VOLUME XVI.2 | MARCH + APRIL 2009

interactions

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Cover Story on Identify Theft
by Hunter Whitney

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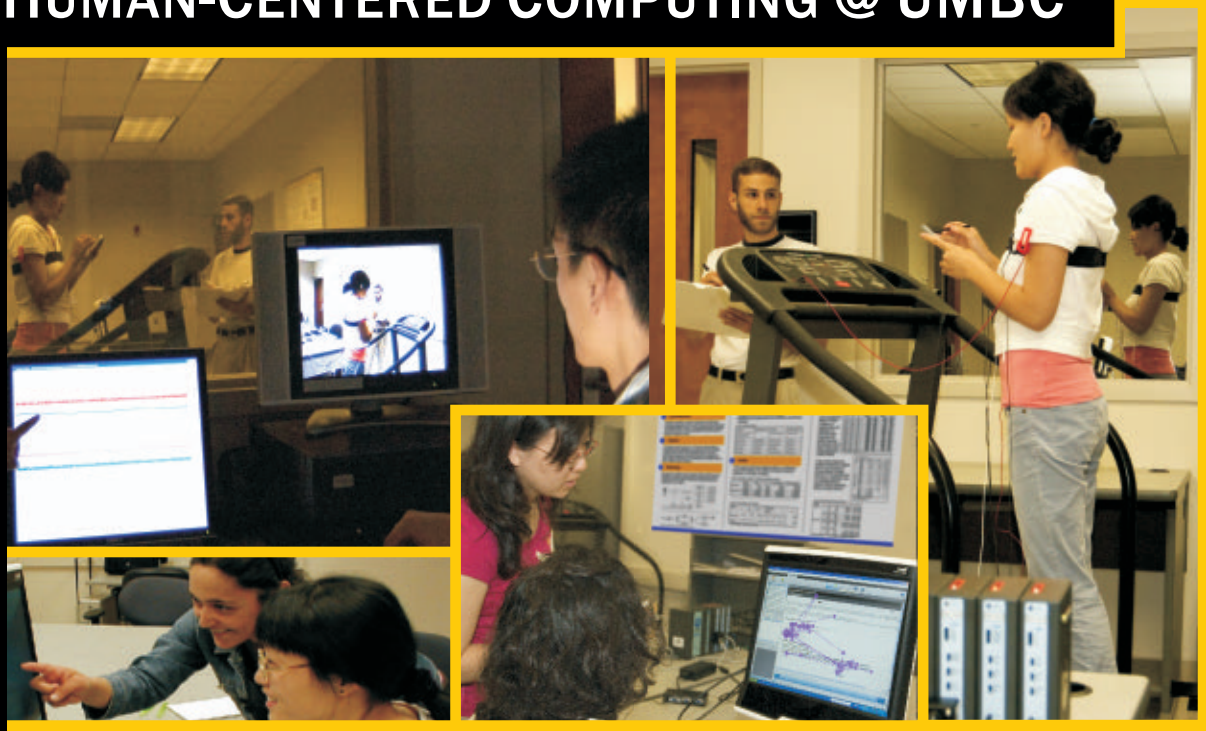

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Interactions: Trust, Collaboration, and Empathy

▶ Richard Anderson

▶ Jon Kolko

As the articles in *interactions* continue to focus on experiences, people, and technology, we are beginning to find these three core concepts appearing in unexpected places and with increased resonance. While the world copes with unprecedented changes and challenges, it's easy to slip into a sense of fear and distrust. We all look to traditional sources of leadership and energy, such as government, faith, and self, yet we encounter new and difficult changes that make us uneasy. The idea of trust is central both to social technologies and to experiences that require or encourage collaboration. And while trust is fragile and difficult to gain, a relationship characterized by respect and trust can forge powerful advances.

This issue of *interactions* explores the idea of assurance and the feelings of ease or unease in regard to relationships of confidence or skepticism. Contributions from Jennifer Whitson and Hunter Whitney explore the notion of the digital self, as related to privacy and identity—and describe the technical and experiential implications of identity theft on culture and the individual. Dimitris Grammenos proposes a metaphorical ambient mirror that can help us better trust ourselves, while Steve Portigal ponders if we can ever trust advertisers.

Eli Blevis explores the notion of confidence in the future by looking at something as seemingly innocuous as food. As Blevis says, "We in the industrialized world might be better off learning about conservationism and simple living than conceiving of social equity as something attainable only through the industrial-world consumption of digital technologies." Juxtaposed is Gary Marsden, who is embedded in the very same developing world implied by Blevis. Marsden considers the nature of digitization in cultures through artifacts. Blevis and Marsden agree that interaction design in developing worlds is quite different from the developed world, and both implicitly consider the nature of collaborative trust and the ability for empathy.

Trust can be particularly difficult to achieve when different organizations or organizational levels work together in significant ways. However, Ben Fullerton argues that trust is essential when designing services, and an Intel team led by Kraig Finstad argues that trust is essential when designing "off-the-shelf" enterprise software. Alex Wright presents "Doing Business by Design," in which he reviews books by Robert Brunner and Stewart Emery, Peter Merholz and his team, and Marty Neumeier. Wright drives home the point that "all three of these books share a purpose: trying to influence business readers to shift their focus from one-off-product development to a more integrated approach to designing the customer experience." It is these business readers who might be in the most prominent and appropriate position to implement changes related to trust, empathy, and collaboration.

The positioning of interaction design as a strategic embodiment within the enterprise raises it above the pragmatism of interface design; the books Wright has chosen, and the other articles in this issue describe a manner of designing for behavior, with the end goal of bettering the human condition.

From "Food, Dude" to "Trusting Your Socks to Find Each Other," this issue of *interactions* attempts to find a way to embody and enhance trust, build collaboration, and better the world we live in through the changes and challenges we face on a daily basis. We hope you enjoy this issue as much as we do.

—Richard Anderson and Jon Kolko
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Co-Creation in Service Design

Ben Fullerton
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When we look at design in all of its many forms, we find numerous examples of manifested, perceivable objects that demonstrate the vision of the designer. Sitting in an Arne Jacobsen chair, holding a William Morris fabric, or using the latest piece of technology from Tokyo, Seoul, or Cupertino, we are acutely aware of the sensibilities of the designer (or design team) that informed the form and the function of the thing with which we are interacting. Interactions like these lead to the notion of "genius design," where the designer plays the role of an absolute authority whose natural instincts produce a considered, desirable experience.

Genius design may well work for something that will be built—whether software, hardware, furniture, an environment, or any other tangible form our design might take. But how well does it work when we design for less tangible experiences? If there is nothing that can be seen, touched, or used that clearly embodies the whim of the designer, how does the role of the designer change?

The (relatively) recently developed practice of service design seeks to address exactly these types of problems, concerning itself with applying the thinking learned from crafting well-considered, tangible experiences to those that do not terminate in a single product at a single moment in time, such as our experience of interacting with our cell phone provider, using our bank account, or when we visit a hospital.

At first glance, the process involved with a typical service-design project doesn't look too different from that of any other design project. Broadly, there are phases of discovery (learning about the context in which the service will be delivered), design (ideation and design of the service itself), and delivery (delivering the new service concept to the client, and working with the client to implement it). In a project where the end result is a somewhat "static" experience, this usually results in a fairly clear set of end deliverables [1].

Services present a different challenge, however. They are produced and consumed in the same moment—an interaction with a service does not exist until a customer initiates it by phoning a call center or sitting down in a restaurant. In their book *Total Design: Managing the Design Process in the Service Sector*, Gillian and Bill Hollins outline exactly what differentiates a service from a product. A key distinction is that "the 'people side' of design is more important in a service product and must be considered right at the start of the process in the specification [2]." The point here is that the quality of a service experience relies, to a huge extent, on the people who will be involved in its delivery. Since very few—if any—services exist that don't involve a person-to-person interaction at some point during the customer's journey through it, it is vital to ensure that those interactions are as carefully considered as any other digital or physical touch point.

So what implications does this have for how a design team works within the context of a service-design project? Because of the nature of the work itself—applying techniques and thinking learned from interaction design to business processes in order to deliver a customer-centric experience—the deliverables are often quite strategic and high level in nature. (Bill Hollins also points out that "whichever form it takes, it must be consistent, easy to use, and be strategically applied [3]," "it" in this context meaning the service-design engagement itself). Typical deliverables of a service-design engagement include service blueprints (a document that "describes a service in enough detail to implement and maintain it carefully"), customer journey frameworks (that describe key stages in the customer's journey through a service and the most important touch points at each of those stages), and a service ecology map (that describes the "system of actors and the relationships between them that form a service"). All of these deliverables could fall under the umbrella of "strategic," intended for senior stakeholders within an organization. There may be communication vehicles

[1] I use "static" here with advisement—the inference being that the user experience remains largely unchanged from one interaction to the next (I'd hope that my chair behaved the same way each time I sat in it.)

[2] Hollins, G. and B. Hollins. *Total Design—Managing the Design Process in The Service Sector.* London: Pitman, 1991.

[3] Hollins, B. "What is Service Design?" *Design Council*, 24 November 2006.

(such as filmed scenarios) that clarify the aim of the design project, but these are likely to be pitched as more of a "vision" rather than something that can be easily shared throughout the entire client organization.

The design process itself determines the success or failure of a service-design project. Simply delivering a set of documents to management and hoping that a design's intention somehow filters down throughout the organization is no guarantee that the service experience will be as good as it can be when it eventually reaches the point of delivery. The key role of the design team, then, must be to attempt to engage with all levels of the client organization, from key stakeholders at senior levels right down to those involved in provisioning the service at the point of use. Moreover, focusing on the so-called bottom of the organizational pyramid provides vital insight—the individuals who work at the point of service delivery are among the best resources for learning how well a preexisting service functions. To ensure the best possible service experience, these staff members should be included in the design process on an even deeper level—they should be empowered as co-creators who contribute to the process of innovation itself.

In the "Make It Work" project for the Sunderland City Council, London-based service-design consultancy live|work studio enabled a design process that did exactly this. Agencies and workers, who provide employment support services, were empowered as the co-creators of service concepts. live|work facilitated this by running "engagement events" with the people who would eventually end up providing these services to those who needed them. And by doing this, the support agencies felt a much greater level of ownership over the concepts.

First, some context: Sunderland is a city in northern England, with a manufacturing-based workforce. It has seen increasing levels of economic depression over recent years, coinciding with rising levels of unemployment—26 percent of the working-age population is "economically inactive." The Sunderland City Council engaged live|work to explore how the long-term unemployed—those whose special personal circumstances (for example, health issues) make it difficult for them to find work—could be better engaged by services that supported them back into work.

During the discovery phase of the project, live|work learned that the long-term unemployed tended "not to volunteer themselves for government employment programs [4]." There were already such programs in place provided by central government and the Sunderland City Council, but these tended to be aimed at the wider unemployed community and unable to support the specific needs of the long-term unemployed. Therefore, there was a real need for this group to be engaged by the local communities who understood the challenges they faced and who could provide the level of support necessary to rehabilitate them back in to society and subsequently back into work. The most important part of the discovery phase, however, was talking to those support agencies that already worked within the community and offered exactly the sort of assistance that the unemployed needed. live|work discovered these agencies were all trying to provide valuable and necessary support, but there was often overlap in their offerings, as well as a lack of communication between agencies, possibly hampering the progress of their clients.

To solve this, the live|work team outlined a five-stage client journey that detailed how a long-term unemployed person would reenter the world of work, from "wellness" to "sustained work," and provided a high-level framework within which each agency could map their involvement.

The most crucial part of the project was a series of "engagement events" organized by the design team. In these sessions, live|work gathered all of the support agencies in the Make It Work program, presented their findings from the research phase and suggested themes to be explored, and then moderated breakout sessions for generating program concepts.

[4] live|work Studio. "Sunderland: Make It Work Case Study." Accessed 16 November 2008. <http://www.livework.co.uk/case-studies/sunderland-make-it-work>

▸ One of the Make It Work engagement events in action.

► The city of Sunderland, on the northeast coast of England, has been the site of rising unemployment. Local officials engaged live|work to study how best to serve and recapture workers who have endured long-term joblessness.

Photograph by Andy Martin. http://www.flickr.com/photos/interzone-inc/ • andy@north-sands.net

These breakout sessions proved especially valuable. Rather than the "genius approach" of designers generating concepts in the studio or inviting a client in for a brainstorm session, live|work team members facilitated a design process that brought together workers from different agencies who delivered care. During these concept-generation sessions, the agency staff members directly addressed how they felt service could be improved, based on the research that live|work presented. They brainstormed outside of the constraints of their work environment, freeing them to consider a broader set of options.

Another issue this innovation exercise addressed was the disconnect between the agencies live|work had observed—by mixing workers from different agencies and having them work collaboratively, live|work enabled the formation of new connections between staff at different agencies that had not previously communicated well. The new networks, enabled by the process of co-creation, formed much of the foundation for successful service delivery and allowed for the development of a cohesive, connected set of support services.

The Make It Work project ultimately acted as an umbrella, bringing support agencies together, enabling communication between them, and unifying the client's experience of service delivery. The program is ongoing and expanding, and the results so far are impressive: In one area of Sunderland alone, 966 people are currently moving through the program at different support agencies, and 206 have found work.

As Gillian and Bill Hollins remind us, "Everybody can be creative. It is simply a case of teaching people how to be open to experiences beyond their own.... Allow them the opportunity to use their creative skills and give them the environment in which they can be creative [2]." In this sense, live|work's approach to the Make It Work project demonstrates that when designers take the backseat and actively involve individuals from all levels of an organization in the innovation process—empowering them as co-creators of service concepts—they can develop a more cohesive experience at the point of use. Following the genius design approach of a design team that maintains control over the innovation process before handing off deliverables at the end of the project would have meant missing vital nuances. By opening up the design process in this manner, live|work identified crucial factors that led to the project's continued success.

Acknowledgments

With great thanks to Richard Telford and the rest of the live|work family.

ABOUT THE AUTHOR

Ben currently works as an interaction designer at IDEO in Palo Alto. He has facilitated workshops at Adaptive Path's UX Week, spoken at the Berkeley iSchool, and was an invited participant and speaker at Design Engaged. Prior to IDEO, he spent time designing future mobile interactions at Samsung Design Europe, creating services for public and private sector clients at live|work Studio, and building multi-channel digital experiences in one of the UK's first full service agencies, Oyster Partners.

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Bridging the Gaps Between Enterprise Software and End Users

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End users of enterprise software are in a tough spot. While traditional desktop software and websites are increasingly designed with their needs in mind, unique challenges arise with enterprise software. Whether working with a specialized accounting system or a general-use intranet portal, users find themselves confronted with systems that are complex, difficult to learn and use, and dissatisfying.

There are usually sound reasons for an information technology department to implement enterprise software, as opposed to building customized specialty applications. Enterprise software is attractive since total cost of ownership (TCO) calculations support a financial advantage. As Daniel Rosenberg stated, "In the enterprise software market, if the customers of your product are not successful you will go out of business…TCO is related to the real value the product provides [1]." Additionally, the integration possible with a comprehensive one-supplier solution helps streamline business processes. For example, the purchasing system's database is accessible to the accounting system, and sales can be linked to inventory. Ideally, the end user is empowered and becomes more efficient and productive, but in the real world it's not so easy.

The power and high-level efficiency of enterprise software often bring complexity and a lack of flexibility. One of the primary challenges in the world of purchase-and-install off-the-shelf (OTS) solutions is that end users are further removed from the creators of the software than ever before. Instead of user-centered design (UCD) professionals advocating on the part of the users to internal project-development teams, the challenge becomes advocacy to a completely separate entity in the supplier. For many, it's a completely new approach that requires careful consideration. This article discusses the problems with OTS solutions and proposes ways to successfully implement them.

[1] Rosenberg, D.. "The Myths of Usability ROI." *interactions* 11, no. 5 (2004): 22-29.

Case Study: Bypassing User Research

Intel had a homegrown application for the distribution of training material, and significant usability work went into the development process. The tool did not have major usability issues, but in 2005 Intel wanted to upgrade the mainframe back-end system. An OTS solution was selected to replace the homegrown tool. After the supplier was chosen, usability resources were requested. The project usability expert conducted a usability study

on the unmodified ("vanilla") solution. Overall there were a lot of usability issues, and addressing them proved difficult. For instance, the enterprise could not revise some confusing labels without modification. The usability expert conducted a risk assessment for project management, which documented all the risks in terms of level (high, medium, low). The usability expert also proposed modifications in order to address some significant user experience (UX) issues such as the search function. The supplier was willing to do some quick enhancements. The supplier and the usability expert also discussed detailed user interface design. Intel project management eventually approved the modification approach.

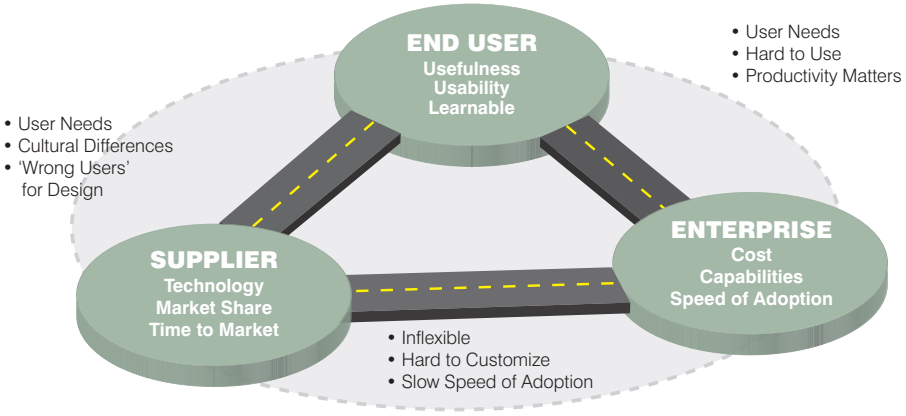
The program, however, was cancelled due to a budget cut. Many key members left the program, and all work ceased. One year later, the program was resumed, and OTS applications were released without any follow-up UX work. The new release did not factor in previous usability work, and significant negative feedback from the enterprise users rolled in.

Companies that have been around for a while have homegrown applications and tools running their various information and business needs. Often, these systems overlap in scope, since different groups in the company, unaware of each other's work, develop them. Thus, multiple applications that offer similar solutions may be found across the corporation. While specific groups using such solutions may be content with what they are getting, the company at large suffers in efficiency due to duplication of systems. In order to eliminate such redundancy in the corporate environment, companies may want to integrate the applications into a single enterprisewide capability by implementing OTS solutions.

While OTS solutions contribute to eliminating or reducing duplicate applications and tools, other issues come into play: those that relate to the users, the enterprise, and the supplier (the OTS solution provider). However, the issues are often interconnected, and it's important to view them as such (see the accompanying figure).

Enterprise Issues. OTS solutions are developed to fit many business needs and are designed to fit the most general business case. By definition, OTS are standard one-size-fits-all solutions that cannot be customized. However, each enterprise has specific business needs and a specific company culture, with unique characteristics such as the vernacular of people in the workplace. Suppliers of OTS solutions often fail to take these things into account. Thus, while OTS solutions are intended for enterprise-wide application, there is always the risk of not providing certain capabilities that the company requires. On the other hand, OTS solutions may also introduce certain capabilities that the company doesn't need, leading to unnecessary cost and maintenance. As a result, new and modified business processes can emerge, ones that may not mesh with existing business processes. And there is always a transition period for a new solution. Due to the generally long implementation and integration period of an OTS solution, the technology may become obsolete—adopting new technologies to make the solution more efficient and effective may require too much time. At the end of the project cycle, testing opportunities often focus on the system design and performance, leaving no room to improve or enhance the end-user input on usability and UX (if such

User Experience: Bridging The Gap



One of the primary challenges of off-the-shelf solutions is that end users are further removed from the creators of the software . . . . Instead of user-centered design professionals advocating on the part of the users to internal project-development teams, the challenge becomes advocacy to the supplier.

input exists at all). End-user needs are at best addressed through mitigation tactics such as training, help systems, and communication.

User Issues. Suppliers often develop OTS solutions for the general user without considering the characteristics of individual users, their roles, their culture, geographical differences, or their work environments. Similarly, when enterprises select a supplier, they do not always take their users' needs into account. Companies fail to study the UX gaps in the current process and workarounds that users may have adopted. As a result, they do not understand what works well in the as-is process, what users are accustomed to, and where they have difficulties. Other user characteristics also go ignored, such as how users access the tools in their own work environments and their cultural differences (particularly in a global company).

Moreover, enterprises seldom develop a strong partnership with the supplier to address the specific needs of their users and solve UX issues. There is no collaboration with the enterprise and supplier to develop mitigation strategies that would make it easy for users to adopt the OTS solution while transitioning from the original system.

Supplier Issues. There are only a handful of large suppliers dominating the market in OTS enterprise solutions. With such minimal competition, the enterprises have fewer options and could end up choosing a solution that may not be a good fit for the company as a whole. Supplier responsiveness to enterprise requests may not be quick and flexible enough, as the suppliers who serve multiple clients are concerned with time to market and tend to focus on overall costs. Only recently has providing a better UX become a competitive differentiator.

User Experience Design. The sheer amount of variables, issues, and mitigations in these situations warrant a comprehensive approach. The user experience design (UXD) approach incorporates not only usability but also program management, training, and transition change management (TCM), among others. For a more thorough treatment of these themes, see Andrew Sweany and Marla Gomez's 2007 paper on UXD and approaches to issue mitigation [2].

Case Study: Internal User Experience Design

Phase 1 of an Intel employee self-service application project was kicked off in 2003. This phase was part of a program to upgrade a large enterprise back-end database system. The system supplier was entering the web-based, front-end application area and had just released its first generation web-based solutions in the business domain. The supplier was offering a free web-based, front-end package as part of the whole system upgrade package. After the first phase was released in fall 2004, distinctly negative feedback came in from the end users.

- ***Supplier-side issues.*** *Since the web-based package was the first-generation, front-end solution built by the supplier, the supplier had not done enough usability work on the design. The product was delivered with a lot of usability issues and inflexible business processes and configuration capabilities.*
- ***Enterprise-side issues.*** *Due to the cost-sensitive environment at the time, and a prior vanilla back-end system upgrade, the program adopted a rigorous no-modification approach for the front-end solutions as well.*

Due to the negative feedback, a Phase 2 program was kicked off in early 2005. Intel IT's usability group was engaged to support this effort. Post-release analysis of Phase 1 clearly indicated that although there were many usability

[2] Sweany, A. and M. Gomez, M. "Bringing the Voice of Employees Into IT Decision Making." *Intel Technology Journal* 11, no. 1 (2007): 45-55.

issues, the usability tool issues accounted for only a small proportion (11 percent) of the total issues identified. The overall identified issues were distributed across all aspects, including system, tool, configuration, performance, or user help. Obviously, if we fixed just some of these issues, we still wouldn't be able to significantly enhance the overall UX. Furthermore, the traditional user centered design (UCD) approach, which focuses mainly on tool usability, had difficulties in meeting these challenges. As a result, the usability expert proposed a UXD approach to Phase 2, which was successfully released in the third quarter of 2006. The overall UX improvement for one major module was ranked ninth best among 102 U.S. corporations in the 2007 Top Employer Web Benchmark by Potentialpark Communications.

A complete UXD approach consists of the following:

• *Form a UX team.* The UX team includes representatives from different functional teams across quality assurance, business process, TCM, training/online help, and user support. The usability expert can serve as facilitator of the UXD process and maintain a partnership with other teams by working with these representatives on the UX team. Each of those UX team members owns the planning and execution of the UX component corresponding to their functional area.

• *Include the usability expert with program management.* In order to keep track of the UXD progress and increase visibility of UXD work, the usability expert should be a member of program management. This differs from traditional UCD, wherein a usability expert is typically embedded within the program as a member of a sub-team.

• *Define a UX scorecard and the tracking process.* The UX scorecard should define not only success criteria for tool usability design, but also other aspects of UX. A tracking process needs to be defined across the lifecycle of a program, which will enable program management to closely monitor the progress of UXD and take any necessary actions. Besides, the UX scorecard and tracking process also increase the overall awareness of a UXD culture within the program.

• *Follow a UX data-driven approach for optimizing business processes.* Gather real end-user data; for example, through iterative usability testing, as business processes evolve. For instance, a vanilla solution may require three sub-business processes (legal process for approval) in addition to the existing business process. Testing the impact of these changes can help determine the right trade-off between the UX and business processes.

• *Strategically collaborate with the supplier.* Leverage usability test data to convince the supplier to fix high-priority usability issues. This is especially relevant in the case of OTS solutions. Getting recommendations embedded into purchased solutions avoids many of the costs and inefficiencies associated with enterprise software.

Case Study: Supplier Influence

One of Intel's early forays into enterprise software involved a web-based purchasing system for general use. Preliminary usability testing demonstrated considerable difficulty for users, high error rates, and low satisfaction ratings. Several iterations of the system were developed and put through usability testing, and distinct improvements emerged in the Intel-customized version. At the user-interface level, as much data entry as possible was consolidated into a main screen, and controls and labels were altered to match user expectations. At the user-interaction level, warnings were put in place to prevent users from mistakenly losing their data, for instance by navigating away

KEY TAKEAWAYS

Supplier

- Develop a partnership with enterprises and adopt an enterprise-participate design approach (for example, conduct field studies in the enterprises' workplace).
- Adopt the UXD approach; select target end users for usability studies.
- Set up a user group that includes enterprise members for regular communication of new design and feedback gathering from enterprises.

Enterprise

- Influence their design.
- Consider UX when selecting a supplier to foster suppliers' UX culture.
- Build an in-house UX team or leverage external consulting.
- Provide post-release feedback to supplier on time and influence improvements of future releases.

Industry

- Set up an industry consortium and develop industry standards to foster an industrywide UX culture.

from the system. An even more advanced version of the customized system took into account the issues most important to users (according to tech-support calls and usability testing). Contextual help links were placed directly on the screen at the most problematic areas as a supplement to the global help from the supplier. As a result, the number of tech-support calls on those issues dropped substantially.

Unfortunately, Intel has had to move away from this internal customization model. Mitigations to UX issues often take the form of issue-focused training, help, and transition efforts. In the long term, a mutually beneficial supplier/customer UX relationship was developed that can provide improvements directly to the end user. The supplier receives valuable usability research data, recommendations, and rare insights into their system's end users. The customer company ultimately benefits from improved systems that accommodate its end users' needs.

