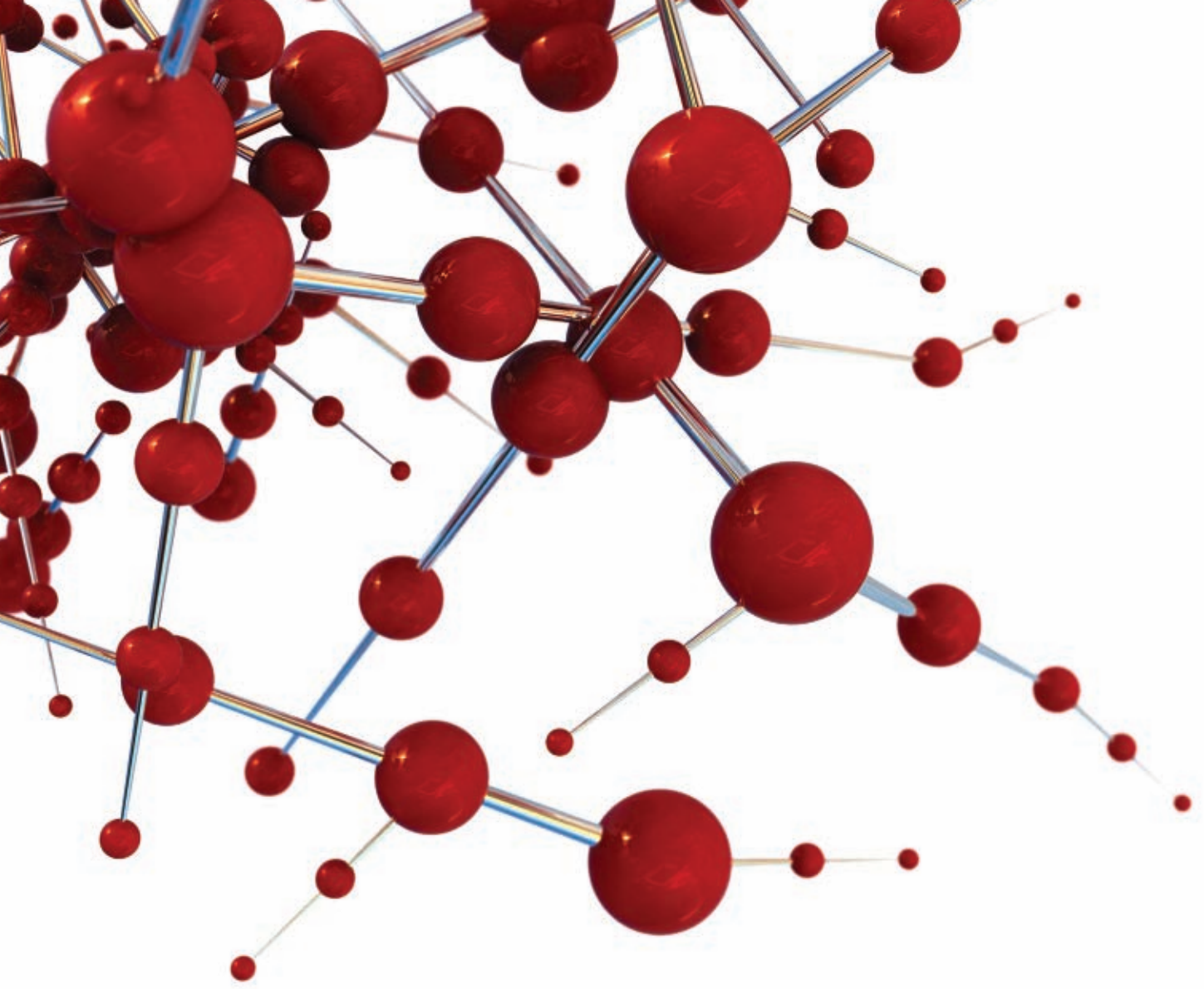
1. Assume that anything is possible. As an educator you quickly become aware of the relative boundaries of your students, and it's easy to set expectations based on these perceived limitations. Traditional teaching models are quick to group students by these segments—usually defined by socio-economic boundaries—and these segments have unusual staying power. The educational revolution to come will operate with the assumption of adequation, where students are empowered to try.

2. Understand the "whole student." At all levels of education, the homogenous body of knowledge that is taught en masse has come to mirror the assembly line, with teachers focused on their own tasks with no awareness of the larger context. The educational revolution will empower teachers to support a whole student, realizing that any factual content needs to be positioned in a much larger and broader context.

3. Leverage the content democratization afforded by technology. It's almost colloquial to espouse the rich benefits of Internet content, yet in many educational settings, this repository is ignored. Traditional, and highly conservative, textbooks are used, which are neither engaging nor as broad in focus. During the educational revolu-

(Continued on page 71)

[1] http://ask.metafilter.com/17980/Do-you-use-Blackboard/



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