Specifically, the supplier's system has made the procurement process more straightforward, complete with a single-page approach, clearer controls, and a more efficient screen workflow. A warning dialog has been added to prevent accidental data loss, an improvement that other supplier systems have adopted. Prototypes of future systems show a more context-aware approach to system help, so the user doesn't have to seek help as a separate (and disruptive) task.

The comprehensive UXD approach provides a solid understanding of enterprise-software end-user needs beyond traditional UCD. In the cases where internal teams handle system development, the end-user and development-feedback loop is entirely self-contained, and improvements may be rapid but expensive. All that has really shifted in the OTS UX approach is an additional part of the loop: the supplier of the solution. This is a slower path to successful influence, but it is ultimately the most cost-effective method. There is lower TCO in terms of upgrading and maintenance, and also an increase in end-user productivity that comes with more usable systems. Moreover, there is the advantage of not only reuse, where the customer no longer needs to remodify a system due to included improvements, but also of "pre-use," where UX improvements spread beyond the original system to other supplier offerings for future purchase. In the long run, the interaction between external development and internal research and implementation means a productive and efficient experience for end users.

As UX professionals, we must add this process to our toolbox. With more and more companies engaging at this level, the cross-sharing of information in communities and interest groups becomes possible. Even though the larger sphere of influence is different, the fundamentals and end results are the same. If we continue working to understand our users and business, then pass that information on to external suppliers, OTS enterprise software can be powerful, flexible, and easy to use.

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Gary Olson recently moved to UCI from the University of Michigan, where as faculty member and acting dean, he participated in the formation of its influential School of Information, described in this article. I have helped track down historical information on other influential iSchools. We may be witnessing the birth of a new star in the academic firmament—its growth, so far only a little slower than a supernova, may be tested by the economic collapse, but could accelerate with a recovery. —*Jonathan Grudin*

The Information School Phenomenon

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The past 15 years have seen a remarkable movement in academic circles, the emergence of information schools, or iSchools for short (the moniker created by an organization of such schools). In this article we examine the iSchool movement, tracing its history, speculating on its longevity, and looking at its impact on human computer interaction (HCI) research and education.

The iSchools have an organization—the iSchools Caucus (www.ischools.org)—and hold an annual conference; as of this writing, 21 schools are members. Antecedents of the iSchool phenomenon emerged gradually in the late 20th century. The movement gathered momentum in the early 1990s and has already stirred several pots: the library world, computer science, design studies, to name a few.

Let's preface the history of the iSchools with a brief digression on the status of a school in a university. Although there are no formal definitions of what a university is, most universities consist of a collection of schools and colleges, which in turn oversee the programs of the various disciplines or departments. Universities themselves are fascinating organizations, evolving and reacting to changes in society around them. At many U.S. universities, a school or college is in a politically strong position. Their deans are powerful in the university's administrative structure, much more so than departments and department chairs [1].

So in the context of university life, it is significant that we are talking about iSchools. Most of the organizations under this banner are indeed schools or colleges; many can be found at leading research universities.

"Information" Becomes an Academic Focus, and Syracuse the First iSchool

The term "information" was gradually added to the names of departments and schools. In 1964 the Graduate Library School at the University of Pittsburgh became the Graduate School of Library and Information Sciences. In 1968, the new University of California Irvine campus established a "proto-school" called Information and Computer Science [2].

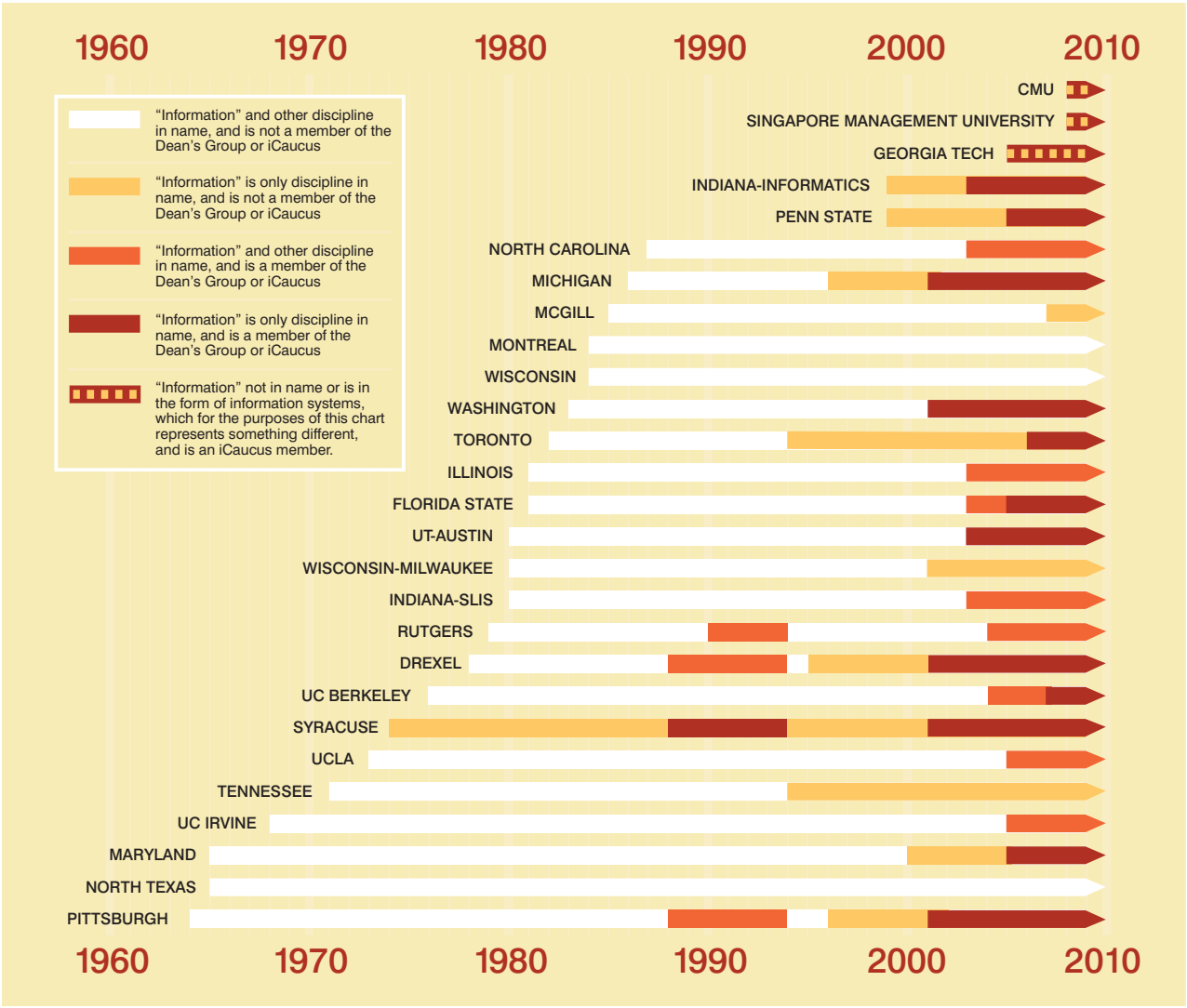
Then, in 1974, Syracuse University Dean Robert Taylor, noting the rise of telecommunications and computing, rechristened the School of Library Science as the School of Information Studies. He considered this "a way to fold the library science program's vision of enabling people to find and use information into an ever-broadening set of academic disciplines." It would be 20 years before another school selected a name in which information was the only discipline [3].

Library science has a central role in this account, so it is important to note that departments and schools of library science went through a very rough period during the 1970s and 1980s. More than 15 library schools closed, including several at leading research universities—Chicago, Minnesota, Columbia, and the University of Southern California. They were producing librarians but

[1] Some universities apply the terms school and college to somewhat different organizational entities, but we follow the convention used by most, whereby they are essentially equivalent.

[2] We call this a "proto-school" because while it was a department, not a school, it was not part of any other school, and reported to the vice chancellor.

[3] The quotation is from T. Didomenico, "Three Decades as an Information Leader," *Home Page* 7, no. 1 (2004). <http://ischool.syr.edu/newsroom/newsletters/ISTSummer2004.pdf>. Interpreting the word "information" in a title is complicated by the use of "information systems" as a synonym for computer hardware and software systems in the management field. We consider "information systems" to be a tightly defining term, not an expansive term, so do not include it as a variant of information. In contrast, "Informatics" as used at Indiana has a social, multidisciplinary focus. Our incomplete canvas found an M.S. in information science at Drexel in 1963, thus far the earliest iDegree of which we are aware.



failed to meet the academic standards of leading research universities. In addition, librarianship was overshadowed in the eyes of many by the rapidly expanding, highly paid information technology profession [4].

Itwas in this period that many schools added the term "information" to their name, most often by shifting "library" to "library and information," although there were other combinations as well. Pressure continued into the 1990s as the spread of digital technologies raised questions about the future of libraries and publishing. Several schools with a major library focus rethought their missions. In 1996 the University of Pittsburgh rechristened its school as the School of Information Sciences, and the University of Michigan officially sanctioned the School of Information.

The dean of the School of Library and Information Science at Indiana wrote of the change at Michigan: "In 1996, the School of Information and Library Studies at the University of Michigan metamorphosed into the School of Information. A first. Used though we were to talking about schools of business, we found it devilishly difficult to insert a period after 'information.' We'd become accustomed to 'information' being coupled with a qualifying noun such as 'studies,' 'science,' or 'management.' It took a little time to get used to the new moniker, and snickering could be heard in certain quarters. Those who scoffed have since had to eat their words. Michigan's scholar-dean, diverse faculty and research accomplishments mark it out as a program of note, a benchmark for other aspiring I-schools [5]." Here, we describe the process at Michigan, in which one of us participated, in more detail.

The University of Michigan School of Information

In 1992 University of Michigan President James Duderstadt appointed computer scientist and innovator Dan Atkins to be dean of the School of Information and Library Studies (SILS). Duderstadt provided resources to support change and convinced the W. K. Kellogg Foundation to invest, over

[4] Ostler, L.J., T.C. Dahlin, and J.D. Willardson. *The Closing of American Library Schools: Problems and Opportunities.* Westport, CT.: Greenwood Press, 1995.

[5] Cronin, B. "An I-dentity crisis? The information schools movement." *International Journal of Information Management, 25* (2005): 363-365.

time, more than $15 million in the school and the information movement in general.

Atkins organized activities to explore possible directions. Under a Kellogg-funded initiative called CRISTAL-ED (Coalition on Reinventing Information Science, Technology, and Library Education; www.si.umich.edu/cristaled), he gathered leading educators and thinkers from the library field and the broader information world. Participants explored the nature and possible futures of library education. Atkins liked to point out that the advice he got from these conferences was to think and act radically.

At the same time, Atkins convened a group of University of Michigan faculty with diverse perspectives; many had participated with him in past interdisciplinary projects. Several were SILS faculty, but most were from other departments, such as psychology, political science, economics, business administration, and computer science. In parallel with the CRISTAL-ED efforts, this group considered for more than a year how to institutionalize their mutual interests. A key strategy, ultimately successful, that emerged was to use Atkins's role as dean of SILS to transform the school into something much broader. These efforts led to the establishment of the School of Information in 1996, the name being selected from a list of more than 100 possibilities in discussions led by George Furnas.

The initial set of professional programs reflected the new mission. In keeping with the U.S. tradition of the principal library science degree being at the master's level, a collection of master's of science in information (M.S.I.) specializations were created: library and information science (LIS), archives and record management (ARM), human computer interaction (HCI), information economics management and policy (IEMP), and a tailored option. LIS, HCI, and the customized program were initially the most popular, although the other specializations grew over time. Subsequently, the school expanded to nine MSI specializations. Interestingly, when SI went to the American Library Association (ALA) for accreditation, ALA accredited the entire MSI program, not just the LIS portion.

A concomitant change was a huge increase in sponsored research. It grew from a few hundred thousand dollars per annum to more than $10 million within a decade, radically changing the culture of the school.

Alternative Paths to Schoolhood: Berkeley, Indiana, and Penn State

Another high-profile university, the University of California at Berkeley, found its small library science school beleaguered. In 1992 it suspended its Ph.D. program and considered closing the school altogether. An external committee recommended shifting the focus to information. In 1994 Berkeley recruited Hal Varian from Michigan, where he had been active in the School of Information discussions, to be dean of the new School of Information Management and Systems. ALA accreditation was abandoned, a clear break from the past. In 2006 UCB adopted the name School of Information, joining Michigan and Texas.

Indiana and Pennsylvania State University adopted pure startup models, both in 1999. Indiana's School of Informatics was independent of its School of Library and Information Science; Penn State's College of Information Sciences and Technology stood alongside its Department of Computer Science. Penn State hosted the first iSchool conference.

During the mid- to late-1990s, other schools enlarged their missions in different ways. Some changed their names, others retained older names while broadening disciplinary coverage—the University of Illinois is a strong example of the latter.

Multiple Disciplines

What were these changes about? The core vision is that information, technology, and people are considered to interact and to be of roughly equal significance. Launching this required a decidedly interdisciplinary approach, with experts in each area sharing insights into meaningful syntheses of the three components. The information component was populated from the fields of library science, archives, and information retrieval. Technology came mostly from computer science, but could include a range of information appliances, such as telephones, handhelds, and embedded systems. People were initially represented by psychologists, sociologists, anthropologists, and management specialists. How to meld this interdisciplinary mix became a central energizing thrust at the early iSchools.

Of the 21 schools in the iSchool organization, 15 have library science in their genes, but other developments were also significant. Some computer science schools have broader missions,

The iSchools Caucus

University of California, Berkeley
School of Information

University of California, Irvine
The Donald Bren School of Information and Computer Sciences

University of California, Los Angeles
Graduate School of Education and Information Studies

Carnegie Mellon University
School of Information Systems and Management, Heinz College

Drexel University
College of Information Science and Technology

Florida State University
College of Information

Georgia Institute of Technology
College of Computing

University of Illinois
Graduate School of Library and Information Science

Indiana University
School of Informatics

Indiana University
School of Library and Information Science

University of Maryland
College of Information Studies

University of Michigan
The School of Information

University of North Carolina
School of Information and Library Science

The Pennsylvania State University
College of Information Sciences and Technology

University of Pittsburgh
School of Information Sciences

Rutgers, the State University of New Jersey
School of Communication, Information, and Library Studies

Singapore Management University
School of Information Systems

Syracuse University
School of Information Studies

University of Texas, Austin
School of Information

University of Toronto
Faculty of Information

University of Washington
Information School

notably those at Georgia Tech, Carnegie Mellon, and UC Irvine. Of these Georgia Tech and Irvine have joined the iSchool caucus—Carnegie Mellon participates via the School of Information Systems and Management. All three represent movement toward the iSchool vision by computer scientists. In contrast, Syracuse and Pittsburgh have more alignment with information systems, UCLA with education, and Rutgers with communication.

So, from diverse origins, a collection of schools emerged with highly overlapping visions. This convergence suggests an academic movement with considerable traction. Its presence in several high-profile universities suggests that it is lodged under the academic skin. For sure, many top universities, such as Harvard, Stanford, Yale, and Virginia, have nothing in the area, but additional universities were in the Wikipedia iSchool list at the time of this writing, some of which are considering joining the iCaucus.

To anticipate how this might evolve, we can examine parallels. Interdisciplinary fields such as public policy and neuroscience succeeded first at a few pioneering universities, after which other major players created similar programs and eventually formed schools. Cognitive science had a similar multidisciplinary formation in the late 1970s, but growth has been slower, with several departments but no major schools. It is too early to confidently forecast the evolution of the information focus, but with so many schools already in place, it appears to have reached a critical mass.

The iConferences

A sense of common purpose and identity was forged by meetings of iSchool deans that evolved into the iConference series. In 1988 Dean Toni Carbo of Pittsburgh initiated semiannual gatherings with the Syracuse and Drexel deans, soon joined by Rutgers, at which they met privately and with the faculty of the host university to discuss a range of organizational, curricular, and research issues. This practice waned but was resumed by Carbo in 2001 with the inclusion of the University of Michigan, where the transformation of a leading library school had legitimized the effort in many eyes, and the University of Washington. In 2003 the number of participating Schools doubled [6].

Shared interests and common understanding were amplified by movements of faculty that somewhat resemble court marriages in feudal Europe. As noted, Hal Varian left Michigan to

become the dean at Berkeley. In addition John King left UC Irvine to become Atkins's successor as the dean at Michigan, and Mike Eisenberg left Syracuse to become the founding dean of the Information School at the University of Washington. Social and intellectual networks grew dense.

The iCaucus formed, and the iConference series was initiated as part of the now annual gathering of deans. Participation in the iConference program has been restricted to faculty and graduate students of participating iSchools, but attendance is open.

The first iConference, held at Penn State in 2005, engendered a lively discussion of the iSchool vision. The second, at Michigan in 2006, focused more on research. The third, held in early 2008 at UCLA, introduced a broad range of venues: peer-reviewed papers, panels, posters, and roundtables, where everyone sat down and joined in discussing a topic. The next two are scheduled for North Carolina this year and Illinois in 2010. These meetings have attracted some curiosity-driven participation from outside the iSchools. Attendance has been healthy: The two-day UCLA meeting drew more than 100 students and 160 faculty, with nine non-academic participants. Although there were some plenary events, sessions typically had 10 parallel activities, each of which attracted a small interactive group. Many deans and senior faculty attended, but it was a youthful crowd overall, with even gender representation.

Between the first and the third iConference, the iSchools hired many new assistant professors. They came from different home disciplines, but their first job is in information, they strongly identify with it, and they attract good, enthusiastic grad students. The first faculty worked out pidgin languages to speak across disciplinary boundaries; by analogy to linguistic creolization, these younger researchers seem to be creating new complete languages and cultures.

To focus more narrowly, what are the implications for the field of HCI? In a word, enormous. Most iSchools have an HCI component, and in many cases it is the most vibrant HCI activity at their university. There is a natural fit between the core of HCI and the iSchool's charter of considering people, information, and technology in more fruitful ways. To be sure, often HCI also exists organizationally elsewhere in iSchool universities: in computer science, engineering, social or behavioral sciences, business schools, and in programs like communication studies and technical communication. But in many of these schools and departments, HCI is marginalized or a fringe activity, and much HCI education and research may gravitate to iSchools in the future.

Whither iSchools?

Sustainable, or a passing fad? Considering the staggering growth in our ability to inexpensively collect, transmit, transform, visualize, and store information, the study of information is probably in its infancy. It seems to us that this is an appropriate blend of intellectual traditions that fits with what's happening in the broader culture. Most iSchools have a reasonable mix of basic and applied research, occupying Donald Stokes's "Pasteur's Quadrant" [7]. In all academic evolutions, there are legacy organizations and there is some resistance to change, but the gathering momentum and energy in the iSchool movement cannot be denied. Graduates of iSchools are faring well in the job market, landing a variety of kinds of jobs in academics, nonprofits, government, and industry. iSchool faculty are contributing research that is respected in their home disciplines as well as in the information sphere. Our advice is, watch this space!

A Tip of the Hat...

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[6] This history draws on a November 26, 2008 personal communication from John King and on Ron Larsen: "The iSchools." In *The Encyclopedia of Library and Information Science.* Edited by M. Bates, London: Taylor & Francis, in press.

[7] Stokes, D.E, *Pasteur's Quadrant: Basic Science and Technological Innovation.* Washington D.C.: Brookings Institute Press, 1997. Stokes criticizes the traditional linear model of the relationship between basic and applied research, and instead we should conceptualize these as two independent dimensions. To him, Pasteur represents an instance of being high on both the search for fundamental knowledge (basic) and the solving of practical problems (applied). In other words, these two dimensions are not in conflict.

Problems Before Patterns: A Different Look at Christopher Alexander and Pattern Languages

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Interaction and system designers alike gravitate to the idea of pattern languages. The notion of patterns comes from the work of architect Christopher Alexander, who with his associates Sara Ishikawa and Murray Silverstein of the Center for Environmental Structure, published *A Pattern Language* in 1977. The book defines a set of fundamentals for building and planning urban and architectural projects that can be used by non-expert designers. "Each pattern describes a problem which occurs over and over again in our environment," wrote Alexander and his coauthors, "and then describes the core of the solution to that problem, in such a way that you can use this solution a million times over, without ever doing it the same way twice [1]." While the authors addressed architectural and urban problems—in effect, spatial problems—the approach offered (and continues to offer) ready parallels with the design problems faced by all designers.

Alexander has long influenced interaction and software designers. Pattern languages have made numerous appearances in previous issues of *interactions*, explored by Aaron Marcus, Shelley Evenson, Hugh Dubberly, and Rick Robinson, to name a few [2,3]. Alan Cooper's approach to design was strongly inspired by pattern languages. Kent Beck and Ward Cunningham not only cite Alexander's influence on the development of object-oriented programming languages at Xerox PARC in the early 1990s, but also on extreme programming during the later part of the decade [4, 5]. And Erin Malone and Christian Crumlish are currently writing a book about patterns for social software, titled *Designing Social Interfaces: Principles, Patterns, and Practices for Improving the User Experience*.

For designers of many disciplines, pattern languages are attractive because they offer a way to identify the core design problem and because they seek replicable rules and building blocks in their solutions. Alexander and his colleagues even envisioned the kinds of sharing mechanisms central to contemporary pattern libraries. As early as the mid-1960s, they thought that patterns should be shared via an ever-growing, open database of design problems and solutions [6].

While pattern literature often focuses on patterns, there's an even greater focus on the reproducible solution to a design problem. As patterns move to online reference models, they concentrate less on outlining the problem and the context, and more on the object, component, or interface solution. Where this might help someone find a quick reference, it can be done at the detriment of a problem statement that offers expertise and context. John Vlissides, one of the four authors of *Design Patterns: Elements of Reusable Object-Oriented Software*, noted in a 1997 article that one of the primary offerings of patterns as a whole is their usefulness in addressing recurring problems. "In short," he wrote, "patterns are primarily food for the brain, not fodder for a tool [7]." Skimping on defining the problem makes it more difficult to critique, share, or build upon the learnings of the pattern.

The *Pattern Manual* deals with the issue of the design problem. This little-known text by Alexander and his colleagues defined the landscape of the design problem in 1967—a decade earlier than the publi-

[1] Alexander, C., S. Ishikawa, and M. Silverstein. *A Pattern Language: Towns, Buildings, Construction*. New York: Oxford University Press, 1977.

[2] Aaron, M. "Patterns Within Patterns." *interactions* 11, no. 2 (2004): 28-34.

[3] Dubberly, H., S. Evenson, and R. Robinson." The Analysis-Synthesis Bridge Model." *interactions* 15 no. 2 (2008): 57-61.

[4] Beck, K. "Embracing Change with Extreme Programming." *Computer* 32, no. 10 (1999): 70-77.

[5] Beck, Kent. <http://c2.com/ppr/about/author/kent.html>.

[6] Alexander, C., S. Ishikawa, and M. Silverstein. *Pattern Manual*, Berkeley, 1967.

[7] Vlissides, J."Patterns: The Top Ten Misconceptions." *Object Magazine* 7 no.1 (1997): 30-33. <http://www.research.ibm.com/designpatterns/pubs/top10misc.html.> Accessed 24 November 2008

Photograph of Christopher Alexander by Richard Morgenstein

cation of the more familiar *A Pattern Language*. The methodology in the manual specifies a structure for setting up design problems in order to find generalities, particularities, and eventual solutions. The authors considered it a "minimal and natural" format: the what, where, and how of a situation; in other words, the problem, the context, and the resulting pattern [6]. Shifting the focus to the definition of the design problem and not just its resulting pattern helps to ensure the pattern properly addresses the situation, particularly in complex environments.

Alexander long maintained an interest in defining a design methodology in the face of complexity. *Notes on the Synthesis of Form*, originally published in 1964, more than 20 years before *A Pattern Language*, outlines the difficulty of designing for a series of intermeshing, interacting systems, even when the final designed object itself might not look complicated. "In spite of their superficial simplicity," Alexander wrote, "even these problems have a background of needs and activities which is becoming too complex to grasp intuitively;" needs and activities that sit within a growing ecosystem of other pressures, whether social, cultural, or informational [8]. In this setting, Alexander found no place for the secret, intuitive processes traditionally claimed by many designers, ones which did not take the intricacies of their contexts into consideration. Instead, he advocated a logical, objective approach to design, in which form fit context by addressing a set of design requirements. With these requirements, Alexander expanded the architectural notion of program (it specifically means the set of functions fulfilled by a room, space, or building). It is a program, he wrote, "because it provides directions or instructions to the designer [8]." If this sounds like engineering language, it is no surprise. Alexander developed design-requirement data sets in the early 1960s that were complex enough to necessitate an IBM 704 mainframe computer for analysis. With his colleagues at the Center for Environmental Structure, Alexander moved away from such a byzantine analysis of requirements, instead seeking a method for creating straightforward descriptions of the program—that is, the design problem—in the *Pattern Manual*.

The manual defines a grammatical structure that maps to a designer's mental model. A designer follows three steps when developing a pattern, "or, for that matter, [when he] entertains any idea about the physical environment…. He considers a problem, invents a pattern to solve the problem, and makes a mental note of the range of contexts where the pattern will solve the problem [6]." Contexts and problems are paired with each other—wherever a particular context appears, so too does its problem. The context modifies the pattern in the way that an adverb modifies a verb: It says how the pattern works and in which circumstances it is valid. The problem statement provides the reasoning behind the pattern and context. It can be much lengthier, offering an explanation of the situation, a "common-sense description of the problem, as it exists today [6]." The pattern, then, is a set of parts that relate to each other in space. Patterns can address anything from the appropriate layout for a kitchen, to freeway ramps, to designs for users of a certain income or educational level, to furniture design, to structures that hold up houses [6]. Where they can address a huge variety of problems, they themselves seek to be reductive and essential, offering only what is necessary. Where patterns might not provide the only solution to the problem, without it or an equivalent, "the problem will go unsolved [6]."

Although titled the *Pattern Manual*, its heart is the design problem statement—the most important element "from a human standpoint [6]." Problems subsume the considerations that system designers address, called "functional demands… [that] at one time or another [have] been called requirements, needs, performance standards, facts, tendencies, objectives, constraints, activities, technical data, and so forth." Yet the functional demands do not stop with what a system should do: They address a wide variety of issues surrounding the ecology of a system. "They may concern human behavior, economics, the state of technology, the political climate, whatever. No limits can be placed on the kinds of elements necessary to describe a problem properly [6]."

If that sounds vast, it is. Patterns address an astonishingly wide variety of elements that are organized in space in some manner. The *Pattern Manual* offers an expansive list that includes "all kitchens; dormitory

[8] Alexander, C. *Notes on the Synthesis of Form*. Cambridge, MA: Harvard University Press, 1971.

kitchens; efficiency apartment kitchens; …all industrial sites larger than two acres; a 2x4… residential areas with 40 percent of their population under 25 and median incomes between $6,000 and $8,000; garden paths; cobblestone paths; a doorknob; any freeway; freeway exit ramps; bookshelves [6]." Any of these patterns provides a solution to a problem that exists in space, whether the demographics of a neighborhood, the kind of structure required for a house, a transportation issue, or the optimal setup of a dormitory.

As an example, the *Pattern Manual* describes the difficulty of reading house numbers from a moving vehicle. It states the context tersely and specifically: "Freestanding house on a street where cars move at speeds between 5 miles per hour and 30 miles per hour [6]." The problem statement is much longer—in this case, three pages—and sets out the series of issues the pattern will need to address, beginning with: "House numbers are very hard to see from moving cars, especially for the driver. Many signs are parallel to the road (on the house face, or garden gate), so that they can't be seen from up the street [6]." The rest of the problem statement includes facts about house numbers and signage, references to studies on driver vision, and the limits of potential positioning of signs—in essence, the evidence for a case to support the problem. The following pattern, for instance, addresses the house-number problem:

- Two house signs, each at about 45 degrees to the street, facing up and down the street, respectively.
- If the house is one of a regular sequence of houses all using this pattern, then the sign letters are at least 6 inches high.
- If the house is isolated, or is one of a regular sequence of houses not using this pattern, then the sign letters are at least 12 inches high [6].

Consequently, a simple pattern that addresses angle and direction of signage and the size of letters tackles a broader design problem. It notes different use cases—sequences of similar houses versus isolated or nonsequenced houses—and offers different variables for the solutions. While a designer could simply use the pattern, the richness of the framework lies in the overall problem statement and context.

Furthermore, the goal of pattern libraries is not only to offer solutions to design problems, but also to solicit critique and invite improvement. "We want our ideas to improve under public scrutiny," wrote Alexander's team, "and we want our good ideas to be potentially combined with other good ideas [6]." The Center for Environmental Structure first sought to publish its patterns under the rubric of a catalog to which anyone could submit patterns using the format described in this article. An editorial board would select patterns; catalog subscribers would receive the patterns. Alexander and his colleagues thought that by 1970, patterns could be stored in a computer and offered to subscribers—a central feature to contemporary pattern libraries for games, object-oriented programming, or Web design [9].

Through their straightforward approach to describing a complex network of design considerations, Alexander, Ishikawa, and Silverstein all anticipated and inspired contemporary methods for design thinking. By seeking to provide "a natural way of expressing thoughts about the physical environment," the authors offered a vital means to articulate the richness not only of a design solution, but its problem and its context [6]. At the same time, the earlier publication of *Pattern Manual* serves as a reminder for elements of patterns that often receive less focus. At the heart of every pattern is a design problem. When well defined, the design problem represents the designer's collective expertise of issues, information, and problem context, making for better patterns and design solutions. In examining how the pattern language developed, we see how important the latter parts of that sentence were to Alexander and his colleagues—and to the continued evolution of design thinking in general. With straightforward language, the problem and pattern language continue to bring a systematic approach to design to the wider audience who practiced it, improved upon its elements, and continue to develop the concept today.

[9] Alexander, C. *Theory, Organization, Activities.* [Pamphlet], Berkeley, Center for Environmental Structure, 1968.

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Memory Is More Important Than Actuality

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"Your discussion regarding … the fact that memory of an event is more important than the experience made me remember my trip to Thailand a few years ago...

- *I traveled for three weeks and lost 10 pounds because I didn't like any food.*
- *There were insects on steroids everywhere I turned*
- *And the restrooms were no joy...*

However, I had the time of my life and I would go back in a second."

(email from Tammy Guy, Nov. 10, 2008. Reproduced with permission.)

As interaction designers, we strive to eliminate confusion, difficulty, and above all, bad experiences. But you know what? Life is filled with bad experiences. Not only do we survive them, but in our remembrance of events, we also often minimize the bad and amplify the good. Consider this email from Tammy Guy, an audience member who heard me give a talk about the triumph of memory over actuality. Her email included photographs of fried insect treats, a huge spider, and an unseemly looking squat toilet. Would she go back to Thailand? She would. If the total experience were good enough, I'll bet many of you would, too.

What is it about our experiences that lead us to repeat them—and recommend them—despite the bad parts? It turns out there are good psychological reasons. Let me call it "the distancing effect." We remember events differently when we achieve distance from them, whether the distance is time or space. We anticipate and evaluate the future, remember and reflect upon the past. Both are at a distance in time from the event itself. In anticipating events, we review the past in order to make choices for the future. In remembering events, some things fade from the mind faster than others. Details fall away faster than higher-level constructs. Emotions fade faster than cognitions. In psychology these phenomena have been studied under several rubrics, including "temporal construal theory" and "rosy remembrance." There is considerable psychological evidence to support the notion that positive and negative events fade at different rates from memory, and that affective elements fade differently than cognitive ones (or in my terminology, reflective memories fade most slowly) [1].

The aforementioned email is but one example of many. The implication for design is clear. We should not be devoting all of our time to providing a perfect experience. Why not? Well, perfection is seldom possible. More important, perfection is seldom worth the effort. So what if people have some problems with an application, a website, a product, or a service? What matters is the total experience. Furthermore, the actual experience is not as important as the way in which it is remembered.

The argument starts with a simple thought experiment. Suppose in some task, using a product or getting a service from a company, you had some perfectly horrid experience along with some positive ones. Now, just suppose you had no memory of the horrid experience. Would you go back and repeat the experience? Most people would repeat something they remembered as enjoyable. Of course, the premise is suspicious: If the experience were truly that horrible, I would maintain a memory of the negative parts. Yes, but memories for bad experiences dissipate differently than those for good ones. The negative emotions associated with the bad parts fade away more quickly than the cognitive evaluation does. So although I

[1] Trope, Y. and N. Liberman. "Temporal Construal." *Psychological Review* 110, no. 3 (2003): 403–421.

remember the events, the emotions have dissipated. Notice the delight with which the writer of the email shared her story of the negative experience with me. Yes, the bad things were horrible. But yes, she would go back.

The problems and frustrations of life do not matter nearly as much as you think. What matters is the memory of the events. With positive memories, people go back to a website, store, or amusement park, return to Thailand, and recommend products to their friends.

Consider some simple case studies. I asked people to tell me what they hate most about a wide variety of things. I asked about Apple's operating system, iPod, iTouch, and iPhone. I asked for the biggest downsides of a Disney theme-park visit or a cruise-ship voyage. I asked about automobiles such as the VW Beetle or the Mini Cooper. In all cases, I had a litany of horror stories. "I hate the lines," they say about Disney theme parks. "I hate the way Ikea forces me to go through the entire store." When prompted, people are pretty good at generating a list of dislikes, even hates.

But then I asked if they would go back, or purchase the item again, or repeat the experience. Would they recommend it to their friends? The answer was a resounding "yes!" Not universally, I hasten to add, but way up there in terms of percentages. High-enough percentages to make executives at these companies smile and nod their heads with satisfaction.

Terence Mitchell and Leigh Thompson identify three different aspects of an experience: "rosy projection," "dampening," and "rosy retrospection." [2, 3]

► A snack of fried insects, an unseemly squat toilet, and a monster spider—all regularly encountered in Thailand—represent the triumph of memory over actuality.

Rosy projection: "the tendency for people to anticipate events as more favorable and positive than they describe the experience at the time of its occurrence";

Dampening: "the tendency for people to minimize the favorability or pleasure of events they are currently experiencing";

Rosy retrospection: "the tendency for people to remember and recollect events they experience more fondly and positively than they evaluated them to be at the time of their occurrence."

There is considerable experimental evidence to favor the concept of these three aspects. Note that we are speaking of events that would normally be seen as positive. For example, Mitchell, Thompson et al., studied a 12-day tour of Europe, students going home for Thanksgiving vacation, and a three-week bicycle tour across California. The results were all similar. Before an event, people look forward with positive anticipation. Afterward, they tend to remember the event fondly. During? Well, reality seldom lives up to expectations, so lots of things go wrong, sometimes

[2] Mitchell, T. and L. Thompson. "A Theory of Temporal Adjustments of the Evaluation of Events: Rosy Prospection & Rosy Retrospection." In *Advances in Managerial Cognition and Organizational Information-processing*, Vol. 5, edited by C. Stubbart, J. Porac, and J. Meindl, 85-114. Greenwich, CT: JAI Press, 1994.

[3] Mitchell, T. R., L. Thompson, E. Peterson, and R. Cronk. "Temporal Adjustments in the Evaluation of Events: The 'Rosy View.'" *Journal of Experimental Social Psychology* 33, no.4 (1997): 421-448.

Thailand photographs by Tammy Guy

pretty horribly wrong. But afterward? The unpleasantness fades and the fond memories remain, perhaps to intensify, and even get amplified beyond reality.

Psychologists who study natural memories are quite familiar with these results. People sometimes fondly remember events that never happened (and strenuously insist that they did happen, despite the evidence). In one experiment people recalled seeing Bugs Bunny at Disney World despite the fact that he is not a Disney character and could not be seen there. As the authors of this study said, "To know that a memory is reconstructed and not necessarily a veridical representation does not make it any less meaningful or enjoyable at the time the person is remembering the event [4]."

Although the studies have primarily looked at events that are anticipated as being positive, I presume similar psychological mechanisms would apply to negative events, such as dental surgery, a colonoscopy, or other unpleasant experiences.

Those of us in the design profession can learn a lot from these observations. Do people hate the lines at a Disney theme park? Absolutely. Would they go back? Most people would. Disney does its best to provide delightful, memorable experiences, the key words being "memorable" and "delightful." Do we really get frustrated when our iPhone or iPod crashes, when we can't remember how to turn off the iPod, when we discover we can't change the battery, when the case scratches? People brag to me about how easy these devices are to use, but when I ask them to demonstrate various features they stumble, flail away for a while, apologize, and give up. So what? These are all minor inconveniences in a delightful experience. People love these products. They would buy them again, recommend them to their friends, eagerly purchase the next versions? Some people even save the boxes their devices came in, tell stories about their love for them, and take great pride in ownership.

In my own life I have experienced this phenomenon. I remember a vacation when my wife and I drove from central Spain to France. Along the way we stopped at a lovely store and purchased a picnic lunch, but after driving into the countryside, climbing up a hill, and setting up on the grass with a wonderful view, we had a nasty surprise: On opening the package of food, we discovered garbage and scraps instead of the wonderful sausage and cheese we thought we had bought. A horrid experience that is, for me at least, now one of the highlights of the trip. Rosy remembrance indeed.

As is true with all psychological generalizations, people vary. There is solid experimental evidence to defend the general proposition that the positive outweighs the negative, but not always. In the case of the drive through Spain, my wife vehemently objected to my rosy remembrance. "I totally disagree with you," she wrote in the margins of the manuscript. "You need to explain how a normal person could have a fond feeling for such a negative memory. I would never wish to repeat that experience!" True, my fond memory is of the total experience, which includes the negative event. And of course my fondness may reflect the fact that I am an observer and storyteller, so every experience, whether positive or negative, adds to my collection, often useful at unknown times in the future (for example, suddenly recalling it while writing this article). Would I want to go back to Spain? Yes. Would I want that exact sequence of events to be repeated? Of course not. But the disagreement between the two of us reflects real disagreements among people. Generalizations about human behavior should always be viewed with caution.

So what does this mean to the designer? Design for memory. Exploit it. What is the most important part of an experience? Psychologists emphasize what they call the primacy and recency effects, with recency being the most important. In other words, what is most important? The ending. What is most important after that? The start. So make sure the beginning and the end are wonderful. Make sure there are reminders of the good parts of the experience: Photographs, mementos, trinkets. Make sure the experience delights, whether it be the simple unfolding of a car's cup holder or the band serenading departing cruise-ship customers. Accentuate the positive and it will overwhelm the negative.

[4] Braun-LaTour, K. A., M. S. LaTour, J. E. Pickrell, and E. F. Loftus,. "How and When Advertising Can Influence Memory for Consumer Experience." *Journal of Advertising* 33, no. 4 (2004): 7-25. <https://webfiles.uci.edu/eloftus/BraunLaTourPickLoftusJofAd04.pdf>

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Embodied Child Computer Interaction: Why Embodiment Matters

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When I first read Paul Dourish, I was intrigued and compelled to learn more about the nature of embodied cognition. I was also interested in finding ways to apply embodied cognition to my research in child-computer interaction—where goals often involve the facilitation of engaged and playful learning rather than supporting adult work practices. After reading several more books, numerous articles, and having many conversations with colleagues, I came to that familiar place in human computer interaction research where I asked, but how do I apply these ideas? I was reminded of a paper on physical affordances entitled, "But How, Donald, Tell Us How?" [1]. Only this time, it was "But how, Paul, tell us how to use ideas about embodiment in interaction design for children?"

The first answer to this question came up in cases in which embodied cognition was used as an analytic lens to view users' interactions with existing products and systems. Consideration was given to a larger unit of analysis than a single mind; the social and physical environment, both computational and noncomputational, were scrutinized. However, I was not satisfied. I wanted to understand what embodied cognition meant for me as a designer and a design researcher. What were the consequences for design? This article presents some of my ideas on how embodiment matters to those who design children's interactive technologies.

Embodied Cognition and Children

There has been a rethinking of the nature of cognition for more than 50 years in philosophy and about 15 in human computer interaction research. Embodiment means how the nature of a living entity's cognition is shaped by the form of its physical manifestation in the world. An embodied perspective on human cognition foregrounds the role of the body, physical activity, and lived experience in cognition. Put simply, embodied cognition emphasizes how the particulars of human bodies acting in complex physical, social, and cultural environments determine perceptual and cognitive structures, processes, and operations. In contrast to traditional views of cognition, an embodied approach suggests that humans should be considered first and foremost as active agents rather than as disembodied symbol processors.

This shift is an extremely important development, one that has been underappreciated in human computer interaction research in general and in child-computer interaction research in particular. Yet a wealth of developmental psychology and media-studies literature provides evidence for the importance of understanding the role of action and the environment in the development of children's thinking skills. Jean Piaget began a long tradition when he suggested that cognitive structuring through schemata accommodation and assimilation requires both physical and mental actions [2]. More recently, social scientist Jane Healy argues for the importance of physicality in childhood. She suggests that children's increased access to TV and video games reduces the amount of time they spend in physical, sensorial, and perceptual activities that foster awareness of relationships in the world, awareness that is crucial to their cognitive development [3]. Designers of digital media for children can benefit from understanding and supporting the ways in which physicality influences cognitive development. Whether interacting with computation through a mouse and keyboard, a tangible user interface, or a handheld device, an embodied perspective on cognition both broadens and changes the focus

[1] Djajadiningrat, T., K. Overbeeke, and S. Wensveen. "But how, Donald, tell us how? On the creation of meaning in interaction design through feedforward and inherent feedback." *Proceedings of DIS '02*, 285-291. New York: ACM Press, 2002.

[2] Piaget, J. *The Origins of Intelligence in Children.* New York: University Press, 1952.

[3] Healy, J.M. *Failure to Connect: How Computers Affect Our Children's Minds.* New York: Simon & Schuster, 1998.

▸ Exploring the puzzle space: manipulating pieces offloads part of mental visualization to physical action.

of design of children's technologies. Conversely, a lack of understanding of the importance of embodiment can lead only to an impoverished view since it ignores the way children (and all humans) create meaning through action.

Foundations: Embodied Cognition

A number of books have appeared that detail this shift in thinking about cognition. Three in particular are highly relevant for the HCI and design communities: *Where the Action Is*, by Paul Dourish [4], *Being There*, by Andy Clark [5], and *Metaphors We Live By*, by George Lakoff and Mark Johnson [6]. Taken together, these works present some important concepts that are particularly relevant for designers of children's interactive technologies.

In general, the embodied cognitive processes of children mirror those of adults. However, the development of such processes depends on children's specific and age-related physical characteristics, their inherited abilities, and their practical activities played out in a physical and social environment. The following ideas from embodied cognition are important in understanding how cognitive development in children depends on their interactions with the world.

Exploiting external scaffolding: restructuring the spatial environment. The first idea of importance relates to how children develop knowledge by exploiting external scaffolding or spatial properties of the environment. Meaning is created through restructuring the spatial configuration of elements in the environment. A highly structured environment does not provide opportunities for restructuring and thus limits knowledge construction. What is required is an environment, either computational or otherwise, that supports multiple spatial configurations. For example, a child may have a nascent understanding of division. When asked to share a bag of candy, the child may restructure their environment by organizing piles of candies into various groups until a satisfactory solution is reached. Through restructuring the spatial configurations of objects, her mind, action, and the environment work in tandem. She not only solves the problem at hand but also better understands the concept of division. Her experiences with spatial structure later give meaning to the symbolic representations used in arithmetic. Children develop new understandings of many phenomena in this way. In doing so, they can test hypotheses, generate new states of information, and actively construct new knowledge in the world by manipulating its spatial properties.

Exploiting physical activity: cognition and action working together. The second idea of importance

[4] Dourish, P. *Where the Action Is: The Foundations of Embodied Interaction.* Cambridge: MIT Press, 2001.

[5] Clark, A. *Being There: Putting Brain, Body, and World Together Again.* Cambridge: MIT Press, 1997.

[6] Lakoff, G., and M. Johnson. *Metaphors We Live By.* Chicago: Chicago Press, 1980.

relates to how children exploit physical action to dynamically offload parts of mental operations to physical action in the environment. Cognitive performance is enhanced through physical strategies that simplify the cognitive aspects of task. For example, in solving a jigsaw puzzle, a child will typically offload some of the difficult task of visualizing puzzle pieces by rotating the pieces with her hands and making spatial comparisons. Children solve many types of problems through this type of tight coupling of mental operations with physical actions in the environment. As they physically manipulate objects, they also learn to manipulate mental models of the world. In doing so, they can successfully tackle problems that require mental abilities they are still developing and concurrently develop the requisite skills.

Exploiting embodied knowledge: building abstract knowledge through metaphor. The third important idea relates to the role that embodied (image) schemata play in the development of children's conceptual thinking. The meaning of many abstract concepts can be traced back to bodily origins. Experiences of repeated linking of bodily experiences with more abstract concepts leads children to implicit understanding of these concepts in bodily terms. For example, a young child may repeatedly experience movement toward a desired object (mother, bottle, toy). Her early physical experiences of reaching goals through movement provide the foundation for her later understanding of how more abstract goals are reached. She comes to understand that goals are destinations that may be achieved through metaphorical movement along a linear path. When she graduates from high school, she may think, look how far I've come. Children come to understand more abstract ideas through implicit, metaphorical elaboration of their physical experiences. In doing so, they build up a system of understanding grounded in physical experiences and extended through metaphor to give meaning to abstract concepts.

Why Embodiment Matters

In general, interaction designers and researchers must think about new ways in which children can interact with computers—ways that are better tuned to children's developing abilities and how they construct meaning through action. The following examples demonstrate how ideas from embodied cognition may affect what is considered in the design of children's interactive technologies.

Interface design. Understanding how restructuring the environment, either digitally or physically, supports the construction of meaning has impli-

cations for how interfaces are designed. For example, in Ferneaus and Tholander's study of tangible support for physical programming, they observed the importance of providing configurable offline space embedded within the computational environment [7]. Children solved programming problems by manipulating the spatial configuration of tangible programming objects offline. Once a potential solution was reached, children changed the status of objects so they were active in the computational program and how they are displayed on the screen In this way, spatially configurable objects served the dual purposes of resources for action and representations.

Design principle: Exploiting external scaffolding in interface design requires the design of computational objects, which offer affordances for action and represent information in their resulting spatial configurations.

Input design. Understanding how offloading cognition to physical action can support developing cognitive abilities has implications for how we choose input methods and design control functions. Tying the hands to a mouse and keyboard may limit children's cognitive performance and inhibit developing mental skills. While many children's designers are constrained to Internet or desktop applications, new gaming platforms like the Nintendo Wii video console and the Nintendo DS handheld gaming platform offer opportunities to support the tight coupling of physical action with mental operations required for learning. In my research comparing tangible and graphical user interfaces for jigsaw puzzles, I investigated the kinds of physical-mental strategies used by children who physically manipulated actual puzzle pieces versus those who digitally manipulated pieces using a mouse [8]. The study provided evidence that children using tangibles more frequently used actions on pieces to offload mental visualization tasks and formed internal representational structures that improved mental performance as the activity proceeded.

Design principle: Exploiting physical activity in input design requires consideration of how mental operations may be simplified through physical actions that control computational objects.

Interaction design. Understanding how abstract concepts are built on bodily schema through metaphor has implications for the design of the interaction model or layer that maps input actions to output responses. It is possible to trace the meaning of abstract concepts represented in a system back to physical actions, and then incorporate those physical actions as input. This approach may better support children in their development of conceptual understandings than relying on abstract representations alone to communicate meaning. Leveraging this kind of embodied knowledge may provide both usability and learning advantages in systems that represent abstract concepts. In my study of a full-body interface to a sound-making application, I found evidence that the strategy of tracing higher-order cognition back to its bodily basis and including this relationship in the interaction model had both performance and experiential benefits for children learning about concepts related to musical sounds [9].

Design principle: Exploiting embodied knowledge in interaction design requires leveraging familiar embodied schema in the mapping layer between input actions and the display of metaphorically related abstract concepts.

Rethinking Cognition

Giving consideration to underlying mechanisms that support the interplay of action, cognition, and the environment will enforce a commitment to embodiment in children's interaction design. Unlike virtual reality, which aims to bring the user into the world of the computer, designers of interactive technologies for children may find success bringing computation into children's worlds. As new applications and forms of interactive technologies emerge, designers who give consideration to the ways in which cognition is rooted in embodied action will contribute to children's successful development into active, thinking adults.

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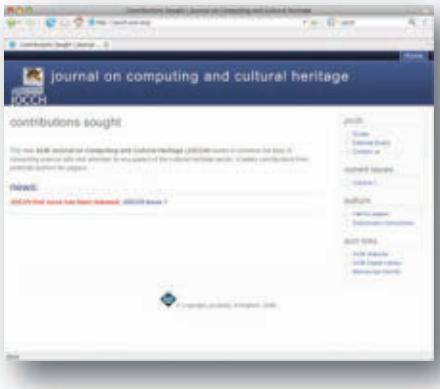

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On Trusting Your Socks to Find Each Other

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I was recently told that we are moving toward a world of "the Internet of Things." I affectionately call this "the arrival of the IoTs" (pronounced "eeyuts"). It seems this revolution will be most helpful specifically in the creation of the "aware home."

For example, if I am traveling, I can still vigilantly watch what is going on in my abode. I can control ventilation and heating. My front door will open for approved visitors even when I am not there. And hopefully it won't be long before all my misplaced possessions start messaging me about their whereabouts. Going further, we all know that ordering food over the Internet has become commonplace. However, imagine if my fridge decides I don't have enough food and sends me a message to ask if it should place a delivery food order. It could even place the order without consulting me, with delivery set for my usual arrival. Maybe my laundry basket will start crowing for attention because it is too full. Currently, these systems work separately, but we are fast approaching a world in which the systems will speak to one another. Goodness knows what will happen when they all start talking to each other. Am I going to be embarrassed when my fridge and laundry basket confer and decide I fit the programmed-for persona of a slob and therefore require an upgrade of commodity decision-making on my behalf? This is a whole different kind of commodity product agency.

Before I continue elaborating scenarios for this emerging IoTs world, it is worth saying a little more about what is meant by the "Internet of Things." A somewhat rough Wikipedia entry states the following:

"In computing, the Internet of Things refers to a, usually wireless and self-configuring, wireless network between objects, such as household appliances."

It goes on to speculate that such connected objects would be things like "cans, books, shoes or parts of cars," all of which would be "equipped with minuscule identifying devices."

How is this going to be possible? A proposed change is the move from IPv4 (Internet Protocol Version 4), the infrastructure of our current Internet world, to IPv6 (Internet Protocol Version 6). IPv4 was completed in the 1970s, and many networking experts believe we are almost out of the four billion addresses that are available in IPv4. IPv6 offers expanded addressing, moving from a 32-bit address to a 128-bit addressing method, so we can identify many more objects. Although the driving scenario for the enthusiastic Wikipedian authors is the reduction of stock shortages and wasted products, the dream has more layers.

The weak IoTs hypothesis (version lite) is that most objects will be addressable so devices can be "pinged" to see where they are and what they are up to. In the version-lite world, this is likely to be a network of dumb things that can be pinged and located; these locatable objects can't, except in the most minimal ways, answer back. Furthermore, aside from the most rudimentary data exchange, there will be little connection between the objects in the network. These objects will not be able to make decisions for themselves or chatter amongst themselves.

The strong IoTs hypothesis (the "full fat" version) includes the world of "spime"—a concept invoked first by science fiction writer Bruce Sterling. In 2004 Sterling painted an image of an interactive device that is enhanced with RFID and GPS tracking and can thus track its history of use. As more objects become addressable and develop more intelligence and agency, we will have a world of autonomous, sort-of sentient devices that commu-

Nosey people still exist, but these days their options for snooping surreptitiously are so much greater. Curtain flickers not need even approach the window, so there are few cues as to who is monitoring your actions.

nicate amongst themselves and will be able to auto-organize depending on the context. Some pundits of what has been called "ambient intelligence" are very excited about this version of the IoT world.

I am largely in agreement; this all sounds really exciting. My favorite, desired scenario for all this auto-organization calls for the development of sentient socks that can find each other. Yes indeed, I want a sock drawer that resembles Noah's ark, with neatly assembled socks stacked two by two. Right now what I have is a lot of singletons wondering where their other half went.

I have been spinning this kind of simple, everyday fantasy for a while. Years ago, Les Nelson, Tomas Sokoler, and I designed a suite of objects called "Tools That Tell Tales." One such tale-telling tool would be the loaned wheely bag that reports back to you to say it is having a nice time on vacation with your friend. Perhaps that wheely bag is a spime—but when we elaborated this design space of chattering tools, the term had not yet been coined.

One thing to note in our scenario, however, was that the tools told you their tales only when you asked for them. We never tackled how on earth they would know when and whether or not to share their experiences spontaneously with us humans or with each other, should the situation so demand.

I realize there are fundamental concerns about the autonomy, politeness, and social decision-making of these semi-sentient, communicating things. I am not really sure I trust my socks to self-organize without disrupting the other inhabitants of the clothing drawer. And what if my confused and lonely socks get so distraught in their unsatisfactory search that they get into a fight with each other and with my other objects and they collectively crash the operating system? As I think about whether I would or would not trust my semi-sentient socks, I realize that, for me, the cloud on the horizon of this dream world of sentient (or at least semi-sentient) objects is trust in all its forms.

Trust is a slippery concept. Judd Antin of the iSchool at UC Berkeley and I checked out the stats: The word has appeared in the titles of papers indexed by the ACM Digital Library more times between 2005 and 2007 (149 times) than in the previous seven years combined (1998–2006, 131 times). Research into trust is all about uncertainty and risk. Most of the reported research addresses trust in enterprises, especially in the context of e-commerce, trust as developed in mediated human-human communication contexts, or systems perspectives on trusted/untrusted networks and network security. In interface and interaction design, trust unpacks to the familiar concepts of reliability, predictability, credibility, and visibility/transparency.

I see at least three dimensions of uncertainty and risk for IoTs to address if they are to be deemed trustworthy by experiencers (these are not necessarily users, after all; we may just be experiencing these IoTs unknowingly—the word "use" implies awareness).

First there's system reliability, consistency, credibility, and transparency. As system designers, we know that people will not continue to use technologies that they cannot trust to do the job they are supposed to do on a regular and predictable basis. The problem is, once there has been a breach we could not have foreseen, distrust sets in. And distrust is much harder than trust to navigate. Distrust is about fear and self-protection; it is about not believing in the product, the tool. Once someone distrusts a system, it is very difficult to regain their confidence. Lack of reliability and consistency are

deal breakers for most people.

Let's think about some design challenges that must be addressed to ensure continuing user trust in the home IoTs system: exception handlers for sock drawers; incompatible sock releases; house virus updates; and operating system conflicts for merging households. And then there are the open design questions: How are you going to debug the house if it decides to lock the bathroom door with Auntie Elsie inside? How do you negotiate with your household IT administrator if she is 13 years old and angry at you for grounding her? And how do these systems inter-operate: What is in an effective decision-making hierarchy? Who gets to have the last say? Think of the power struggle if my applications are in conflict—my jeans in conflict with my T-shirts about which require my attention first. Anyone who has been around children who are arguing can understand the power struggles that come about between somewhat independent, sentient, and opinionated agents. And the question of all questions: how many buttons are there on an IoTs household remote control?

Second, there is a stickier problem—the reliability, consistency, credibility, and transparency of the network information transport; that is, the possibility for data/information leakage. Internet connections are often insecure, spewing data out and allowing others to see our activities, intentionally or by accident. The boundaries between walls are permeable. What if my sock resolutely, but incorrectly, pairs with a sock next door? And what if my fridge starts putting my favorite foodstuffs on my neighbor's shopping list? Do I really want them to know that my sophisticated palate requires at least two jars of peanut butter a week? The question is: Are my sentient objects going to know whom to share content with and whom not to?

There may not be a malevolent entity using these data or snarfing your bandwidth, but even opportunistic information observers may enjoy this. When I was growing up in the U.K., there was a term for nosey neighbors whose personal joy is to research other people's personal lives: these curious individuals are called "curtain flickers", known as such because most of their observations took place by peering out of their windows. One of the advantages of curtain flicking for the observed is that you can see the movement of the fabric indicating that you are being watched. Nosey people still exist, but these days their options for snooping surreptitiously are so much greater. Curtain flickers not need even approach the window, so there are few cues as to who is monitoring your actions.

Third, there is the thornier problem of malicious attack through deliberate and intentional hacks. The boundary of bricks and mortar is easy to see; unseen entryways are more difficult. Marketers of household cleaning products have for years been warning us of unseen dangers like germs and small creatures that can enter our home; the germs of tomorrow in the IoTs world are going to be those in service of humans with malicious intent. Frankly, once you get malicious or self-interested humans in the loop, all is likely to go to hell. It is worse than the days of yore, when shills and confidence tricksters used classic motivators—ego, greed, avarice, lust, in fact, all seven deadly sins—to trap us into giving away information that in other circumstances we would not share. Worse than these kinds of social cons are unseen attackers who steal personal information like bank account details and social security numbers, without ever interacting directly with us. In these cases we may not know for some time about a breach.

The second and third aspects of trust here revolve around the permeable boundaries that the Internet creates, and in the home setting, that means a whole new angle to perimeter security. The perimeters of the home have shifted, requiring new forms of vigilance. Of course, this crossing has been happening for some time with TV shows downloaded to TiVos and so on, but with newly developing aggregated services for living environments, more people are crossing the residential gateway. These Internet-enabled agents who are hackable and live in an integrated world of data flows—where my sensitive information resides—make me feel vulnerable.

If you think I am being overly conservative, picture this. It's a chilly evening, and as you head to bed and snuggle down, you feel safe in the knowledge that the next morning will bring a nice strong cup of cof-

fee to break the day. But, in a hilariously titled online June 2008 entry, "All Your Coffee Are Belong To Us," Slashdot posted the following: "Craig Wright discovered that the Jura F90 Coffee maker, with its honest-to-God Jura Internet Connection Kit, can be taken over by a remote attacker, who can cause the coffee to be weaker or stronger; change the amount of water per cup; or cause the machine to require service. Best yet, the software allows a remote attacker to gain access to the Windows XP system it is running on at the level of the user. An Internet-enabled, remote-controlled coffee machine and XP backdoor—what more could a hacker ask for?"

Whether this coffee pot hack actually ended up causing people problems or not, I don't know; I could not find any follow-up stories. But the unwitting Internet-enabled home device as a Trojan horse is surely something we can all imagine. One response to this is that we need to educate users—or better still, let's just insist that users "be more careful." Not going to happen. It is a strange thing that although we see the Internet as a risky place, we do not take steps to protect ourselves. Study after study shows that people do not secure their wireless home networks. And you only need to spend 20 minutes on social networking sites to find out way too much about a person—information that could help you breach the confidentiality of their personal data. Finding out a whole heap of stuff about a person is really easy with just a little technical expertise; most famously, Sarah Palin, the running mate of defeated John McCain in the 2008 election had her email hacked—her password and security questions were easily guessed from information available on the Internet.

Trust is fostered through reliability, predictability, transparency, assurance, and insurance—and it is a moving target in the design of all evolving complex systems. Perhaps nowhere more so than in the upcoming IoTs world. This IoTs world is going to involve a lot more emotional engagement with data devices. We will be increasingly intimate with our semi-sentient devices; we will weave them into our lives and entrust information to them—probably more than we entrust our data to social networking sites, which we expect to safeguard our precious data. And we are more likely to feel emotionally distraught and betrayed when we discover breaches. The affective bonds that we develop with these interactive things will likely mean that models of vigilance, which assume dispassionate security practices and emotionally uninvolved risk assessments, will be even more challenged. These models get stymied by trusted "friends" with access to our information. Conversely, these models do not account for the betrayal we feel when our interactive helpers allow themselves to be hacked. We can of course treat our things like children, expecting their boundary setting capabilities to be at about the level of a 5 year old. But that does not seem like the right model.

In any case, I suspect that continuous negotiation with the IoTs and with the network providers who control them is going to make me tense or tired or both. All this makes me want to jump headlong into a research agenda centered on infrastructure policy and on network security, and to actively promote a view of the IoTs world in terms of socio-technical, emotional networks of trust, reliability, and confidentiality. Not simply a world of consumer devices, simple and innocent nodes in the networks within and between which digital information flows. Right now, when thinking about the strong IoTs hypothesis at least, I am inclined to agree with J.K. Rowling's character Arthur Weasley in *Harry Potter and the Chamber of Secrets* when he said, "Never trust anything that can think for itself if you can't see where it keeps its brain."

On a positive note, there are new employment opportunities here: interior home integrators, managed home Internet services, remote Internet locksmiths, thing-programming specialists, and thing therapists specializing in human and device family and couples counseling.

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The Counterfeit You

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Imagine that some stranger in a shady corner of the Web comes across your name and a few details of your life and puts together an online presence uncomfortably reminiscent of you. Hard to know what to think at first. It could be anything from coincidence to a con or something else altogether. But this feels more ominous than the theft of a credit card number. We can cancel the plastic, but we can't cancel our identities. I was involved in such a case recently, and while I cannot discuss the specifics, it introduced me to ideas involving the broader significance of online identity, which is perhaps not discussed widely enough in our professional community.

Your identity consists not of the impersonal strings of numbers assigned to your name by business and government, but of the combination of attributes that fundamentally make you, you. It is a kind of quicksilver that can be hard to grasp but ultimately is crucial to how you relate to others and how they relate to you. It is the sum of our personal histories, personalities, relationships, beliefs, biology, the patterns of our lives and activities, our habits, and more. It is our interface to the world and the internal code that drives us.

Both actively and passively, we create an ever more detailed digital self-portrait. We may be the original content providers, but we are unable to know what material will be viewed and how it will be used now and in the future. From blogging to swiping a card at the supermarket, the behavioral patterns of our daily lives are captured in data streams; they create new representations of ourselves. The resulting depictions are dependent on how the data is crunched by algorithms and also by the various kinds of people who interact with it. Sure, that sounds a little abstract and distant. It's difficult to imagine anyone doing anything problematic with your stuff. But that's part of the problem; it can be entirely and reasonably unimaginable. Until it isn't. Our personal identities may be appropriated for simple, direct theft or for more elaborate and nuanced forms of "social engineering" misdeeds such as pretexing. While the idea of using someone else's name or information for all kinds of underhanded purposes is certainly as old as human society, the impostors have powerful and rapidly evolving new sets of tools.

For many of us, our online presence is becoming an important part of our external identities and has a growing sway over our professional and personal lives. Digital media can capture and present sides and angles of ourselves that we may not have known were there. Our virtual presence can have lasting influences on real-life interactions. Facebook, MySpace, Twitter, LinkedIn, and Match.com, not to mention the Google search results of our names, can sometimes make up the sole representation of our identities to someone interested in learning about us. We are numerical strings, user names, and template profiles. Accurate or not, such data can be someone's primary means of forming an impression of who we are. We are entering into a kind of open source experiment in identity. Who knows how much the things we choose to present about ourselves online may influence our self-perception. Do we start to believe our own hype? There may be identity feedback dynamics that we have yet to recognize and understand.

It would be hard for many of us to conceive not having the search results at our disposal. The results provide us with instant résumés and context about others. In the past, if we really wanted to learn about someone, we had to rely on talking to people. Now we can get insights and information about others almost instantly without the input of anyone else. For a Web 2.0 spin on Descartes, consider that "SEO *ergo sum*" may be more appropriate these days than *Cogito ergo sum*. The catch is that much of this process is mediated by algorithms rather than people. This means that a system that can often be a powerful proxy of our identities can also be easily manipulated. We can SEO (search engine optimization) ourselves, but the question is, what do we stand for? What are our true

keywords? Some businesses work hard to improve their meta-identities, but in the great leveling ground of the Web, individuals may sooner or later want to consider these issues for themselves. In a media-saturated culture, it seems like the word "brand" is far more fitting than "identity." This is true for celebrities, but in a world of Web-enabled micro-celebrity, will brand attributes become a greater concern than character traits for some people?

Perhaps one analogy to help in thinking about our online identities is open source software development. It has unlocked floodgates of creative participation and, for the most part, brings out the best in people. However, there are also a few bad actors who will do a malicious hack of a program for pure sport. Put another way, imagine your online presence as a wiki entry—the "Wiki You." Perhaps you are the main author, but the content is malleable and only partially controllable. The content of a wiki entry is subject to the vicissitudes of inaccuracies, inconsistencies, agendas, and sometimes zealous partiality or malice.

If safeguarding our strings of numerical identifiers is important, what is the value of managing our online identities—the information, stories, and images that portray us, on the Web? Just as computing power has enabled a massive trade in our numeric identifiers, so will evolving technology make possible the traffic in more personal forms of information, the uses of which we cannot yet fully imagine. The idea of trying to manage a swirling cloud of digital data seems impossible. Perhaps it is. But that does not mean there's no chance to put some stakes in the ground for ourselves and others.

People in the user experience field, in one way or another, have been in the thick of it. They have helped create the entrances into the online arena for people who would not have otherwise ventured there. This has enabled them to project themselves on a stage with the capacity for a massive audience. Working in front of a computer can feel like such a personal and intimate experience that it is difficult to remember it is more like a great stage with crowds milling in and out of the auditorium. Like an actor on a stage who can barely see the spectators, our glowing screens show us a limited view of our audience. Some of our viewers are visible and some are not, many invited but many others not. User experience professionals have empowered people to step onto a vast stage and tell their story, both factual and otherwise, to the world. The audience often has to decipher fact, fiction, or some combination of the two. As we help them ascend the stage, what role can, or should, we play in this unfolding drama—set designer, stagehand, fellow actor, audience member, all of the above?

There is a new opportunity to think about what identity means to ourselves and everyone else. Perhaps a first step is increasing our understanding of the meaning, value, and potential vulnerabilities of our cyber-identities. It is, after all, a hard-won and unique collection of information, experience, and perspective. The life you have lived shaped this collected knowledge and set it apart from any other—the happy and painful moments, the things you have learned, the mistakes you have made and the victories. Like so many things in life, we pay attention to things of value only after they are threatened. It is only after a more direct encounter with online identity infiltration, fortunately with a successful resolution, that I see this issue in a new light.

Lost in the Crowd: The Commodification of Our Identities

Finally, after a long time in the waiting room, a nurse calls your name. As you walk over to her, you notice another person also approaching. Both announce yourselves to the nurse by the same name. The quizzical look on the nurse's face soon turns to irritation as you and your counterfeit debate who should get the exam. While that scenario may seem fanciful, in fact there are instances of people who are taking on stolen identities to get medical treatments covered by the legitimate person's health care plan. This situation points to one consequence of commodifying our identities. If the fraudster were dealing with a longtime family doctor, it would be unimaginable to assume a false identity to get medical treatment. However, in a less personalized environment, in which the physician has never before and will likely not see you again, ID theft is all too plausible. In the midst of depersonalizing health care and other services, we are becoming more like numbers and less like individuals. People may be hard to manage; numbers are all too easy to rig.

While the discussion of identity theft is often framed in the

▸ Hunter Whitney

Rough Definitions from the Rogue's Gallery of False Identities

Identity Theft: Stealing someone else's personal information or impersonating them for purposes ranging from financial theft to obtaining services to concealment of other criminal activities.

Social Engineering: Using various forms of deception and psychological manipulation to acquire confidential information and/or gain unauthorized access to data or systems or to get unwitting sources to perform or assist in illicit activities.

Pretexting: A type of social engineering in which a perpetrator creates a scenario, frequently using a false identity, to extract information or for other illegal activities.

Spoofing: Impersonating a person or organization in a faked email, IP address or other communication source for fraudulent purposes.

More resources:

Prevent Identity Theft in Your Business and also *Identity Fraud Investigations* both by Judith Collins, Ph.D., adjunct associate professor, School of Criminal Justice, Michigan State University (both published by John Wiley & Sons, Inc.)

The Truth About Identity Theft by Jim Stickley (published by FT Press)

Stealing Your Life The Ultimate Identity Theft Prevention Plan by Frank W. Abagnale (published by Broaway Books)

Schneier On Security by Bruce Schneier (published by Wiley Publishing)

Googling Security by Greg Conti (published by Addison-Wesley)

Websites:

http://www.idtheftcenter.org
http://www.idtheft.gov
http://www.ic3.gov/default.aspx
http://www.ftc.gov/bcp/edu/microsites/idtheft

context of privacy, paradoxically, privacy may also be part of the problem. Consider a jammed road in a large city center. Drivers converge in close proximity in a fluid public space. The sense of privacy in interacting with others, give some license, so to speak, to act in ways they would not if they knew the other individuals involved or were more exposed themselves. On the whole, the system works. But as we all know, the semi-anonymous interactions bring out problematic behaviors in a small percentage, although it may often seem small enough to not present a serious problem. That may be the case, but if you bear the brunt of someone's road rage, it suddenly can be very significant. On the Internet, we mingle with some people known to us and many more who are not. We are visible, but only partially so. This environment makes it easier for others to mimic traces of our identity, and gives them the ability to hide the sources of the information.

Perhaps a key to identity protection is not just about increasing privacy, but also about building real community. The case I was involved in was solved by a range of people with different skills and interests who came together. It was also about good friends and colleagues watching out for each other in this environment.

Here are some of the other lessons I learned in my exploration of identity theft.

- *Look closely.* A cheap imitation of an expensive watch, at a distance, may look like the real thing. Setting up a false, but superficially plausible, identity online requires very little time and effort.
- *Be imaginative.* We are becoming increasingly aware of protecting our identities, but should start thinking more imaginatively about how to safeguard them. Can we imagine scenarios for how our identities and autobiographies may be used and misused in the future?
- *Include irrationality.* For some of us, it can be difficult to understand or accept that people will do bad things for no practical or rational reason.
- *Find strength in community.* There is no substitute for strengthening ties online and in the real world to people we know and trust.
- *Create anti-counterfeiting measures.* What are the possibilities of "watermarking" our Web presences?
- *Balance risk and reward.* How can we strengthen and protect our online identities without stifling self-expression? Can online identity protection be taken too far and be overly engineered?
- *Pursue justice 2.0.* Our legal system is behind our technology. What can be done to update legislation to prevent abuse?
- *Don't be complacent.* We need to pay attention to our online identities and those of the people we care about.

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Identity Theft and the Challenges of Caring for Your Virtual Self

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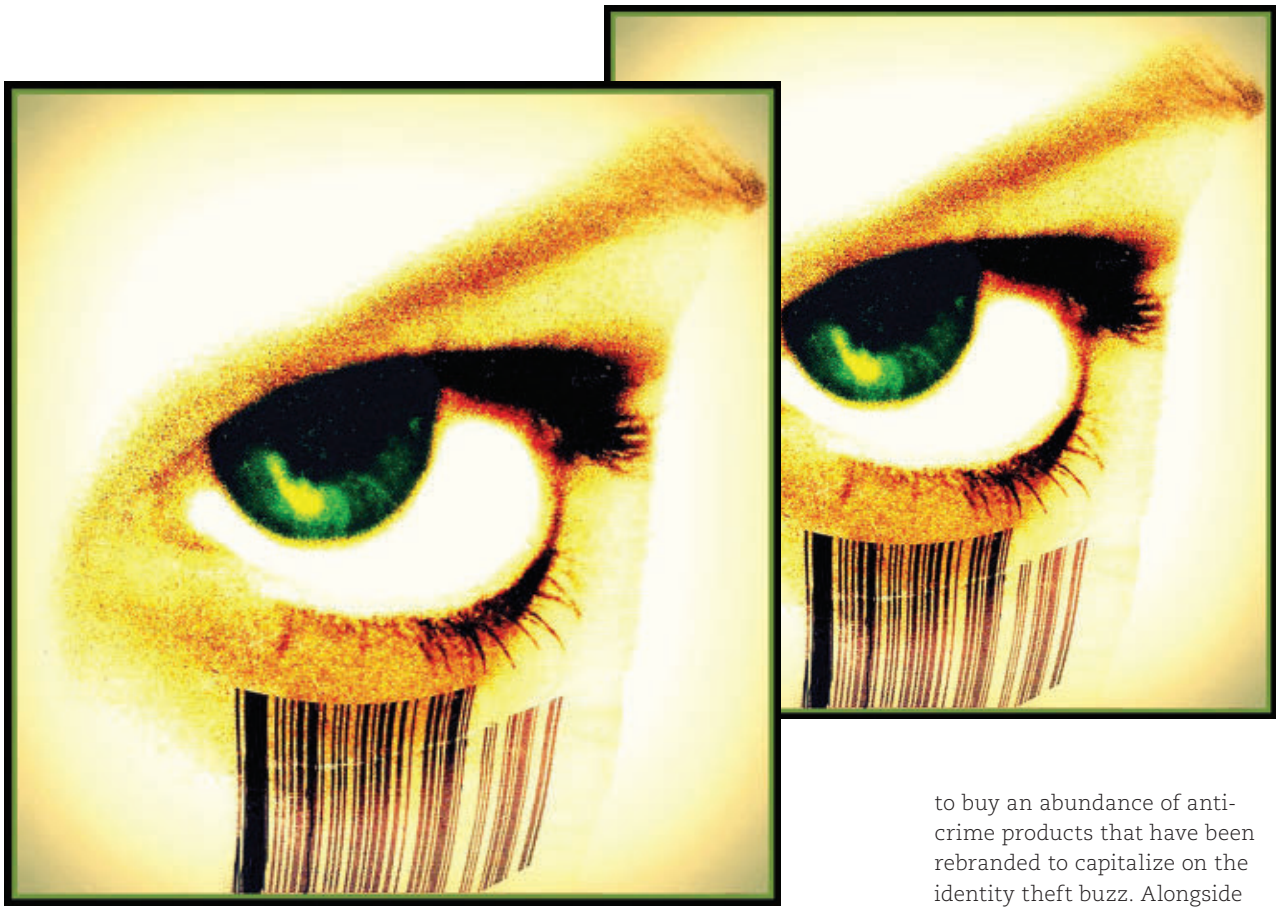
Several recent high-profile incidents have thrust identity theft into the media spotlight. The first to gain notoriety involved the credit-verification company ChoicePoint, which in 2004 inadvertently delivered electronic files containing the names, addresses, social security numbers, and credit reports for almost 140,000 people to identity thieves in the Los Angeles area. In 2007 the British government lost computer disks that contained the personal details of every family in the country. In both cases, the media and authorities articulated a series of anxieties about how this data could be exploited. A plethora of security experts quickly emerged to offer citizens concrete advice on how to mitigate the risk of identity theft, including tips on both prevention and on what to do if victimized. These tips, the rationale behind them, and their implications have provided considerable fodder for this article. Every year there are similar stories of corporations losing customers' personal information, and while citizens are repeatedly told to protect themselves, the parties responsible—both the companies that lost the data and the thieves themselves—are often unscathed.

Although there are different definitions of identity theft, the crime typically involves illegally using someone else's personal information to secure some benefit. Thieves acquire such information through various sources and means, including customer service representatives, hacking and data-mining programs, "dumpster diving" for personal documents, and stealing computers. Victimization ranges from single-instance fraud to more elaborate, extended uses of a person's identity. And while estimates of the extent and cost of identity theft differ, it is commonly recognized as the most rapidly escalating form of crime in both North America and the United Kingdom.

The rise in identity theft parallels the rise of bureaucratic identity markers such as driver's licenses, credit cards, and passports. The shift to an information economy means that people interact with each other at a distance. Over the phone, on the Internet, through the mail, people use these markers to verify their identity and their trustworthiness. As they go about their daily lives, they actively invoke or unknowingly draw upon a host of markers, in the process producing yet more information about their behaviors that institutions store, analyze, and sell. Making a purchase with a debit card, opening a door with a swipe card, telephoning a friend, requesting a travel visa, driving on electronic toll roads—an expanding range of activities leaves informational traces that cumulatively compose a dispersed and loosely coordinated network of information that can be drawn together in particular configurations to produce detailed profiles of a person's behavior, health, travels, consumption patterns, and so on. These profiles are commonly referred to as "data doubles [1]." They are the lifeblood of new forms of informational capitalism and e-governance, and are used to ascertain a person's trustworthiness and value as a customer, as well as to streamline services and improve corporations' daily operations. Data doubles are also a prime target for identity thieves. Institutions anxious about the risks inherent in data doubles falling into the wrong hands are now championing assorted projects of personal information management designed to reduce the prospect of identity theft.

Several initiatives have been established to counter iden-

[1] Haggerty, Kevin D. and Richard V. Ericson. "The Surveillant Assemblage." *British Journal of Sociology*, 51 (2000): 605-622.



tity theft, the most prominent of which involve efforts to encourage citizens to alter their regular routines to reduce their risk of victimization. These measures can be understood as encouraging a care of the virtual self—a wider social project that encourages people to reduce the risks and maximize the potentialities related to their data double. In the context of identity theft, however, institutionally promoted methods for virtual self-care transcend what is reasonably practicable for most citizens and mask the role played by major institutions in fostering the preconditions for identity theft.

Institutional advice on identity theft offers a dizzying array of tips on how citizens can avoid victimization. These tips range from limiting the information one carries and using secure passwords, to closely analyzing bank and credit card statements and ordering credit reports every six months, to keeping all personal information in a safe (ideally locked) location and locking one's mailbox. Tips telling citizens to avoid shopping online and to avoid giving out personal information on insecure phone or Internet lines often stray on the side of paranoia. The most common tip is to shred everything from receipts to bank statements, to magazine address labels. In order to manage the risk of identity theft, citizens are encouraged to buy an abundance of anti-crime products that have been rebranded to capitalize on the identity theft buzz. Alongside the shredder, other devices sold to thwart identity theft include computer locks, safes, firewalls, and encryption software, as well as new services such as identity theft insurance. Marketed by credit card companies as a benefit to potential victims, such services also offer businesses some hope of reducing costs related to identity theft and generate a new revenue stream.

Many of the recommended risk avoidance measures involve forms of "responsibilization," a process of encouraging individuals to become more involved in managing the risks they face. Under pressure to streamline their services, governments increasingly encourage individuals and the private sector to shoulder more responsibility

in managing risk and preventing crime. But this responsibilization is far from perfect. Rather than identity theft being the fault of consumers' poor information-management practices, research suggests that the greatest proportion of this risk can be attributed to the careless or negligent data-management practices of major institutions. More than 50 percent of stolen identities, for example, are taken by employees or people impersonating employees [2]. Other research has noted that up to 70 percent of identity theft can be traced to leaks within organizations [3]. Yet statistics such as these aren't common knowledge. When concerned citizens ask their local police, government, and corporate authorities about identity theft, they receive lists of tips on theft prevention, and on what to do once one has (seemingly inevitably) become a victim.

The process of reestablishing one's identity is the greatest source of frustration. The material costs of the initial fraud or theft of data can pale in comparison with the frustrating and time-consuming work required to rectify the problem. These frustrations are compounded by the fact that victims encounter a reverse onus; they are expected to provide appropriate documentary details in prescribed forms and within a specified timeline to prove their victimization (in duplicate, and by registered mail). The investigation and resolution of their case often depends on the speed and the accuracy of the information they provide.

There is a standardized four-step process for recovering from identity theft. First, victims should contact the police and file a report—a requirement that has almost nothing to do with the prospect of effective police assistance, but is instead understood as a key component in the documentation process. Police reports are vital when trying to prove victimization to credit bureaus, account providers, and government authorities. Second, victims should contact the three major credit bureaus to acquire copies of their credit report to examine for discrepancies. A client can also register a fraud alert—a form of notification stored on their file to caution agents that someone has been manipulating their data. Third, victims should close any accounts where they suspect involve identity theft activity has occurred. Finally, they should contact government authorities to log their complaint and provide statistical information to the relevant authorities. Reclaiming identities involves intense scrutiny of the bare essences of a person's life that can resemble a Kafka-esque toil with inscrutable organizational routines and seemingly unending paperwork that on average can take up to 40 hours to complete. Victims of extreme instances of identity theft are best situated to deal with their case if they are familiar with bureaucratic protocols and have a heightened sensitivity to the importance of documentation. They also need perseverance, and, above all, a plan.

Whereas most crime victims are expected to do little more than contact the police, great weight is placed on identity theft victims to rectify their situation, through an expansive program of self-documentation and mediated communication with social institutions. Indeed, one of the paradoxes of identity theft is that while the crime itself raises questions about institutional trust in documentary identities, this trust can be reestablished only through an elaborate frenzy of further documentation. Ultimately, the victim's task is to return their data double to the status of one among millions of unremarkable transactions in a global system of informational relays.

Curiously, the discourse on identity theft is almost entirely lacking in specific references to criminals, beyond vague references to hackers (even though most identity theft methods require very little computer skills). It appears to be an almost criminal-less crime. Instead of employing breathlessly moralized accounts of evil criminals, institutions treat the crime dispassionately, as a simple risk to be managed. One consequence of this lack of a conspicuous criminal is that the gaze of surveillance focuses on the victim herself. In the absence of identifiable perpetrators, victims become the predominant object of statistical knowledge, trend predictions, risk profiling, and bureaucratic "dataveillance."

Victims are often treated with suspicion and must do considerable work to prove their innocence. An extreme example of this involves cases in which a criminal provides someone else's personal details when they are arrested for a crime. In this case, the victim must report to their nearest

[2] Jewkes, Yvonne. "Policing the Net: Crime, regulation and surveillance in cyberspace." In *Dot.cons: Crime, Deviance and Identity on the Internet*, edited by Y. Jewkes, 15-35. Cullompton, England: Willan Publishing, 2002.

[3] Collins, Judith M. and Sandra K. Hoffman. *Identity Theft Victims' Assistance Guide: The Process of Healing*. New York: Looseleaf Law Publications, 2004.

Identity Theft Prevention Tips

(source: Federal Trade Commission)

Deposit your outgoing mail in post office collection boxes or at your local post office, rather than in an unsecured mailbox.

Don't carry your SSN card; leave it in a secure place.

Give your SSN only when absolutely necessary, and ask to use other types of identifiers. If your state uses your SSN as your driver's license number, ask to substitute another number. Do the same if your health insurance company uses your SSN as your policy number.

Carry only the identification information and the credit and debit cards that you'll actually need when you go out.

Keep your purse or wallet in a safe place at work; do the same with copies of administrative forms that have your sensitive personal information.

When ordering new checks, pick them up from the bank instead of having them mailed to your home mailbox.

police station (if they haven't been arrested already) and file an impersonation report. To complete this report, the victim must ask to have mug shots taken and to be fingerprinted. These prints and photos are then compared with those of the imposter. Their mug shot and personal details are entered on a police computer accessible to officers 24 hours a day. Police record and store their fingerprints and offer no assurances that these records will ever be removed. If exonerated, victims should then request an official clearance letter or certificate of release and are expected to carry this with them at all times in case they are wrongly arrested again. This process represents a complete inversion of the usual processing of victims and criminals. Unlike criminals, however, victims are expected to willingly subject themselves to this documentary regime or risk being judged as having failed to live up to the new responsibilities associated with their "victim identity."

Victims and potential victims alike are expected to transform the minutia of their daily routines in light of informational risks. It is a project that involves attending to the flows, accuracy, and security of the composite bits of documentary identities. For individual citizens, this process aims to foster a particular form of life characterized by an ongoing hyper vigilance about routines for managing their data double. The often mind-numbing minutia of the proliferating identity theft risk-reduction strategies often exceed the bounds of what might be reasonably expected from most citizens in managing a single risk. When all such expectations fall on individual citizens, it becomes highly unlikely that all of these can be effectively incorporated into a person's daily regimen.

This, in turn, accentuates a larger political point about how individuals are positioned as the source of identity theft risks. Such a characterization effectively ignores the role of institutions in creating the risk of identity theft by systematically placing profit and organizational self-interests ahead of any concerns about the public. When information security has been breached, policies often preclude companies' informing customers of this fact out of a fear of negative publicity and as a way to save money. So, even when credit card companies know that the personal details of thousands of their cardholders have been compromised, they do not routinely issue those customers new cards because of the costs involved. Instead, they subject the consumption patterns of those suspect cards to still greater electronic profiling, and cancel individual cards only when there is evidence of fraudulent use. This practice saves the company the considerable cost of having to mail out thousands of new cards, but in the process they effectively consign a subset of cardholders to victimization.

The policies and practices of credit agencies are most responsible for the comparative ease of identity theft. Take preapproved credit cards. While it is common knowledge that identity thieves regularly steal and use them, these costs—and the attendant victimization of innocent citizens—are written off as a cost of doing business. But beyond the obvious risk of this junk mail is something more insidious. The credit industry is fixated on being able to quickly grant credit, and individual agencies pride themselves on being able to approve transactions in a few seconds. This emphasis on speed consciously sets aside questions about the accuracy of information and the security of transactions. Businesses fear that if credit purchases take too long to process, or if security measures are too stringent, then legitimate purchases will be rejected and they will lose revenue. From a business perspective, one of

the major dangers of credit is the expense associated with security measures that might mistakenly reject legitimate purchases. Hence, while championing a host of individualized responsibilization measures against identity theft, the credit industry has opposed proposals to conduct basic fact checking for credit transactions—a policy that would reduce the number of frauds, but that would also slightly slow down the credit-granting process.

The fact that institutions have knowingly created many of the necessary conditions for identity theft, refused to rectify glaring problems, and established the bureaucratic structures that give identity theft victimization its characteristic form all suggests that the recommended individual responsibilization measures are themselves part of a political strategy whereby institutions are divesting themselves of responsibility for the full social and economic costs of the risks they have produced. These costs are effectively externalized through policies that champion an individualized project of care of the virtual self, as individual victims are expected to pay the price for institutional policy decisions. And although such responsibilization measures are unlikely to prove immediately effective in reducing the prospect or pains of victimization, they do signal a step change in an ongoing historical attempt to foster bureaucratically rational capacities in citizens and help reveal emergent heightened expectations about the role that individual citizens are to play in caring for their virtual selves.

The lessons here for HCI practitioners are apparent. Given the increasing media accounts of large-scale information breaches, ensuring the security of data flows from individuals to institutions should be a priority. But an even larger priority is improving the data-handling practices within corporations. While technological security solutions may help decrease data leaks, increased attention must be paid to the humans that handle this information. Along with examining how these physical—rather than digital—practices can be better secured.

The case of the credit card industry highlights how corporations as well as consumers commonly prioritize ease-of-use and convenience over security. The challenge for HCI professionals is to avoid thinking of these traits as mutually exclusive. New technologies can be convenient, but also more secure. For example, consumers are warned never to leave their debit and credit cards out of their sight when paying for purchases, but this is often impossible to avoid, especially in restaurants where the terminals are kept in the back. New technology has helped address this risk while simultaneously increasing convenience. Wireless credit and debit machines in restaurants allow payments to be securely processed at clients' tables where the cards can remain in their owners' sight at all times. This example demonstrates that although security practices are often weighed against other interests, innovative design and conscious attention to how users interact with technology can help shore up gaps through which users' information is leaked

Beyond helping to design products expressly geared at protecting clients' information, there lies a much larger challenge. Data mining and profiling practices undergird the information economy and employ many HCI practitioners. But they also create numerous risks, including large-scale identity theft. While practitioners have a role to play in improving the security of these large databases and tightening up information handling practices, they should not only ask themselves, "Should we collect this data, just because we can?", but measure the benefits of collecting and storing data against the risk of it falling into the wrong hands.

For more information on how to protect yourself from identity theft, read the Federal Trade Commission's 2005 report "Take Charge: Fighting Back Against Identity Theft;" http://www.ftc.gov/bcp/edu/pubs/consumer/idtheft/idt04.shtm.

ABOUT THE AUTHOR

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The Ambient Mirror: Creating a Digital Self-image Through Pervasive Technologies

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Ambient intelligence envisions a future in which our environment is populated by an infinite number of interoperating, computing-embedded devices of different sizes and capabilities [1], which are interweaved into "the fabric of everyday life" and are indistinguishable from it [2]. The ultimate goal of all these devices is to serve human needs through the provision of a wide range of physical, digital, and hybrid services [3] that improve the quality of life by making it easier (smart homes, e-commerce), safer (accident prevention and avoidance, monitoring the location and safety of children), healthier (assisted living, telemedicine), more productive and efficient (teleworking, traffic management, driver assistance), and even more pleasant (social-interaction and entertainment activities).

The first step toward meeting any human need is, of course, identifying it. Ambient intelligence technologies achieve this task through a vast collection of hardware and software modules, which can generically be described as "sensors" [4], since, in one way or another, they have the ability to collect information that is, implicitly or explicitly, produced by humans. These various pieces of information can then, individually or collectively, be mapped to human actions, states, intentions, and, eventually, needs.

Examples of hardware sensors include simple mechanical or electronic devices, such as microphones, video cameras, distance, movement and pressure sensors, as well as more sophisticated apparatuses such as electroencephalographical devices and neural implants. In general, all these sensors detect physical "output signals" of the human body, whether sounds and gestures, physiological measurements, exerted forces, electrical signals, or brainwaves.

Software sensors complement the hardware ones but do not have a physical embodiment. Their role is to detect the immaterial (i.e., intellectual) products of human activity created through the mediation/support of information and communication technologies. For example, these sensors may monitor Internet-based services such as email, Web portals, chat, and search engines, but also operation systems or typical desktop applications, like word processors, spreadsheets, and computer games.

The information gathered by the various sensors is then propagated to software modules that—assuming the role of miniature brains—store it, analyze it, change their own internal status and then decide accordingly upon related actions that should be taken, often affecting the state of the user's physical or digital environment. In a future ambient-intelligence-enhanced world, there may be several such decision-making modules of different sizes, capabilities, and sophistication working independently, collectively, or even antagonistically.

The Ambient Mirror

Generally, unlike the approach of Big Brother, described in George Orwell's *1984*, it is expected that in the emerging ambient intelligence environments, most of the collected information will be distributed among the numerous sensors and applications (i.e., many "small brothers"), never making it to a centralized repository of any kind; also, due mainly to storage constraints, a large part of it will never be permanently stored.

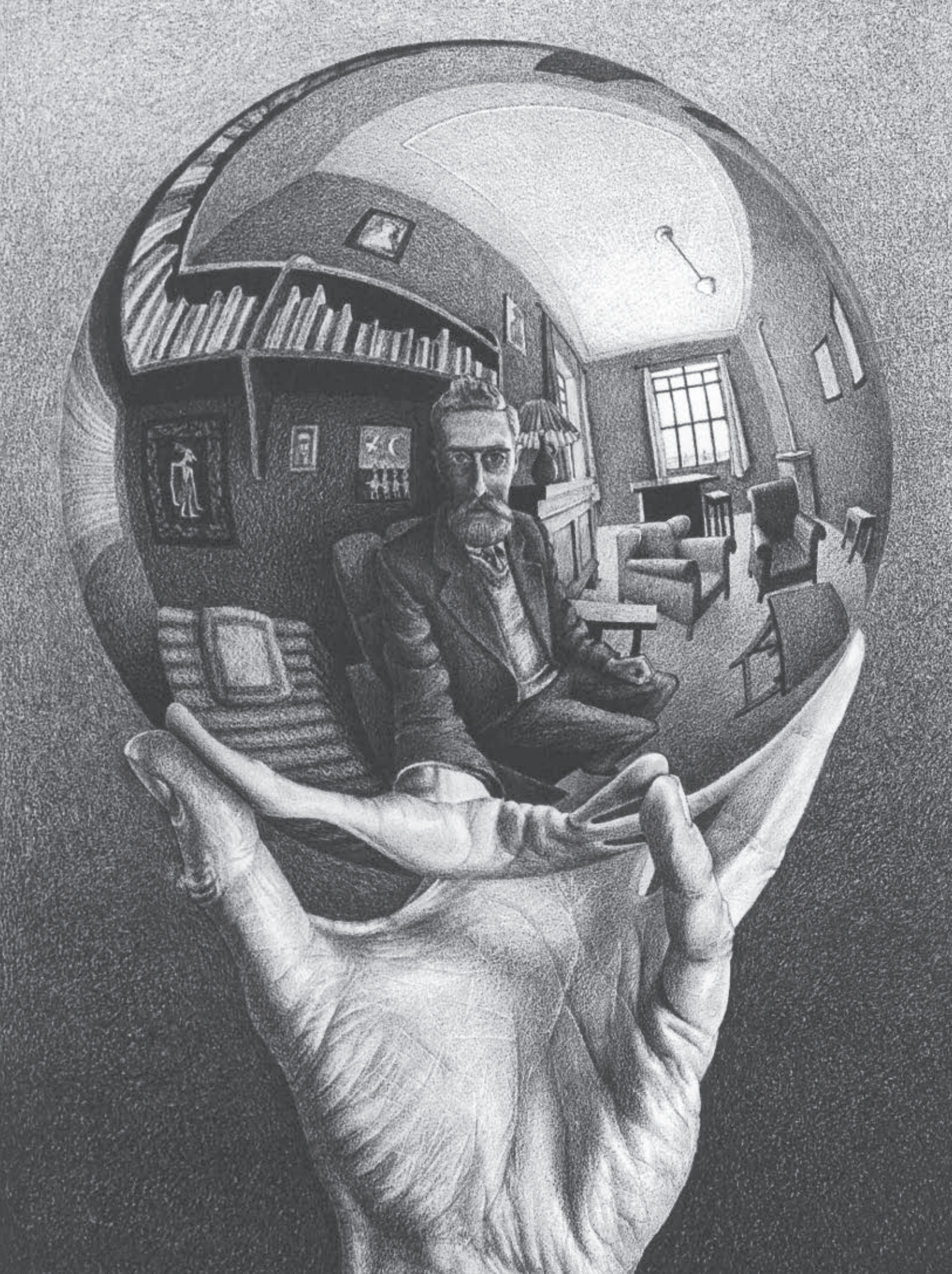
But what if, at some point in the future when practical barriers are alleviated, the option

[1] IST Advisory Group 2003. "Ambient Intelligence: From Vision to Reality." <ftp://ftp.cordis.lu/pub/ist/docs/istag-ist2003_consolidated_report.pdf>

[2] Weiser, M. "The Computer for the 21st Century." *Scientific American* 265, no. 3 (September 1991): 66-75.

[3] JRC/IPTS 2003. "Science and Technology Roadmapping: Ambient Intelligence in Everyday Life (AmI@Life)." <http://forera.jrc.ec.europa.eu/documents/SandT_roadmapping.pdf>

[4] Zhai, S. and V. Bellotti. "Introduction to sensing-based interaction." *ACM Transactions on Computer-Human Interaction* (TOCHI) 12, no. 1 (March 2005):1-2. <http://doi.acm.org/10.1145/1057237.1057238>



of accumulating each and every piece of information, no matter how trivial or elaborate, related to the whole life of a single human being becomes feasible? Would we then be able to re-create a complete and accurate representation of that person—not only her appearance, actions, interests, and habits but also her personality and way of thinking?

And what if, instead of feeding this model into software applications and services, we presented it to its rightful human owner? In this case, the biggest obstacle that we would probably stumble upon would be that of data rendering, or how to present such massive and diverse, and potentially chaotic, data in a structured, meaningful, and comprehensible way.

For the sake of our hypothesis, let's suppose that we eventually manage to create an appropriate rendering machine, which we entitle the Ambient Mirror—the contents of which are accurate, noncontroversial, and human-readable.

Then, the first thing that one would probably ask is, "Will the person in question be able to recognize their actual self in this digital reflection?" You see, humans tend not to keep a "high resolution" account of who we are, what we think, or what we do. Instead, we draw a rough sketch of ourselves based on a small, and sometimes fictitious, portion of the available information. Our brain constantly filters millions of details, retaining only a few important facts or events, often creating idealized, mitigated, or aggravated versions of them. Furthermore, over time, much of this retained data is forgotten, corrupted, pushed back, or merged.

If we somehow manage to get a satisfying answer to the aforementioned question, then the next step would be to identify possible "applications" of such a tool and assess their potential usefulness, as well as their impact both to the individual and the to the society as a whole.

Personal Use of the Ambient Mirror

On an abstract level, the Ambient Mirror can be described as a tool for recording past personal experiences. Over the course of a few thousand years, humans devised and used several other tools for the same cause. Indisputably, the first one was memory. Then came the spoken language, writing, as well as art, mainly in the form of painting and sculpture. In the modern age, the task is further facilitated through a multitude of electronic devices such as microphones, photographic/video cameras, and computers. Of course, all these "traditional" means will also be basic constituents of the Ambient Mirror, but in a novel, pervasive (and probably miniaturized) manifestation, as well as integrated with additional monitoring technologies and reasoning components that will extend their grasp and complement their abilities. Table 1 illustrates an attempt to sum up the foreseen differences between past practices and the Ambient Mirror.

PAST PRACTICES	AMBIENT MIRROR
The data-collection process is user initiated and user driven.*	The data-collection process is self-triggered, taking place everywhere, anytime.
The target person is always aware* of the personal data-recording process and means and also knows what kind of data is being recorded.	Many different types of data about the target person are constantly being recorded without her knowledge or consent.
The means used for acquiring the data have a physical, monolithic manifestation.	The means may be distributed and embedded in the building blocks of the environment, or may even be immaterial (a software sensor).
The recorded data comprises only disjointed fragments of the person's bodily and mental activities.	Theoretically, the recorded data comprises each and every detail of the person's bodily and mental activities.
Data are recorded "as such", i.e., exactly in the form in which they are produced. Any correlation or interpretation is the result of post-processing by their retriever.	Correlation and interpretation of various data is done on the fly, at the same time that it's being produced. Such "meta-data" becomes part of the recorded information and becomes timely available to the retriever.
The retriever views and/or listens to the data from a third-person perspective (i.e., like watching someone else).	The retriever can experience the data from both an "exocentric" (i.e., third person) and an "egocentric" (i.e., first person) perspective.

* Except in cases of wire tapping or surveillance.

▸ Table 1: Foreseen differences between past practices and the Ambient Mirror.

Based on its unique characteristics, some of the possible personal uses of the Ambient Mirror include:

Extending human memory and awareness. For anything ranging from today's schedule or self-medication plan, to vacation memoirs or critical incidents of one's life. In this case, the mirror works like a recording/playback device that can present information to its owner both (pro)actively, based on predefined programs ("always remind me about a meeting an hour ahead," "when I meet someone, remind me of her name") and passively, using dynamic requests ("I want to re-experience: (a) X specific minutes of yesterday; (b) all the times that I felt happy during the past month; (c) a collection of my personal thoughts expressed today"). Since the mirror collects data from far more sources than the human senses, it can potentially "remember" more things about the self than this person can even perceive, thus not only increasing the storage capacity of the human brain, but also (retrospectively) enhancing its awareness capabilities.

But if we rely even more on technology for remembering things, would we then deliberately further weaken our own memory? Could we arrive to the point where we use our brain only for short-term storage of data needed for immediate processing and then dump everything else on the Ambient Mirror, in a way that's analogous to RAM and hard disks? And what will happen if the mirror "breaks," for example, it is partially destroyed or is infected by a virus? On the other hand, if the mirror helps us free all the memory space and processing overhead devoted to mundane things, would we then be able to put these resources to better use? Beyond these concerns, another question is, would the capability of accurately replaying past events result in an endless torment of regret about things that we should (or should not) have said and done?

Seeing the unseen. In other words, converting abstract personal information into a tangible form. The mirror intrinsically possesses this ability since most of the collected data is imperceptible to human senses (physiological measures, analysis of written and oral communications). This information can work as real-time feedback for various uses such as stress control, accident prediction and avoidance, or instant health or mental status checkup before an important match, performance, or meeting. A related example is that of biofeedback, in which bodily functions (blood pressure, heart rate, skin temperature) are measured and then visualized (using numbers, graphs, or even games) in order to help a person understand and master her unconscious physiological activities. Furthermore, the mirror has the ability to keep track of, spot, and report phenomena that are usually difficult to self-identify because they span or change over time, such as habits, interpersonal relationships, likes, dislikes, acquirement of (or loss) of skills, degradation of senses, etc.

Self-knowledge and self-improvement. Development of physical skills (much like what athletes and actors do by reviewing videos of their performance to identify errors and correct their technique) and introspection/self-reflection for scientific, educational, and psychological purposes. A basic concern of this type of personal use is that currently some guidance or monitoring by a trained specialist (a trainer or a psychologist, depending on the case) is required in order to ensure the safety of the person in question and the achievement of tangible results. In this case, one may claim that required expert knowledge can also be offered by the Ambient Mirror, either in the form of intelligent agents or by acting as a mediator between the person and remote experts. Another potential risk is that the mirror may work as a self-fulfilling prophecy; the person looking into it may (sub) consciously alter their actions or even character traits in order to "align" themselves to their perceived image.

Social Use of the Ambient Mirror

If, as admitted earlier on, we can really see ourselves in the Ambient Mirror, then the mirror probably would also be a handy tool for allowing other people to "see" us. Currently, this function is served by personal conversations, profiles, CVs, biographies, blogs, photo albums, and video clips. The key difference with the mirror is that it will not just allow you to see somebody else, but to almost experience being somebody else!

Of course, in this case, one would like to be able to decide who has access to which parts of one's mirror. In other words, some kind of "tools" will be needed for selecting specific parts of the mirror's content and releasing them to selected view-

ers. An ethical question raised here is related to the fact that, as a person's life path (intentionally or accidentally) intersects at some point in time with that of other people, the mirror will also contain data referring to them, compromising their privacy. A possible way to overcome this problem is through a pervasive filtering mechanism, which will be able to anonymize, block, or even erase data recorded by all or selected other Ambient Mirrors. Such a solution may create new problems, since one can foresee that this function can easily be exploited for "stealthing" malevolent actions. Additionally, if someone managed to get control over other people's filtering mechanisms, they could apply a novel form of censorship that can reach to the extent of virtually erasing all evidence of a person's existence.

The related potential applications of the Ambient Mirror include all those situations in which personal information needs to be disclosed, such as interpersonal relations and communication, work applications, and medical filing, among others. Furthermore, the mirror could advance the art of autobiography to a new level, since it will allow the "reader" to almost relive the "writer's" life, experiencing a kind of "living reincarnation."

But what if the mirror is also used as a piece of evidence, like in a courtroom? Would anyone be able to use fragments of their mirror as a valid testimony? Is there a possibility that someone manipulates the content of your (or someone else's) mirror for someone else's favor? Would a third party (the state, the police) be allowed access to anyone's mirror, thus materializing part of the Big Brother scenario?

And, since, in our example, the mirror—up to this point—is considered a personal artifact, whose interests should it serve when a conflict arises? Its owner's or those of the "universal" truth? In other words, would my mirror lie for me? Would it give me away to my boss when I ask for a day off pretending to be sick or to my wife when she asks me where I was last night? And what about all these cases of "white lies" imposed by political correctness, for example, when one asks us if we really liked the food, the dress, the painting, or if we had a good time? Would the mirror become a tool of unprecedented rudeness?

Afterword

In the—not so distant—future, it is quite possible that ambient intelligence technologies will provide scientists with all the components and knowledge required to build a device similar to what is described in this article as an Ambient Mirror, reflecting every trace of human existence. Ideally, this mirror will become a new means of altering human self-perception, as well as that of others, eventually leading to autognosis while also fostering mutual respect and understanding. Furthermore, the mirror may even develop into a kind of "synthetic conscience," shepherding people when they go astray. Then again, if the mirror is not working or properly used, it could totally distort our view of the world with unpredictable, but unquestionably catastrophic, consequences. Furthermore, the mirror might prove to be the ultimate surveillance mechanism, which would permanently end the notion of privacy as we know it. Nevertheless, as is the case with any other type of technology, the Ambient Mirror cannot be characterized, per se, as good or bad. Its use by our society will provide the final verdict.

In his afterword to *El hacedor* ("The Maker"), Jorge Luis Borges wrote: "A man sets out to draw the world. As the years go by, he peoples a space with images of provinces, kingdoms, mountains, bays, ships, islands, fishes, rooms, instruments, stars, horses, and individuals. A short time before he dies, he discovers that the patient labyrinth of lines traces the lineaments of his own face [5]."

So, if in Borges's passage the man discovers in his drawing just "the lineaments of his own face," what would the same man discover by looking into the Ambient Mirror? The lineaments of his soul?

[5] Borges, J., L. *The Aleph and Other Stories.* New York: Penguin Group, 1960.

ABOUT THE AUTHOR

Dimitris Grammenos is the lead interaction designer of the human computer interaction laboratory of ICS-FORTH, where he heads the lab's universally accessible games activity. He holds a B.Sc. in computer science and an M.Sc. and Ph.D. in electronic engineering. Grammenos has expertise on interaction design issues in traditional Windows-based environments, as well as in technologically advanced environments, such as virtual and augmented environments, wearable computers, and ambient intelligence environments. He has been involved in several European R&D projects related to design for all and universal access, and has given related lectures, seminars, and tutorials. For more information visit: http://www.ics.forth.gr/hci/people/dgrammenos.html.

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Interacting With Advertising

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There's a famous saying (attributed to John Wanamaker, the retailing pioneer): "Half the money I spend on advertising is wasted; the trouble is, I don't know which half." And while that's still true, we propose this corollary: Half our encounters with advertising are dripping with evil; the trouble is, we don't know which half.

Our culture at large, and interaction-focused professions specifically, seem to be enthralled by advertising. Our reactions range from bemused tolerance—an eye-rolling "What will they come up with next?"—to giddy hilarity over such antics as headvertising (writing or even, yikes, tattooing on the forehead, in exchange for financial compensation), or potential lunar-surface advertisements. The TV show "Mad Men" has made the advertising profession chic again, but with the narrative in a bygone decade, we don't have to consider the impact of these mad men on our lives. People are being paid to put advertisements on their forehead? An entire show about advertising? Shouldn't we be outraged?

But bombast makes for great entertainment; the bigger the posturing, the more gruesome satisfaction we feel in the extremity of our own times. At the peak of dot-com irrational exuberance, Half.com (remember them?) paid Halfway, Ore., $75,000 and donated 20 computers for the town to change its name to Half.com, Oregon. Crazy stuff, right? But in 1950, Hot Springs, N.M., renamed itself Truth or Consequences and was awarded hosting privileges for the radio quiz show of the same name. While we like to imagine we're going to hell in a handbasket, the only thing new under the sun may be that the handbasket is running Google ads on its embedded plasma display. The underlying technology may change, but the absurdity stays the same.

As interaction designers refine their skills to better infuse usability and usefulness, the same approaches are being used to trick or persuade us into consuming advertising messages. Using what we would call forcing function, hotels wrap a cardboard advertisement around the TV remote, and even though we immediately extract it for use, the cleaning staff ensures that the remote is back in its commercial sleeve the next day. Instead of making every bit of text readable, we're now regularly exposed to (and ignoring) "mouseprint"—the faint, low-contrast, tiny type that rapidly disclaims (or clarifies), "Professional driver. Do not attempt," or exhaustively documents rights surrendered in an EULA, or end-user license agreement ("By submitting, posting, or displaying the content you give Google a perpetual, irrevocable, worldwide, royalty-free, and nonexclusive license to reproduce, adapt, modify, translate, publish, publicly perform, publicly display and distribute any Content which you submit, post or display on or through, the Services.") Elsewhere, billboard and sign designers leverage the colors, layout, and typeface of wayfinding signage to promote wares in giant, distracting form.

Meanwhile, we feel a subtle irony in advertising. Red Bull gives you wings, and SoyJoy helps you see the bright side of things. Of course, neither of those products literally does either, but somehow we don't react negatively to the false claims.

Much has been written about the role of branding and marketing in Barack Obama's presidential campaign. One aspect to consider is the viral behaviors that emerged on social networking sites: people changing their middle name on Facebook to "Hussein" in order to normalize the name; people changing their avatar on Twitter to a portrait of Obama (often the one created by Shepard Fairey, a master mememaker); and the pre-election phenomenon of "donating" one's Facebook status to remind others to vote. We may never know where these ideas came from, within or outside the campaign. Something as supremely viral and participatory as the Obama campaign may have essentially transcended traditional boundaries, thus blurring the lines even further between politics and advertising.

But as we are supposedly increasingly enlightened and empowered as consumers, where do we draw the line with what advertisers are allowed to do? A couple of years ago I was back in my hometown of Toronto. Walking down Bloor Street late one night, we were invited into the cinema for a free screening at a documentary film festival. The emcee introduced the movie and thanked the sponsor, then introduced the director for a few questions, and then rolled the film. We got the usual film-festival promo trailer, a few acknowledgments screens, and then an ad for Cadillac, the sponsor. The audience began to boo. And while I wouldn't normally do this, I shouted out against the booing, "You're seeing a *free movie*, so shut the $@^& up!" The exchange (watch an ad, see a movie) seemed perfectly reasonable, and the booing seemed more like hipsters on autopilot ("advertising = teh suck – pwn3d") than a considered objection. Sure, I have all the latest ad-blocking software in Firefox, but I'm not joining the Billboard Liberation Front or subscribing to Adbusters. I'm happy to limit my exposure but don't generally need to become an activist either.

Yet the first time I found myself on an airplane where the tray table was plastered with an ad, I reacted angrily and peeled it off. I was responding to a previously virgin part of the service—one that I paid dearly to utilize—being sold and sullied.

Of course, advertising as an effort often lives entirely outside the delivery of the product promise. Witness Microsoft spending copious amounts of money on an extensive advertising campaign to staunch the failure of Vista. Mightn't that money have been better spent to fix Vista's shortcomings and convoluted line logic? How can Target continue to get away with aspirational advertising about the emotional impact of design while the in-store experience is such a complete failure (and many of the products are of such poor quality?). When advertising uses truthiness to tell a story we want to hear, we'll grant it endless permission to be in our face. Apple's ubiquitous advertising—hot colors, black silhouette, white earbuds—demonstrates that wonderfully. Until then, I'm remaining vigilant against the noxious invaders, staying curious about the delightful informers, and hoping for savvy judgment so I can tell the difference.

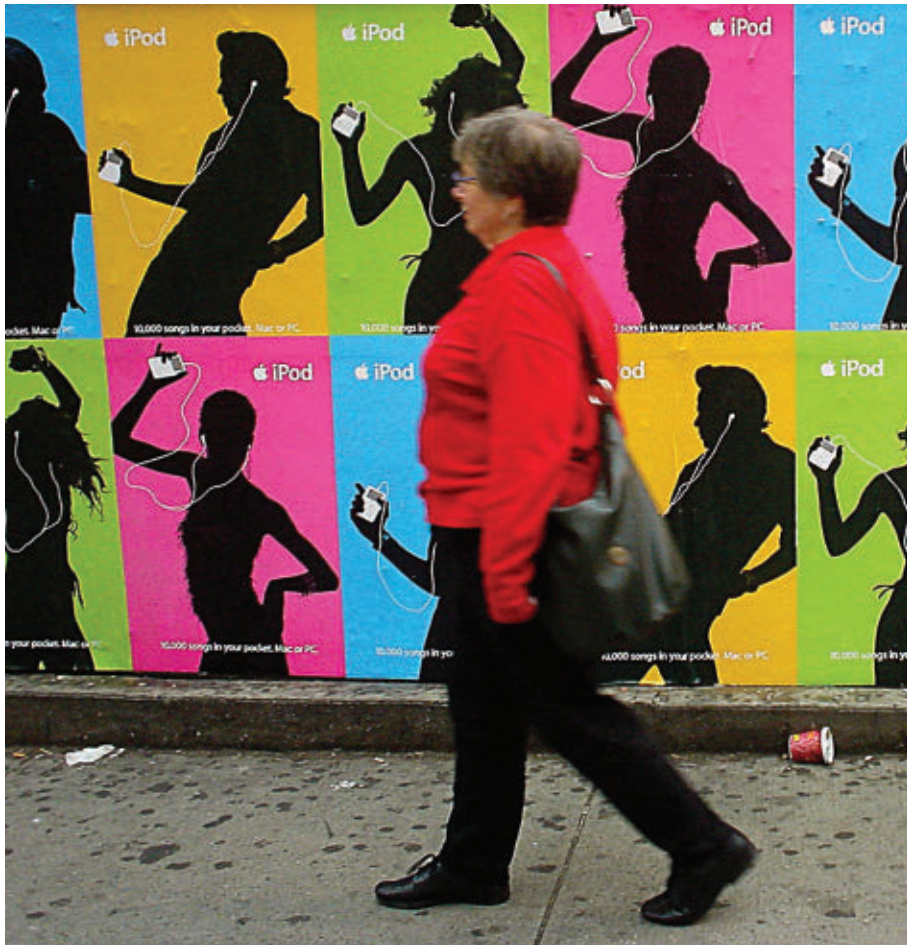

Photo by Steve Portigal

Photograph by Steve Portigal

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Taking a Broader View of the Human Experience

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Experience design is a human-centered activity. It starts with a deep understanding of people's needs and contexts of living or working, and the end result is a product or service that provides people with a quality experience or a culturally relevant solution.

With such a clear and deliberate focus on people, other issues such as technology, economics, belief systems, or the broader topic of ethics and sustainability take a secondary role. But should they?

The way we organize our lives and societies in social, economic, spiritual, and environmental terms is very much part of the human experience.

And since we are living in a time of rapid change, our task as professionals is not just to understand the current context or anticipate future possibilities, but to help create a future world that is socially, economically, spiritually, and environmentally sustainable.

From this vantage point, the end-result of our work—that quality experience or culturally relevant solution—takes on a whole other meaning that goes beyond the relevance for an individual (the "user") or a client.

[1] Kuniavsky, M. "User Experience Design for Ubiquitous Computing." *interactions* 15, no. 6 (2008): 20-22.

[2] Nathan Shedroff, email communication with author, 5 November 2007.

Distributing Technology to Distribute Power

Four billion mobile devices are currently in use in a world population of 6.6 billion. Deduct infants, and you realize that a very large percentage of humankind has a mobile phone. The advantages of this technological tsunami for the so-called bottom of the pyramid have been widely publicized, but most of the important decisions in how our countries and economies are run are still in the hands of very few people.

Even in the best scenarios, this power concentration is based on the logic that we need to delegate decisions to accountable leaders, that we cannot involve ourselves in all decisions that matter to us, partly for practical reasons.

This is now changing. Distributing technology in the hands of the many opens previously unfeasible options for a growth in participatory decision-making. But how can this be implemented in the future? What kind of tools would designers need to create to support this? And how can the design itself be decentralized?

As Bruce Sterling recently said during the LIFT Asia '08 conference to an audience of startled Koreans:

"When you are working on cell phones, when you are working on the Web, when you are working on electronic money and payment systems, you need to think: What if my user is a North Korean? How would I do this differently if I knew my user was from Pyongyang, that his regime had collapsed, that his economy had collapsed, he was completely bewildered, and he had never seen a cell phone or a computer in his life, and I intended to make him a productive and happy fellow citizen in 10 years, what kind of technology would I give that person, what kind of trading system, economic system?"

We don't have all the answers yet, but it is clear that pervasive mobile devices—these always-connected mobile computers—are going to have a transformational impact on our world.

Designers have a responsibility to enable this transformation, to bring the power to the people, and to provide them with the tools to better govern their lives and the communities and societies they live in.

The Physical/Digital Confluence

People are social animals; the extent to which online social tools online are affecting people's social lives and behaviors in the physical world comes as no surprise.

The growing pervasiveness of smartphones combined with cheap data plans are changing this landscape even more: Not only will we be online wherever we are, but we will be online

everywhere, all the time and in many different types of contexts, and these will all be known and processed by online services.

This not only opens up opportunities for a range of new tools and services, but will fundamentally change our basic human experience, as the virtual and the physical converge more and more, and eventually become indistinguishable.

The ever-growing presence of localized and contextualized mobile devices will mean that well-designed services will have to be immersive services. The Web will be about providing people with things that matter at a particular time, in a particular location, within a particular context.

And it doesn't stop there. Digital devices are not just smart phones. The digitization of our physical space also includes RFID systems, sensors, alert systems, cameras, GPS, among others.

In such a mixed physical/digital space, designers need to be respectful of people's identity and privacy, and not take all control away from them. But what does it really mean to design for a world of physical/digital confluence?

Frankly we don't know. Mike Kuniavsky wrote in this magazine about user experience principles for ubiquitous computing [1], and other thinkers such as Adam Greenfield, Genevieve Bell, and Jan Chipchase are approaching the subject as well, but there is no consensus yet. The debate is only starting.

Our behaviors change but the underlying human drives that guide those behaviors do not change so easily. Understanding this delicate balance and being respectful of what it means to be human are the two keys to unlock the physical/digital design challenge.

The High-Tech of the Local

People in local communities have always shared and exchanged things without the support of money. But this local practice sits at the margin of the dominant economic model and has a reputation for being naïve, precisely because it is local, relies on person-to-person trust, and is therefore slow.

But the anonymity that comes with global markets has created its own set of problems and this is currently affecting us all. Not just the current recession, but also the enormous environmental challenges of buying things from afar that could have been produced nearby.

Can the new digital world help recreate the trust of the local, and allow for other types of compensation, such as time, skills, services, a sense of belonging and community, visibility, reputation, public recognition, identity?

What could possibly replace money as it exists now? What could be sharable and what cannot? What impact could this have on people and communities? How could a post-money economy best be organized, especially given the failures of the current economic model? How do communities of sharing shape and maintain themselves? How do they build their values? Do they have explicit or implicit values? What are the differences between global/online

Since we are living in a time of rapid change, our task as professionals is not just to understand the current context or anticipate future possibilities, but to help create a future world that is socially, economically, spiritually, and environmentally sustainable.

It is clear that pervasive mobile devices...are going to have a transformational impact on our world. Designers have a responsibility to enable this transformation, to bring the power to the people, and to provide them with the tools to better govern their lives and the communities and societies they live in.

and local/physical communities of sharing? To what extent can digital/mobile communication tools help people in both online and physical communities manage their sharing and exchanging practices? What would the rules, rituals, and habits of this future world be?

I was recently involved in KashKlash (www.kashklash.net), a collaborative foresight experiment that asked these questions, and many more. People like Bruce Sterling, Regine Debatty, Nicolas Nova, and Josh Klein did the first groundwork on understanding the future of money, sociality, and alternative currencies. Later, many more thinkers and professionals joined in on creating shared future scenarios. At the time of this writing, the results of the project were not yet known, but should be available for you to view and reflect upon by the time you read this.

The Data Avalanche and Human Control

People are not computers. We forget. We cannot search our mental databases. Our thinking and memory are not disconnected from acting and sensing. The two are engrained and inseparable.

Yet computers are increasingly driving our day-to-day lives and pushing their paradigms into our human experience. We are rapidly moving to a world where everything is always stored—in many different locations—and everything is always accessible.

Life would be easy for us if we just thought like computers. But we don't. We feel bombarded with data, but we can't find what we need, we can't make sense of it.

So what are human-centered data? How should they be presented, stored, organized, visualized, so that they are relevant for us, and not (just) for a computer? What does that mean for such varied fields as car design, mobile device software, or digital signage?

We will need new metaphors that embody very human concepts such as preciousness, moods, attraction, surprise, and forgetting, and apply them to data sets, data algorithms and data visualizations.

The Human Experience of Sustainability

The world we currently live in is far from sustainable across all the core contexts of human experience: economy, society, environment, and spirituality.

Nathan Shedroff argues that user-centered design or experience design in itself leads to more sustainable product development, and he certainly has a point:

"More meaningful products as well as ones that better meet our needs don't require us to buy more and more things (in order to fill those needs and desires). Fewer, more meaningful, effective, and sustainable products will be more fulfilling and more sustainable than more and more less fulfilling, effective, and meaningful ones. In addition, devices that adequately meet our needs, especially technological ones, often have the effect of not only dematerializing competing products but also products in other categories (like the iPods and iPhones are doing)." [2]

Although a nice discussion could be had about what interaction design for sustainability might actually entail, there is more to it than just making the products themselves more meaningful, effective, and sustainable.

The bigger issue is the context for which these products are conceived and where they will be consumed. Take for example the context of luxury, which is not often known to pay much regard to sustainability. What could design develop in terms of an ecological and sustainable approach to luxury?

This requires a new sustainable consumption model, which goes far beyond the boundaries of our profession and practice. But as designers we can inspire and guide toward such a model, and help people better manage a sustainable lifestyle.

The Evolution Theory of Interaction Design

The dominant model of technological innovation lies on a simple core tenet—it must be market-proof. Investments and research are always directed to where the hopes for profit lie. Most designers are at the complete service of this dominant innovation model.

People-centered design is not based on an economic model. Instead, it emphasizes our human limitations (such as perceptual-motor constraints and the bounded rationality of our cognitive system), our behaviors (our cultural constraints and living contexts), and our aspirations to change (our desire to be emotionally involved in what we do and be main actors in our future).

But people-centered design is rarely a driving factor of innovation. It is only adopted when it adheres to the dominant innovation model: by promising immediate return on the investments made. In other words, people-centered design matters not because it is centered on people but because it makes money.

There are other paradigms. Some advocate applying the model of biological evolution to technological innovation.

The main principles of evolution could be used to explain how design ideas mutate, are selected, migrate, and drift, finding their natural way from the observation of people's cognitive, behavioral, and emotional patterns to the design of concepts and prototypes, to their production cycle and back to people, in a sort of continuum.

It could even provide guidance and vision for the construction of practitioner toolkits of the future, which would create a much greater responsibility for the designer.

A World of Pervasive Learning

With pervasive technology, learning itself is becoming pervasive. Pervasive learning also means learning by children, the illiterate, the elderly, migrants—in short, by about every category and in every context currently not affected by institutional learning.

Learning therefore needs to become hands-on, experience-based, multi-disciplinary, physical, and enabled by immersive technologies.

This intuitive, direct learning is radically different from institutional learning. We all have some good examples of this, but the educational, pedagogical approach is lacking.

How to develop a new model for immersive learning? It is currently being explored all over the world. The Finnish government will soon merge the three top institutions—the business, design and engineering universities, each with their 100-plus years of history—into a new innovation university with an English-language program, which is all about human-centered, project-based, multidisciplinary learning.

But personally, I expect most innovation to come from unusual places: the slums of Lagos, the villages of India, the fishermen in Vietnam. We just have to understand it as learning.

And Something More...

There surely is going to be "something more." As our world is changing, and time goes by, other topics will rise up. But for now I have my hands full trying to delve into what I just introduced. If you feel you can lend me a hand in this quest, please do let me know.

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Food, Dude

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Permaculture, urban farming, and locavorism—all are newly familiar terms that we define in this month's forum and that are implicated in sustainable lifestyles. All denote opportunities for interaction designers [1]. By opportunities, we mean not only potential applications of interactive technologies to help where no interactive technologies have been previously applied, but also the potential use of interactive technologies to more broadly distribute the cherishable wisdom of those who practice simpler, more sustainable, more natural heirloom and traditional forms of food culture and land use.

Much has been made of the digital divide as a condition that groups us into IT haves and have-nots. High-profile projects such as One Laptop Per Child (OLPC) and NIIT's Hole-in-the-Wall (also known as minimally invasive education) are targeted at providing interactive information technologies to those who would otherwise be on the "wrong side" of the digital divide. Such projects are not only admirable but also controversial—perhaps the topic of another edition of this forum. Another, perhaps more thoughtful, conception of the digital divide is one that sees interactive technologies not so much as a treasure to be shared by affluent cultures with less fortunate ones, but as a two-way mediating and knowledge-sharing technology between the natural world treasured by certain cultures and the increasingly complex digital world of others. To put it another way, we in the industrialized world might be better off learning about conservationism and simple living than conceiving of social equity as something attainable only through the industrial-world consumption of digital technologies.

To be sure, not everyone who is poor lives simply and in harmony with nature. The global situation is much more complex than that. What we are advocating is the conception of interactive digital technologies as a means for sharing knowledge between cultures and as a multidirectional conduit. One thing worth sharing is knowledge of food and affinity for the natural world and its sustainable use and preservation. Such knowledge appears to be highly distributed and oftentimes rare.

The motivations for learning about and practicing sustainable food and land-use culture are manifold: ensuring a secure local food supply, living according to an ethos of sustainability, bridging the digital divide by developing an affinity for stewardship of the natural world rather than the export of digital materialism, and finding meaning outside of the world of material cultures.

Forms of Alternative Food Practices

Before we can delimit the opportunities for interaction designers, we should define a number of practices relateded to alternative land use and food culture.

Permaculture. The practice of designing land for sustainable, agricultural use–the idea of permaculture is not just about food, but also about sustainable use of the land. The permaculture movement appears to trace back to Australians Mollison and Holmgren [2].

Urban vegetable gardens and urban farming. It is nowadays not uncommon for people to transform their lawns and outdoor space into urban or suburban farms, whether to grow food for personal use, to sell in local markets, or both. Just as owning a hybrid electric car is more fashionable than owning an SUV in many circles, having a lawn full of vegetables may one day become more fashionable than having a manicured lawn.

Locavorism. A food ideology that denotes a preference for local foods over imported ones. The sustainability implications of consuming locally produced foods rather than those that travel to reach consumers are obvious.

Food co-ops. Food cooperatives are not a new phenomenon, but they represent a community-owned alternative to supermarket chains.

[1] This edition of Sustainably Ours advances some themes uncovered in research by the permaculture research group of the Sustainable Interaction Design Research Group (SIDRG) at Indiana University-Bloomington, namely Susan Coleman Morse, Rajasee Rege, Xi Zhu, Feixing Tuang, Brandon Stephens, and Eli Blevis. .

[2] Mollison, B.C. and D. Holmgren. (1978). *Permaculture 1: A Perennial Agricultural System for Human Settlements*. Hobart, Australia: Environmental Psychology, University of Tasmania.

Photo by Eli Blevis

Photo by Eli Blevis

▸ An organic farmer's market.

Member-owned and governed cooperatives ascribe to seven principles endorsed by the international cooperative community: voluntary and open membership, democratic member control, member economic participation, autonomy and independence, education, training and information, cooperation among cooperatives, and concern for community. The National Cooperative Business Association (NCBA; http://www.ncba.coop/abcoop_food.cfm) cites that there are nearly 500 cooperative retail food businesses in the U.S.; and the Cooperative Grocer directory (http://www.cooperativegrocer.coop/coops/) lists 307 members.

Plant a row for the hungry. The practice of planting extra food in a garden for the less fortunate is an important alternative food behavior. One can imagine interactive technologies being used to promote such practices and to match growers with those who need food [3].

[3] There are many such programs, including: http://www.hhfoodbank.org/plantarow.htm

Local organic farms. As an extension of locavorism, the idea of buying your food from a local organic farm even at greater cost than imported foods has some traction among certain people.

Organic garden services. In many communities, services that offer to tend a garden on your property or teach you how to grow your own food are on the rise. My Farm, a community-supported agriculture (CSA) organization, is one example of such a service. In exchange for sharing a harvest, the group prepares, plants, and maintains a vegetable garden on your property. The harvest of this property is then split amongst all the participants. Even those without yards can enjoy the bounty and support the effort through purchasing a "share" and receiving a weekly delivery of fresh produce grown by people in their community. Additionally, the group maintains on-site compost, develops and maintains a watering system for

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each garden, and hosts backyard dinners hosted by local chefs [4].

Slow food. Targeted at undoing the harms of a culture that consumes fast food, the slow food movement has seen an uptick in recent years. The website www.bigpicture.tv has several worthwhile videos that address the concept of slowness and the slow food movement [5].

Interactive Technologies for Food, Issues and Opportunities

We can imagine a number of interactive technologies that may improve local food production or promote more sustainable land use. Some of these technologies are now available or in development. Still others are just ideas that represent opportunities for innovations in the use of interactive technologies to promote organic food and land use practices.

Tracking food. Interactive technologies may be used for tracking the origins of foods. This may be important information for consumers, and it is vital information for organic growers who want to certify that their products are organic.

Garden sensors. Garden sensors that help people manage their planting better by allowing measurements of soil pH or temperatures or other aspects of the garden can be tied to computer applications that provide advice about what can be planted and when, and other helpful information [6].

Online communities. Like other aspects of online culture, Web-based communities can serve the needs of people who are interested in learning about gardening, urban farming, and permaculture from one another. The advantage of online communities in this context is that people can share their knowledge and interests and create community with others who are not physically collocated. Nonetheless, it is also a particularly important opportunity for bridging digital divide in a bi-directional way, since knowledge of agricultural is a resource that can be shared from poor to rich as well as from rich to poor.

Grower management software. Several grower management software programs exist. Some are targeted for use at personal scale to track progress in a personal garden. More are targeted for large-scale use, as is the case for local organic farming operations.

Sister families. One idea to promote simpler ways of living as an alternative form of bridging digital divides is to connect families from different countries and cultures—"sister families" who can share knowledge, resources, and stories to create stronger understanding of cultures and practice, especially where food and land use practices are concerned.

Food exchange. In some communities, people share produce by barter system, and such systems could be facilitated by digital technologies, by more broadly identifying who in a community has which produce and is willing to participate, or allowing for some kind of credit-based exchange. Such a system allows certain participants to specialize in particular crops, the need to minimize the risk of encouraging monoculture land use notwithstanding.

Organic and fair-trade footprint calculators. Like the now ubiquitous carbon footprint calculators that populate the Internet, organic and fair-trade footprint calculators could allow motivated individuals to see their impact on others in terms of fair wages and responsible land use.

Food-source monitoring. Like other retailers, local food co-ops need to comply with food source monitoring regulations as a matter of food safety. Such information may be equally interesting to consumers who might like to know how local and organic the food they eat is.

SimOrganicFarm. Like its city-building counterpart SimCity, SimFarm challenges gamers to build and maintain their own digital farm, complete with weather, pests, and problems that all threaten the endeavor to become a successful farmer. The notion of SimOrganicFarm is the same idea and opportunity for the urban farming and permaculture movements.

Satellite images, time-lapse imaging, and GIS. Geographic Information Systems (GIS) are widely available, but current forms, such as Google Earth, present a relatively static view. A more dynamic view, which shows changes in land use over short periods of time—weeks versus years—could greatly inform and motivate the urban-farming and permaculture communities. Such information could lead to communities being able to advertise their progress in terms of increasing permaculture and other forms of sustainable land use, making their towns seem more attractive as places to live.

The Story of the Urban Mushroom Farm

Michael and Luane have been practicing per-

[4] http://myfarmsf.com/about.html

[5] Economist Manfred A. Max-Neef describes the notion of slowness as a healthy alternative way of being in this delightful video clip: http://www.bigpicture.tv/videos/watch/e56954b4f. Erika Lesser also describes the slow food movement in these video clips: http://www.bigpicture.tv/videos/watch/42a0e188f, http://www.bigpicture.tv/videos/watch/3988c7f88, and http://www.bigpicture.tv/videos/watch/013d40716.

[6] An example is: http://www.microgrow.com/greenhouse-control-application-chart.html

Photo by Eli Blevis

▸ A mushroom urban farm—vermiculture worm composting system (Foreground) and mushroom growing logs (Background).

maculture in the form of mushroom farming for more than 25 years. But this is no traditional farm: It occupies their front and back yards, in an affluent residential area. They have transformed their property into an efficient growing environment for shiitake mushrooms, which they sell to their local cooperative grocery.

Over the years, the natural areas surrounding their neighborhood have been developed. What was once a cattle farm to the east now houses hundreds of apartments, a retirement center, a variety of chain stores, restaurants, and a cinema complex. Pavement runoff has created flooding to the south and is becoming a problem for low-lying floodplains.

As the area around them transformed, Michael and Luane grew closer to the earth. Their yard is distinct from their neighbor's. They have little grass, with a worm-powered compost bin stationed outdoors. Inside they use a wood-fired furnace to heat their home. Much of their knowledge comes from trial and error. While they are happy to share their knowledge with others, don't expect them to be posting their techniques and secrets to mailing lists: Their lone computer is on a dial-up modem. and it is rarely powered up.

How could interested parties learn from these practitioners? One potential option would be to leverage the technologies used by the local Center for Sustainable Living as a means of outreach to the larger community. Such organizations recognize the benefit of using technology as an efficient mode of communication. Many communities are making a focused effort to document oral histories of their older citizens. Similarly, efforts can be made to document traditional farming techniques. Through the use of video and audio recording, podcasts, YouTube, or online permaculture networking sites, permaculture and farming techniques are being shared across the world.

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Research Strategies for Future Planning

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In 2005 Motorola hit the market with a new, ultra-slim, sexy cell phone: the RAZR. Almost instantly, it became one of the most sought-after phones of all time. For two years the RAZR captivated the industry. Consumers around the world couldn't wait to get their hands on the sleek, fashionable phone. Analysts praised Motorola's miraculous turnaround. Publications gave the product one innovation award after another. And then, just as suddenly as the RAZR appeared, it was gone. The iPhone came along and fundamentally changed both the market and consumer expectations for mobile phones. In an instant, we moved from fashion to advanced functionality, and Motorola plummeted.

What can cause a company to go from earning $623 million in 2006 to just $100 million a year later [1]? Motorola is an innovative company. It is known for being driven by design. Its leaders hire top-notch researchers and anthropologists to understand people's needs around the world. And they know how to translate these insights into great consumer experiences [2]. This drive for innovation is arguably what led the company to create the RAZR in the first place. And yet, for all of its capabilities, Motorola was still blindsided by the competition.

Getting Beyond Current Thinking

Companies everywhere fear what they can't see coming. It's hard enough just to stay on top of what we know, not to mention the things we don't. But in today's competitive market, that's exactly what's necessary. Why do so many organizations fall prey to unpredictable challenges? Perhaps it's because during times of uncertainty, it often feels best to stick with the familiar—to keep safely within the frames of how we see and think about the world. In an effort to better understand consumers, design- and research-led organizations, like Motorola, are optimized to understand what's going on in the world today. These groups have a plethora of processes, methods, and tools to help them accomplish this. Still, many companies struggle to plan for what's next: to learn not just what customers need today but also to anticipate what they will need in the future.

Planning for an Uncertain Future

Scenario planning is a strategic method that can help organizations prepare for change. It's a process for looking at what's going on in the world, using these trends to explore a variety of potential futures, and synthesizing these futures to strategize how to prepare, no matter what comes to pass. Scenario planning is not a prediction tool. Rather, it can help both companies and individuals make smarter decisions in the short term, while planning for the long term. For Motorola, an eye toward the future could have indicated massive changes in technology, consumer lifestyles, or the competitive landscape and helped them develop a future pipeline.

Scenario planning originated as a military planning tool. In the 1960s Hermann Kahn brought it to the U.S. Air Force in an effort to help leaders get a grasp of the different political situations in which they might find themselves down the road. It was first introduced to the business world in the 1970s when Shell Oil used the method to help divert disaster during the OPEC oil crisis. Today foresight experts such as William Cockayne work with organizations to better prepare for identifying long-term opportunities and potential issues [3]. At Jump Associates, we've used scenario planning to help our clients reinvent existing categories, identify new markets, and develop new sources of revenue. In the process, we've seen how scenario planning helps us envision potential futures and benefits any project, not just ones with a scenario planning component.

[1] Holson, Laura. "Without a Hit Razr Sequel, Profit Drops for Motorola," *New York Times*, 24 January 2008, Technology section. <http://www.nytimes.com/2008/01/24/technology/24motorola.html>

[2] Nussbaum, Bruce. "Does Motorola Really Do Great Design?" *BusinessWeek*, 7 May 2007; <http://www.businessweek.com/innovate/NussbaumOnDesign/archives/2007/05/does_motorola_r.html>

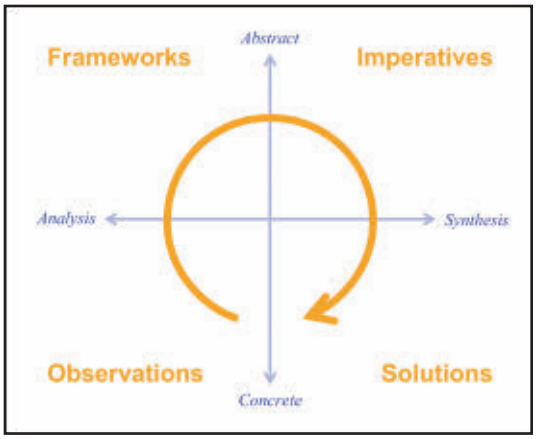
[3] William Cockayne and the Stanford Center for Critical Foresight, spend time exploring the future; <http://foresight.stanford.edu/overview.html>

Developing Growth Platforms in Five Key Stages

A strong process can ensure favorable results for any strategic effort. At Jump we use an explore process for developing new growth platforms that takes us through five key stages. First, we observe—collecting data about the world. Next, we develop frameworks, finding patterns and meaning in the data we collect. Third, we craft imperatives, translating our knowledge into principles for action. We then ideate solutions, taking action to implement the imperatives we've uncovered into new ideas for products, services, and businesses. Finally, we iterate—moving back and forth, left and right, and back to observations through the cycle, time and time again.

The act of innovation can be seen as a process of toggling between items in the concrete world and abstract concepts, between analysis of the situation and synthesis of a desired result. Jump Associates uses an iterative explore process for identifying and developing new platforms for growth.

[4] Schwartz, Peter. *The Art of the Long View: Planning for the Future in an Uncertain World.* New York: Currency Doubleday, 1991. Many of tools and methodologies for developing scenarios that are mentioned in this article have been adapted from the thinking of Peter Schwartz.



► The Jump Explore Process

Reframing Research Methods

Many organizations use some variant of this process to help them gain insights about the world and develop solutions that connect with people's needs. This process is not scenario planning. It's an exploration into identifying and developing new platforms for growth. And yet, many scenario planning techniques can help add a strategic lens to the ideas, imperatives, and even the conversations we have with our colleagues, throughout the journey. When viewed through the lens of a scenario planner, each step reveals a reframe that can help uncover new sources of growth and create lasting competitive advantage.

These reframes include:

1. *Observations:* Look broadly to expand and inform our thinking.
2. *Frameworks:* Imagine where trends are going, not just where they are today.
3. *Imperatives:* Use ideation as a tool to explore what's most important.
4. *Solutions:* Develop rich experiences to create context for proposed solutions.
5. *Iteration:* Monitor leading indicators to engage in an ongoing strategic conversation.

Observations. When researchers begin a new project, they strive to see the world with fresh eyes, listen, learn, and identify new points of view. The reality is that they are often rushed to recruit participants, shorten the timeframe, or cut back on activities. They resort to what they already know and collect the necessary data to better understand only the problem at hand. While this approach gets the project done faster, it may not lead to any new insights about the world.

To counter the tendency to focus on what is already known, Peter Schwartz, a futurist, author, and cofounder of the Global Business Network, challenges research to reach as broadly as possible—to expand and inform organizational thinking. In his book, *The Art of the Long View*, Schwartz suggests using the STEEP framework (social, technology, economy, environment, and politics) to collect data [4]. He asks, what are the most relevant social, demographic, or lifestyle trends? Which technologies or R&D trends could make a dent in the future of the business? What are the forces and industries shaping the economy and business climate? Which environmental issues could have a real and dramatic impact? And what are the policies and regulatory issues that might make a difference? Exploring these five categories is a great way to ensure coverage across a vast territory in a shortened timeline.

Frameworks. Frameworking is the process of organizing information to bring structure and clarity to what might otherwise seem complex. Most often, researchers look for this meaning in the observable and real. While this is helpful for developing incremental solutions, it may be even better to uncover where the world is headed, not just where it is right now.

To do this, scenario planning suggests focusing on "critical uncertainties." Filtering out the issues will be the most criti-

► A planning session with Jump Associates.

cal to the business landscape. Most organizations typically spend time articulating the insights that are already known and likely to make an impact. Yet these may not be the factors that matter most. It's often even more important to identify the issues that are less likely to occur but that would have a greater impact on the company's fortunes. Imagine how much better prepared the United States would have been if economists had dared to imagine and take steps to avoid what seemed inconceivable a year ago? Leading U.S. economists have been blindsided by the unexpected, as the unprecedented credit crisis shows.

Imperatives. At the imperatives stage of a project, researchers attempt to bring many insights together to provide direction and guide ideation. Scenario planning reframes this idea, suggesting that preemptive ideation, not just analysis, is an essential tool for identifying what will be most important. Just as if writing a story, it's important to pick a few key things that are most important to the plot. It's often helpful to try on a few different rationales, to see which one sticks. The same is true when developing imperatives. Collecting the team's ideas, putting those ideas on the table, and analyzing them to harvest tacit insights will help to focus the work and identify the most important issues.

Art Center College's Advanced Mobility Research and Graduate Industrial Design Programs have been exploring ways to do exactly this. They have developed a scenario planning card game. Players develop scenarios at a rapid clip based on the trends printed on each card. Players are forced to quickly enter a dialogue and brainstorm possible solutions and strategies. As a result, they explore many outcomes and quickly converge on what's most important [5]. Any individual, company, or industry would be smart to create their own deck of scenario playing

[5] Art Center College of Design's Advanced Mobility Research and Graduate Industrial Design Programs have developed the "Mobility VIP card game." More information on this tool, as well as their Mobility Vision Integration Process can be found at http://www.mobilityvip.com.

cards. Such a tool is a fun way to explore the most critical issues.

Solutions. During the solutions phase of a project, time is spent making ideas tangible. Designers often turn to visualization as a means to do this. Others might write reports or create spreadsheets to express their idea. But scenario planners know that great scenarios are great stories. Rich narratives bring life and context to any solution.

High levels of creativity and collaboration are required to solve complex problems. At Jump we spend time immersing ourselves in multisensory experiences to push the boundaries of our everyday thinking.

At Jump we often use the metaphor of the theater to remind ourselves to make our solutions as multisensorial as possible. In collaboration with our clients, we've run successful scenario planning work sessions in which we weave visual, auditory, and kinesthetic elements into the day, facilitating our team through multisensory experiences to give them a taste of the future. We prep clients by sending them reading material ahead of time to get them in the right head space. In the session, we use music and lights to set different tones and moods. And we facilitate a series of exercises to help them think through the implications of the work. All of these things contribute to developing rich experiences that give context to our solutions.

Iteration. Although most researchers probably already think of the explore process as iterative, most iteration is done in service of a final solution. In scenario planning, the strategic conversation never ends. It's most important to identify a few "leading indicators" or factors to monitor over time. These are issues that are important to an industry or that could affect a business decision on the horizon. Chosen and monitored carefully, these signposts become a source of enduring competitive advantage. The trick is not keeping track of everything, but identifying the few key issues to keep tabs on over the long haul. Within the context of a strategic conversation, they help to reveal how activity within a given industry is likely to shape the future.

When Peter Schwartz was working for Royal Dutch/Shell in the early 1980s, he proposed studying the future of the Soviet Union. At the time, leaders questioned the relevance of this recommendation. The Soviet Union was a small factor within a large industry. And yet Schwartz saw that this was an indicator that needed to be monitored. It had the force to cause major changes within the oil industry. What was going on in the Soviet Union had the power to signal a change in the political climate. Shell focused on the questions that challenged company mindsets, and when the Soviet Union collapsed in the early 1990s, Shell was uniquely positioned to take advantage.

Hindsight Is 20/20

Even the most experienced researchers, designers, and strategists can overlook what might seem obvious later. It happened to Motorola. While it's difficult to say exactly what went wrong, their actions indicate they were focused more on current activity than on what the world might look like a few years down the line. In 2008 they found themselves with a portfolio built for 2006, the mobile landscape having been redefined by the iPhone. We can avoid the same fate. The methods used as part of a scenario planning process—including looking at what's going on in the world today, using those trends to develop and explore a variety of potential futures, and using these futures to strategize how to best prepare for uncertainty, can help reframe how we do our work. The world keeps changing. People and their needs evolve. In order to stay competitive and create new value during uncertain times, companies need to evolve as well. These strategies can help us to make smarter decisions today and give us confidence in planning for the future.

ABOUT THE AUTHOR

Colleen Murray brings an interaction designer's sensibility to the creation of compelling future strategies. A constant explorer, she has spent a significant portion of her work at Jump Associates focused on helping clients to map out potential new business opportunities. She has helped Jump chart new territory in developing proprietary methods for opportunity mapping and scenario planning. Also an experienced strategic planner, she is adept at leading the most complex projects and finding new ways to get things done. Her experience had crossed a number of industries, including consumer electronics, digital entertainment, consumer package goods, and office environments. She is an adjunct faculty member of Illinois Institute of Technology's Institute of Design, where she teaches students how to plan design research. She holds a master's degree in design planning from the Illinois Institute of Technology and a B.F.A. in graphic design from the University of Illinois.

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Electronic Tablecloths and the Developing World

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Within the HCI community, many of us are working on how to create appropriate technologies for people living in developing countries. Some people are involved in deep ethnographies—studying and living with users in remote communities—while more technology-driven projects seek to establish appropriate digital infrastructure (for example, WiFi networks). Reporting on many of these projects has appeared in this forum over the past few years.

In doing this work, researchers can sometimes feel isolated or at odds with colleagues who are working on more mainstream problems. Certainly, mainstream-HCI techniques do not always make a smooth transition to a developing-world context. Pure participatory design is an example: How do you get someone to suggest a design for a computer system when they have never seen a computer? We get locked into thinking that we need special methods to deal with users from the developing world. But we lose sight of the fact that the users aren't different; it's the environment in which they reside.

This was brought home to me recently as I sat through Bill Gaver's closing keynote at DIS 2008. For those of you not familiar with Gaver's work (shame on you), he creates devices, such as the History Tablecloth, that explore new ways of interacting with digital technology. The History Tablecloth uses weight sensors to detect objects being placed on cloth's surface. Over time the cloth will emit light around the objects, almost like a halo, the intensity of which increases with the length of time the object rests on the table.

Gaver's main point was that devices were not designed to serve a particular goal or solve a problem, but instead offered new opportunities and resources to people. That meant it was up to the users to reason about what they were for or how they might fit into their lives. When users eventually found a use for the product, it was usually not what the designers had expected. This led Gaver to conclude he was unlikely to ever predict all the possible uses of his designs—and that this was a good thing. For example, in the case of the History Tablecloth, users deliberately placed objects on the cloth to create interesting patterns, whereas the research team had anticipated that it would be used as a history mechanism, recording household interactions as a pattern on the cloth. The best one could do, he concluded, was to recognize that users' stories were as valid as those of the researchers. So, in his current work he ensures that some aspect of the design is flexible, allowing users to impose their desires on it. For example, his Plane Tracker system uses aircraft transponders to display a Google Earth visualization of the route onto a screen in a user's living room as the plane flies overhead. However, no geo-political data was layered on top of the visualization in an effort to see how the users would interact with the little data that was presented. Would they augment the experience by looking up the route in an atlas, or be content to see the trip as purely an aesthetic experience?

Coming back to users in the developing world, the issues are surprisingly similar. Here, we also have users being exposed to novel technology, which make it impossible for them to intuitively understand how that technology might fit into their lives. Many of the researchers I have talked to have stories of how their work failed because they had not properly understood the user's needs and the social impact, economic impact, and so on, of the context and culture in which they were working. Indeed, I have many of these stories myself. However, the message I took from Gaver's talk is that failure (in the sense of accurately predicting usage) is inevitable and must be built into the design process.

This is subtly different to the argument advocating the use of prototypes. Prototypes support "fast fail"—they let you get the bad ideas out of the way so you can get on with refining the good

▸ The "History Tablecloth," developed by the Interaction Research Studio is an example of embedding computing in everyday objects. When items are left on the cloth it begins to glow beneath them, creating a slowly expanding halo. When the items are removed, the glow gradually fades.

ones. However, with Gaver's target users, and with those in developing countries, they find it hard to give feedback on how the technology could best be used in their lives based on the half-formed prototype they are presented with. Hence the artifacts that Gaver designs are finished to a very high standard before they are deployed, so that the leap the users have to make is not so great.

Inspired by these insights, my colleagues and I decided to follow Gavers methodology on our most recent study. This involved the creation of an electronic notice-board system that allows users to download multimedia content for free onto their Bluetooth-enabled cellular handsets. This work was inspired by earlier research that showed that many users in the townships around Cape Town had sophisticated cellular handsets, capable of playing MP3 or 3GP files, but they lacked the finances to download such files.

Instead of interviewing these users and including them in design sessions to discover what they would do with a system that lets them download multimedia files for free, we went ahead and built the system. We tested it in many scenarios and with many users around our university to ensure that it was robust and reliable before deploying it in a township community hall. The final system that we deployed allowed users not only to down-

load files but also to upload them. We felt this would allow the flexibility that Gaver had recommended, which would allow the users to place their own interpretation on the technology.

Before deploying the system, we had to think about how we would evaluate it. What would count as success? Our experience in running evaluations in the developing world has shown a very strong Hawthorne effect, with the subjects keen to give experimenters the results they require. Clearly, observing what was going on at the community hall would preclude unbiased results. In Gaver's work, he employed professional documentary makers who would interview participants and create a video presentation that drew out the points that seemed most relevant to the subjects. In this way, Gaver's team could get an unbiased interpretation of the results from the intervention.

In our project, we felt nervous about unleashing a documentary team on our subjects, who would have had little experience in dealing with interviews. Having them followed around by a video team was unlikely to create an accurate reflection of the users' true feelings. Instead, we adapted the documentary approach to our context. Rather than finding a professional team to do the interviews, we recruited two journalism students, who were from the same language group as our subjects. These students were able to interview the subjects in a nonthreatening way, but due to their training, they could report results to us in a way that allowed us to assess the technology's impact. We told the students only that we wanted them to find out how some new technology had affected the lives of the people living in the target community; they didn't know that we had placed the technology there in the first place.

So, after training some users on how to interact with the system and lining up the journalists to conduct the evaluation, we sat back to see what would happen.

The results from the intervention were both surprising and encouraging. As Gaver had predicted, no amount of ethnographic study or consultation would have predicted the ways in which people used the system. For example, the board became a venue for women in choirs to exchange local gospel music. On weekends they recorded their performances on the handset and then uploaded the recordings to share with ladies from other choirs. This usage was discoverable only by creating a complete, robust system that users could appropriate in ways that were truly complementary to their lifestyles.

So should we give up prototyping and just build complete systems and hope they work out fine? Definitely not. There are many instances in which low-fidelity prototypes are entirely appropriate and will help resolve design issues. However, when one is considering how technology is appropriated (as opposed to discovering if it is usable), it is important to remember that even the users themselves cannot predict how a given technology might fit into their lives.

Therefore, based on our recent experience, we recommend that you not despair if users do not appropriate your technology in the way you anticipated. Rather, embrace uncertainty and build it in to the system so that users can modify the technology to meet their needs. In our case, we did that by not prescribing a use for the system—for example, using it to distribute health information to a user's handset. By allowing users to contribute any form of information to the system, we created the space for them to explore ways of appropriating the technology. As a result, we found an application that was unlikely to have emerged through any other means. By using journalism students who were familiar with the users' culture and language, we were also able to assess the impact of that application in a way that was not possible using direct observations or even questionnaires—the creation of a questionnaire would almost certainly have required us to think of all possible outcomes and focus our evaluation to extremes.

This experience has inspired me to think more about why doing interaction design with developing-world users differs from working with users in the developed world. Understanding the divergences will provide insight into which methods can be applied in both developed and developing domains.

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Neuroscience and the Future of Human-Computer Interaction

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If Carl Sagan had been a neuroscientist instead of an astronomer, he might have mused wondrously about the "billions and billions" of neurons that make up the human brain—approximately one hundred billion neurons with each neuron wired to communicate with thousands of neighbors. This massive mesh of computation gives rise to the impressive spectrum of human cognitive capabilities. To date, most HCI researchers have focused on readily observable behavioral metrics (for example, the speed of a keystroke or the accuracy of a mouse click) rather than on the mental machinery operating under the surface. Modern neuroscience offers HCI researchers a way to "lift the veil" on user cognition, greatly expanding the available tool kit for both research and design.

Neuroscience is the study of the brain and nervous system. Although the field concerns itself with the study of neurobiological systems at the smallest scales (molecules and genes), neuroscience also works to understand how the nervous system contributes to macro-level behaviors of interest to HCI researchers. Over the past 20 years, our understanding of brain function has expanded dramatically—partially driven by advances in experimental methodology, but also enabled by a swell of research funding for the study of brain-related disorders like autism, Parkinson's disease, and traumatic brain injury. This growth is reflected in the scale and diversity of membership in the Society of Neuroscience. Founded in 1969, its ranks have doubled in the past 20 years, to more than 38,000 members. A quick tour of the society's annual meeting reveals the broad range of cognitive functions that neuroscientists are studying from a biological perspective—from perception to decision to action.

These advances in neuroscientific discovery are poised to have a profound impact on multiple facets of HCI research and system design. For starters, neuroscience enables us to build more accurate and robust models of human cognitive functions. These models may allow us to evaluate usability and predict user behavior through computation alone. In addition, neuroscience research methods will allow HCI researchers to answer questions that previously lay outside the reach of their methodological toolkit—measuring hidden metrics like interest, affect, or satisfaction. Even further down the road, neuroscience offers the potential to truly close the gap between humans and computers through the development of devices that engage directly with the brain. The aim of this article is to describe these and other synergies between neuroscience and HCI and to make a case for greater collaboration between the two communities.

Building Better Models

The idea that one could use cognitive models in lieu of real humans as a way of reducing the time/costs associated with designing an interface and conducting usability studies is not in itself novel [1]. This so-called "engineering" approach employs sophisticated cognitive models—such as EPIC, SOAR, and ACT-R—to predict how a user (or class of users) might interact with a given interface to perform a specified task. These models represent the cumulative insights of decades of psychological and behavioral research, and their ability to replicate human behavior in some narrow domains has been remarkable. However, a common criticism leveled against

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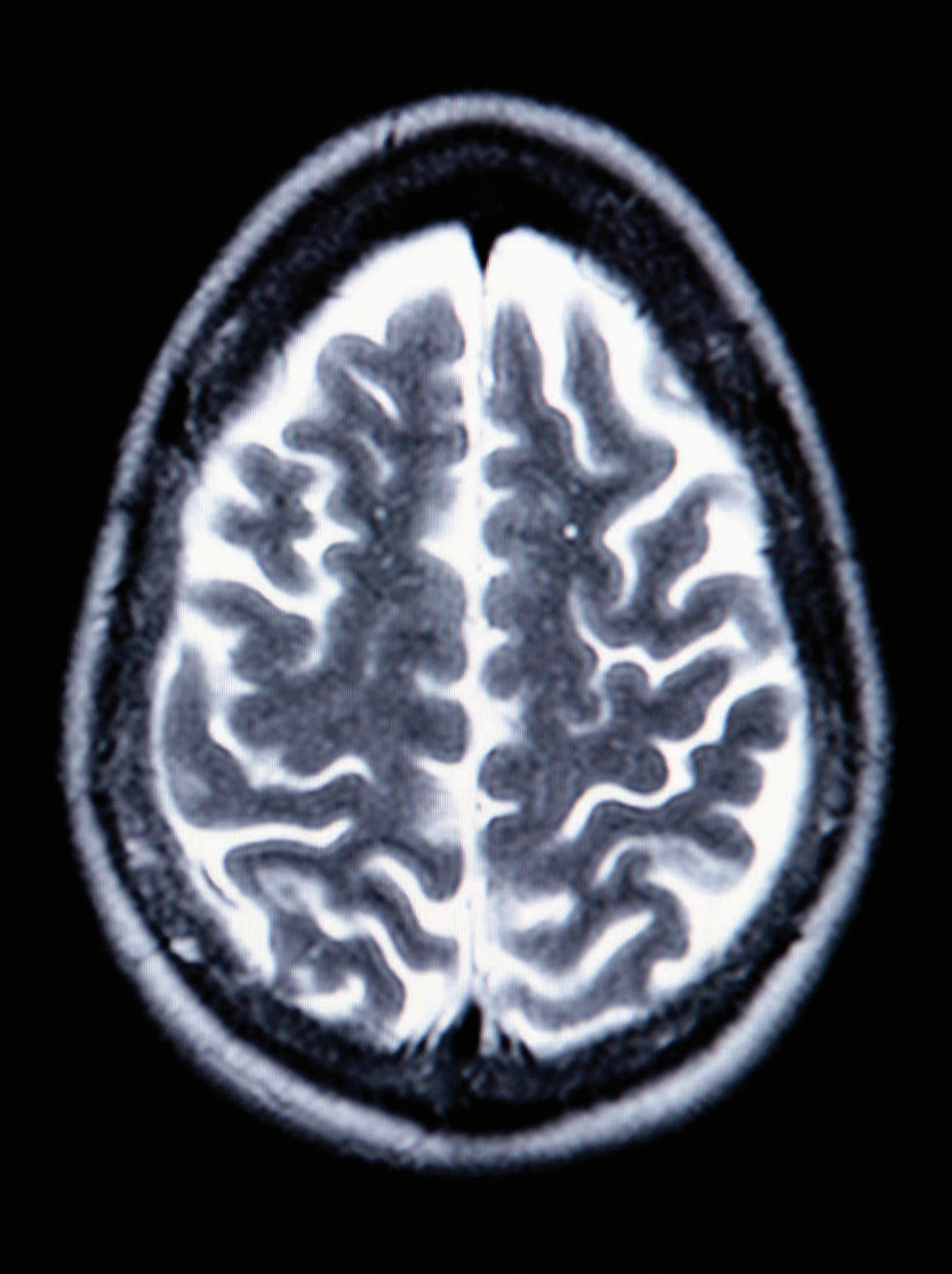

Neuroscience Tools

The tools with which neuroscientists examine brain function have multiplied over the past 15 years. While some of these tools remain fairly specialized, they are becoming more common within academia, research labs, and even commercial companies. Expertise with these and other methods is widespread throughout the neuroscience community, so the best option for the neuroscience-inclined HCI researcher (who isn't eager to wrestle with magnets or electrodes) would be to partner with an academic neuroscientist who shares an interest in the neuropsychological bases of human-computer interaction.

With the advent of Functional Magnetic Resonance Imagery (fMRI) in the 1990s, it became possible to "see" brain activity in subjects as they performed cognitive tasks. fMRI works by imaging changes in cerebral blood flow, which provides a proxy signal for neural activity throughout the whole brain. However, despite its advantages over more invasive recording techniques, fMRI is not without its drawbacks. For instance, human subjects must remain relatively motionless during an fMRI experiment, which limits the range of behaviors that can be studied. Furthermore, the cost and complexity of fMRI act as barriers to HCI researchers looking to incorporate neuroscientific approaches into their work.

There are alternatives, however, that may provide the "window into the brain" that HCI requires. Less capital-intensive methods like functional near infrared spectroscopy (fNIRS) also offer a noninvasive way to probe brain function. Like fMRI, the fNIRS signal reflects the dynamics of cerebral blood flow. However, fNIRS penetrates only a few millimeters below the brain's surface, and unlike fMRI, does not reveal the activity of deeper brain structures. Nonetheless, many of the higher cognitive functions of interest to HCI researchers —working memory, executive control, and visual-spatial processing—are localized within the outermost layer of brain tissue called the cerebral cortex, and thus are readily accessible to fNIRS.

In addition to fMRI and fNIRS, electroencephalography (EEG) —a stalwart tool of cognitive neuroscience researchers since the 1950s—offers a lightweight and low cost option. EEG setups typically consist of a web of electrodes that are carefully fitted over a person's scalp to record low-amplitude electrical brain activity at the surface of the skull. And although the drawbacks of EEG (poor spatial resolution, high susceptibility to electrical noise) limit its utility, recent advances in electrode design and signal processing techniques have expanded the range of applications for which EEG is suitable. EEG has been used to quantify cognitive workload in complex operating environments like air traffic control [2], and has also been used to quantify operator vigilance [3]; as well as to classify mental states like arousal and fatigue [4]. These findings may influence design decisions for features like adaptive automation (When should control be transferred to the machine?), and augmented cognition (In what situations does the user need assistance?). Despite these advances, EEG will need to be less obtrusive and less prone to contamination from outside sources to be useful outside the laboratory. But as the technology improves, EEG has the potential to greatly enhance our understanding of user cognitive function during the interaction experience.

this class of models is that they tend to reduce much of cognition to a collection of if-then rules, even though many, if not most cognitive functions (including perception, sensorimotor control, and some types of learning), are not neatly decomposable into a series of articulated statements. As a result, these models tend to be brittle and fail to capture the gamut of relevant user behaviors.

Computational neuroscience models, which aim not just to replicate cognitive functions but also to explain how such functions arise from underlying brain activity, represent a complementary approach. On the one hand, neuroscience-based approaches can help to improve the design of traditional cognitive models by providing a sort of biological ground truth against which to judge the plausibility of competing hypotheses and model architectures. More important, neural models may offer new functionality in domains where traditional approaches have been lacking. Visual perception, for instance, is one of the most extensively studied cognitive subsystems among neuroscientists, but traditional cognitive models have been notoriously poor at replicating the human ability to process raw visual data. As a result of neuroscience research, great headway has been made in understanding how humans make sense of their visual environment. Recent collaborative efforts between ACT-R modelers at Carnegie Mellon University and computational cognitive neuroscientists at the University of Colorado at

Boulder have led to the development of a cognitive architecture that combines the functionality of a visual neuroscience model with traditional rule-based elements [5]. Such hybrid architectures may represent the future of cognitive modeling approaches to usability analyses.

Inside the User's Head

Only a small percentage of current neuroscience research is explicitly aimed at understanding aspects of HCI. Nonetheless, some recent neuroimaging experiments point to ways in which experimental neuroscience methodology might be leveraged to measure facets of the user-interaction experience at a deeper level than can be achieved with other contemporary methods. For instance, modern neuroscience has begun to characterize the brain circuitry that governs reward-related behaviors, with fMRI experiments revealing that unexpected rewards elicit activation in areas of the human brain that utilize the chemical transmitter dopamine [6]. (A reward in these experiments is typically anything from a squirt of juice to a $10 bill.) These studies raise the intriguing possibility that neuroimaging techniques might someday be used to identify which aspects of the interaction experience a user finds pleasing.

Another example of applicable neuroscience research comes from a series of experiments examining how humans perceive computer-animated characters that vary in their degree of physical realism. One study showed that the tendency of a subject to perceive a virtual character as realistic is correlated with activation in areas of the brain known to play a role "mentalizing" [7]. Mentalizing refers to our ability to place ourselves in the mind of another person and predict their intentions. It is fundamental to human social interaction. Research points to the possibility that neuroimaging methods might be used to assess the degree in which a user perceives a virtual entity (for instance, an avatar) as a fellow autonomous being, or merely as a non-sentient computer artifact.

The main challenge ahead will be to demonstrate that a neuroscience approach to HCI adds value beyond what can be gleaned from behavioral studies alone.

The main challenge ahead will be to demonstrate that a neuroscientific approach to HCI adds value beyond what can be gleaned from behavioral studies alone. If other disciplines offer any indication, the outlook is promising. Consider the medical field, where tests that reveal what is going on "under the hood" (angiograms, throat cultures, or simple blood tests) are ordered precisely because they provide diagnostic value beyond what is available through observation of the patient's symptoms alone. And although the user (like the patient) possesses a unique awareness of what's happening inside his or her own brain (or body), and therefore can provide useful information simply by describing his or her own thought processes, an individual's ability to introspect is limited. In fact, a major thrust of modern psychological research is focused on mapping the extent of so-called implicit cognition—that vast chunk of the cognitive iceberg that floats beneath the surface of conscious thought but drives behavior in powerful ways [8]. Neuroscience will likely make valuable contributions to the discipline of HCI by providing a richer account of user cognition than that which is obtained from any other source, including the user himself.

Current Research

As described here, vision is one of the brain's most extensively studied subsystems. In addition, the brain's memory circuits have also been the subject of intense research. Since visual perception and memory are key areas of study in HCI, neuroscience-based models of these functions may be particularly well poised to have an impact on HCI research. In our work here at the MITRE Corporation, we are exploiting models of visual attention and memory to predict how visual display properties influence perception and recall by users. As part of this study, we are implementing a neurocomputational model of visual attention developed by researchers

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at the University of Southern California and the California Institute of Technology [9]. The model applies a series of feature-specific filters (color, intensity, and orientation) that emulate the processing that occurs in the retina and brain as a user views an image. For a given input image, the model produces a corresponding salience map (Figure 1) that quantitatively describes which regions of the image are most likely to draw the user's gaze—in other words, which regions "pop out" the most.

Our goal is to apply this model to investigate the relationship between the visual properties of an interface and an operator's "situational awareness." Situational awareness is the ability to perceive and understand a changing environment and predict probable future events. Memory facilitates situational awareness by enabling a user to maintain a continuously updated picture of his or her environment (playing back past events). A military commander, for example, needs situational awareness to keep track of assets and adversaries within the battle space over time. In an ongoing set of experiments, we are studying how visual salience affects memory. In particular, we are testing participants' ability to remember the location of icons on a 2-D map and examining whether greater icon salience correlates with lower spatial recall error. The broader scientific aim of our research is to examine how attention and memory subsystems interact within the brain. However, studies such as these, as well as research by other groups [10], are laying the groundwork for a new class of smart interfaces that will be able to improve operator performance by monitoring—and by adaptively modifying—the contents and configuration of the current display.

Our own experiments are examples of research where neuroscience and HCI intersect. For instance, other research efforts for the defense and automotive industries seek to correlate neurophysiological measures of cognitive workload with the properties of a user interface, thereby providing a direct link between interface properties and brain activity. In fact, many of the questions that drive contemporary cognitive neuroscience research also speak to issues in interface design. Opportunities abound for HCI researchers to collaborate with neuroscientists to address these topics of common interest. In addition to the earlier examples, neuroscientists are also studying how the brain:

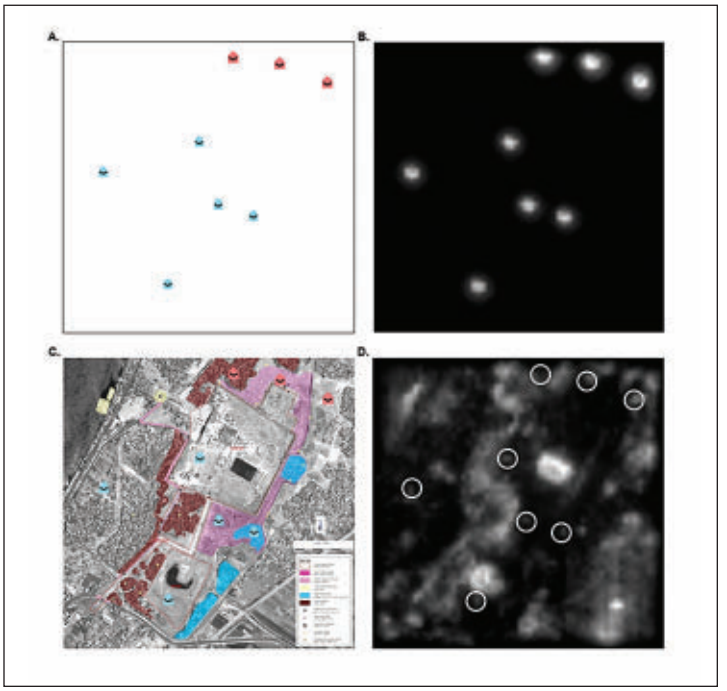
- manages attentional resources across multiple sensory channels,
- navigates through virtual as well as real environments,
- learns the most efficient procedures for performing a task,
- allocates trust in competitive and/or cooperative situations involving multiple agents or other users.

Brain-Machine Interface

The most extreme example of how neuroscience might change the trajectory of HCI comes from the nascent field of brain-

machine interface (BMI). BMI achieves a literal realization of the human computer interaction paradigm by physically connecting man and machine. Over the past several years, BMI research has led to the development of brain-implantable chips that can translate a user's neural impulses into a signal for controlling an external device, such as a robotic arm [11, 12]. Current state-of-the-art neuroprosthetic devices are far from the sleek biomorphic appendages featured in science fiction films, but are rather first-generation prototypes possessing minimal functionality. Although these technologies represent a remarkable step forward for amputees and other disabled persons, it is unlikely that healthy individuals will volunteer to undergo risky brain surgery simply for the potential interaction benefits. However, there is ongoing research to investigate the use of low-cost, noninvasive neural recording techniques—like electroencephalography (EEG)—as a basis for direct neural control of external devices [13]. These noninvasive devices may obviate the risks associated with implantable systems and provide a pathway for making BMI accessible to non-disabled users.

In fact, efforts to turn EEG into a sort of "BMI for the masses" are well under way, with at least two companies, Emotiv (www.emotiv.com) and Neurosky (www.neurosky.com), having developed EEG-based game controllers. It is unclear whether these stripped-down commercial systems (that feature far fewer electrodes than a typical laboratory configuration) actually live up to the marketing campaign. Neural activity patterns recorded through EEG usually reflect slow changes in mental state, such as changing levels of attention and arousal. Without significant advances, it's unlikely that gamers will be able to execute a rapid sequence of actions (kick-punch-jump) with their thoughts alone. But as we've seen with hacks of the Wii controller, placing an EEG device in the hands of eager users may result in new innovative applications. As these and other neurally enabled technologies become more mainstream in the next decade, members of the HCI community should be ready to capitalize on their full potential.



▸ Figure 1: An icon's salience, or "pop-out," is determined in part by the properties of the display. On a white background (A), each icon is readily found; this is quantitatively captured by the model-generated salience map (in B). When pasted on a map (C), the same icons are far less salient (D). In D., white circles denote the position of each icon.

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Doing Business by Design

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Ever since the *Harvard Business Review* declared that "the MFA is the new MBA" in 2004, the business press has published a raft of articles testifying to the rise of so-called design thinking among corporate managers. So it should come as no surprise that designers are finally starting to break out of their professional literary ghetto to write books targeted at businesspeople. Building on the tradition of such airport-bookstore staples as *Built to Last, In Search of Excellence*, and *Good to Great*, a new crop of books has emerged to offer fresh design-oriented perspectives on modern business problems, while—not to put too fine a point on it—burnishing their authors' consulting credentials.

The archetypal design book for businesspeople may be Clement Mok's *Designing Business* (published in 1996), a beautifully designed think piece that promoted the value of information design as a business strategy in the emerging Internet age. In the years since, many companies have embraced a user-centered approach to design, especially on the Web. But too often they remain fixated on designing individual "products" (websites, software applications, or physical devices). Apple notwithstanding, most companies still tend to relegate designers to the status of "exotic menials" (to borrow Ralph Caplan's term), whose job consists mainly of producing lovely artifacts. As design consciousness starts to penetrate the business mainstream, however, some designers are starting to make the case for a more strategic approach that expands the scope of design thinking beyond the realm of product development.

Ex-Apple industrial designer Robert Brunner and *Success Built to Last* coauthor Stewart Emery follow standard pop business book convention with a catchy title—*Do You Matter?*—that serves as a hook for pulling together a series of loosely related case studies that illustrate their central thesis: Companies will "matter" to their customers only if they learn to embrace design thinking at the highest levels of the organization.

Given Brunner's Cupertino pedigree, it should come as no surprise that Apple occupies center stage throughout the book (firmly ensconced in a halo that often feels more than a little self-serving). But the authors have done their homework in seeking out other effective exemplars of companies that have built effective design cultures. In the most dramatic case study, they recount the story of how Samsung chairman Lee Kun Hee transformed his company from a second-tier electronics maker into a global design leader. That transformation was thanks to a remarkably brusque internal campaign that at one point involved force-marching factory workers into a yard piled high with Samsung products, where they watched their products smashed to bits with sledgehammers—driving many of the workers to tears. So began Chairman Lee's "Year of Design Revolution." Those extreme tactics seem to have paid off. Samsung has learned to embrace design at every level of the company, and in so doing catapulted itself into the top tier of global consumer electronics makers.

Other examples are less dramatic but no less compelling, ranging from the obvious—Nike, IKEA, Virgin Atlantic—to the slightly unexpected, like Cirque du Soleil and Whole Foods. Commendably, the book also delivers a few cautionary tales of companies that failed to realize the difference between a well-designed product and a true design culture: the one-off success of Motorola's Razr phone; Starbucks's succumbing to the seductions of efficiency over experience when it junked its old manual espresso makers for the automatic kind; and the story of Polaroid (enough said).

In each case, the authors show how successful design companies move beyond product development to create cultures that drive design thinking across multiple product lines and, even deeper, bring an integrated design approach as many customer touchpoints as possible: customer service, online experiences, and in-person contacts. In the best tradition of pop business books, the authors coin a pithy catchphrase to encapsulate their point: the "customer experience supply chain."

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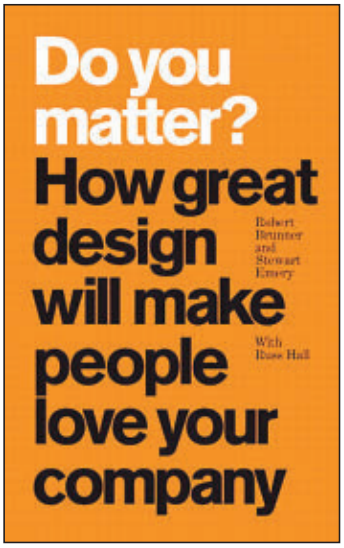
The authors stumble a bit in the closing chapters, when they try to translate their laudable vision into concrete steps that managers might take to institute design thinking at their companies. They dispense buzzwords ("Awareness," "Commitment," "Implementation"), slogans ("Design or die") and—the worst offense—a recursive acronym: FOCUS (focus, long term, authentic, vigilant, original, and repeatable). Many readers may find themselves rolling their eyes at such pop management mantras. That complaint aside, the bulk of the book is well written and the central thesis effectively argued. Readers will come away with plenty of evidence to support the authors' contention that great products alone do not make for a great company.

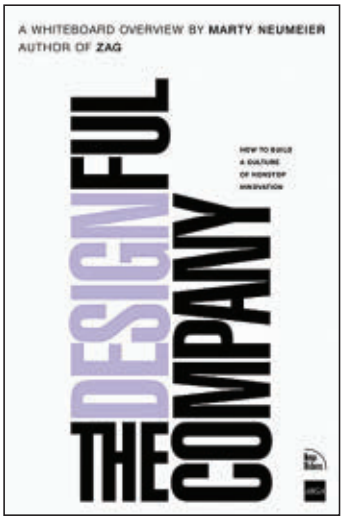
Perhaps the first company to prove that point was Eastman Kodak, whose 1886 one-button camera ("We do the rest") suggests a model of product-service integration that makes it the spiritual ancestor of the iPod. The Kodak story provides an apt starting point for *Subject to Change*, written by four members of San Francisco user experience consultancy Adaptive Path. Like Brunner and Stewart, they argue that in order to succeed in a rapidly changing marketplace, companies must move beyond the limiting perspective of one-off product design and explore ways of creating more integrated customer experiences.

While Apple has long since become the design world's most over-used case study, the authors do manage to find something new to say about the iPod. Digging past the conventional wisdom that attributes iPod mania to the simplicity of its industrial design, and arguing instead that its success really hinges on the chain of services that surround it: such as, the thread of experiences tying the iPod together with iTunes and the Apple Store, effectively integrating what Brunner and Stewart call the customer-experience supply chain.

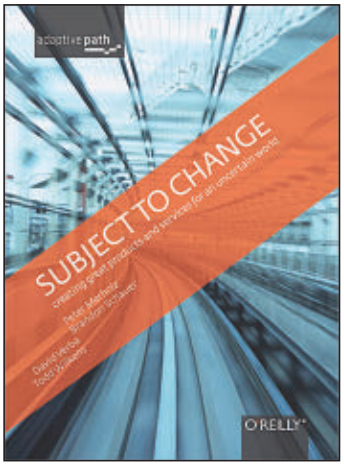
Just as Brunner and Stewart's book weighs disproportionately toward Apple, *Subject to Change* features a heavy dose of Adaptive Path clients. But the authors do manage to turn up a number of other stories that support their contention that companies can succeed by building more nimble design cultures. These range from the predictable, like Flickr and Apple, to the pleasantly surprising, like the Mayo Clinic's SPARC program for medical-service innovation.



Do You Matter? How Great Design Will Make People Love Your Company
Robert Brunner and
Stewart Emery with Russ Hall
Pearson, 2009 / $24.99



The Designful Company: How to Build a Culture of Nonstop Innovation
Marty Neumeier
New Riders, 2009 / $24.99



Subject to Change: Creating Great Products and Services for an Uncertain World
Peter Merholz, Brandon Schauer,
David Verba, and Todd Wilkens
O'Reilly, 2008 / $24.99

All three of these books share a purpose: trying to influence business readers to shift their focus from one-off-product development to a more integrated approach to designing the customer experience. The books also share a flaw: succumbing to the idealistic pitch mentality that is, alas, the consultant's stock in trade.

While the book's central thesis is timely and well focused, the book has a choppy quality that reads something like a group blog: with moments of genuine insight punctuated by a few too many half-formed arguments. In one conspicuous gap, the authors reduce the practice of ethnography down to a mere page that scarcely does the methodology justice (accompanied by the cloying suggestion that anyone interested in ethnographic research should go out and hire a consultant). The authors would have done well to follow Brunner and Emery's approach and hire a professional writer/editor to lend the book a more coherent voice.

When the authors hit their stride, however, they dispense nuggets of useful design wisdom. The book's strongest chapter, "The Design Competency," focuses on how to build an effective in-house design competency, probing one of the central challenges many companies face in trying to embrace design: how to move beyond the MBA fixation on quantitative metrics to drive innovation through qualitative methods. Here the authors stress the importance of learning to live in the "fuzzy front end" of product development by encouraging teams to get beyond reductionist approaches and presuppose multiple solutions, shift focus, and ask tough "what if you could…?" questions (à la Tivo/Netflix/FedEx). Ultimately, the authors argue that the key to product innovation lies in combining qualitative methods with a more agile approach to product development. Some designers might question the authors' wholesale endorsement of agile methods, and their seeming reluctance to devote much discussion to the pros and cons of agile development from a design perspective.

The book's penultimate chapter boils the essence of the book down to a few pithy, one-line slogans under the heading "How to Get There" ("take small steps," "encourage innovation in a tangible way," or "provide specific positive feedback and support.") that will undoubtedly ring true for many designers and managers. Such worthy sentiments cry out for a fuller treatment, however. While,the authors articulate a compelling design philosophy, they fall somewhere short of translating that vision into a workable blueprint for organizational change.

Business readers might not expect to find practical management tips in a book by a brand consultant; after all, brand people often get a bad rap as practitioners of one of the world's fluffier trades. Yet designer and brand consultant Marty Neumeier's new book *The Designful Company* turns out to contain plenty of practical advice for business readers interested in exploring what it would take to imbue their companies with more design thinking.

Keeping his audience firmly in mind, Neumeier bills his book as a "whiteboard overview" designed for a quick airplane read. He even goes so far as to provide a handy bullet-point outline of the book's contents for busy readers (an affordance this reviewer dutifully chose to forgo). Readers who engage with the whole text, however, will find that Neumeier brings a laudable dose of reality to the subject of organizational change, asserting plainly that "a company can't will itself to be agile." Instead, he suggests, design thinking is an emergent property that manifests when the right people and mind-set come together. That said, he goes on to suggest steps that managers might take to nudge their companies to "develop a 'designful mind.'"

Although Neumeier's brand orientation makes for a somewhat orthogonal approach compared with the more experience-oriented books discussed above, Neumeier winds up tackling many of the same topics, albeit with a different vocabulary. Grounding his book in the question of so-called "wicked problems"—social planner Horst Rittel's term for seemingly insurmountable challenges like balancing long-term goals with short-term demands, predicting the returns on innovative concepts, and innovating at the increasing speed of change—he argues that such deeply thorny problems demand a new way of thinking that's altogether lacking in traditional management approaches like Six Sigma. Unsurprisingly, he suggests that salvation lies in the practice of design.

Bemoaning the lack of design thinking among most MBA graduates, Neumeier tries to articulate how managers without a formal design education can nonetheless adopt a designer's point of view by cultivating empathy and intuition, an imaginative and idealistic outlook, and learning to live with the "creative tension" between vision and reality—the distance between what is and what could be. The designer's mind-set, he argues, embraces paradox and encourages so-called "third brain thinking": the ability to zoom in and out of problems at multiple levels.

Like Brunner and Emery and Adaptive Path, Neumeier advocates that managers bring design thinking "up the ladder" through research and development, industrial design, call centers, online experiences, face-to-face contacts, and so on—to create what he calls the "brand ecosystem," echoing Brunner and Stewart's notion of an "experience supply chain" (catchphrases being the currency of the business-book realm).

After a frustratingly brief discussion of the problems facing in-house designers (that Neumeier admits could be a subject for another book), he goes on to discuss what steps managers can take to imbue their organization with design thinking. He argues for establishing a design vision clearly situated in an organizational entity that can pull together a "metateam" drawn from all over the company (here he tries his best to puncture the myth of the "Lone Ranger" model of innovation by individual genius designers). He also suggests—with perhaps a hint of self-interested bias—that in-house teams should own the vision for design while outsourcing a great deal of hands-on design execution.

Neumeier's prescriptions sometimes verge on sloganeering ("Ban Powerpoint," "Establish free-speech zones"), but he does go into satisfying specifics about the importance of establishing metrics like time to market and setting measurable frameworks for evaluating pilot projects. He also argues for establishing brand-training programs to give employees certain core values that can then take shape throughout the entire chain of customer interactions. Finally, he articulates his vision of the "designful company" by pitting it against the "traditional" company, the designful company being a place where customers come before costs, vision and creativity take precedence over command and control hierarchies, and jobs are more product-oriented than role-oriented. If this sounds like Oz, well, surely it's a brand consultant's job to conjure a better world?

Ultimately, all three of these books share a purpose: trying to influence business readers to shift their focus from one-off-product development to a more integrated approach to designing the customer experience. The books also share a flaw: succumbing to the idealistic pitch mentality that is, alas, the consultant's stock in trade. A few too many feel-good nostrums tend to undermine the credibility of worthwhile arguments, by making it all seem a little too easy. One comes away wishing for a more grounded perspective, perhaps incorporating the viewpoint of beleaguered designers and managers laboring in the field (of course, most of these people are too busy to write books). On the other hand, a more reality-centered business book about design might make for less inspiring reading. In the end, we look to designers to transcend the mundane realities of money making, by transforming the world of commerce into a useful art.

ABOUT THE AUTHOR Alex Wright is the author of *Glut: Mastering Information Through the Ages*. He has led user experience design initiatives for the *New York Times*, Yahoo!, Microsoft, IBM, Harvard University, and the Long Now Foundation, among others. His writing has appeared in Salon.com, the *Christian Science Monitor*, *Harvard Magazine*, and other publications. Alex writes regularly about technology and design at http://www.alexwright.org.

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On the Relevance of Theory to Practitioners...

Jon: Subtley embedded in this issue is Molly Wright Steenson's article on Christopher Alexander and pattern languages. Many recognize Alexander's work on patterns, but few are familiar with his work on design methods. He was a proponent of the methods movement, and was fundamental in positioning design as an intellectual creative endeavor rather than a craft and hand-skill activity. Yet his work has largely been absent in the professional discourse, and many practicing designers don't know of him or his writing at all. How is it that professional designers, strategists, and managers can do their work without the larger intellectual context of theory and academic discourse?

Richard: Christopher Alexander has largely withdrawn from all such discourse, and the text Steenson references the most was never published. However, many professionals have neither the time nor the inclination to understand the relevance of theory and academic discourse. And, of course, sometimes—or perhaps often—there is little relevance, which lowers that inclination even more. Obviously, you and I are trying to do something about this, and Steenson's article reflects that, as does other content in this issue.

Jon: One of the rules we have for submissions is the actionable relevance for practitioners—even supertheoretical work must have some sort of applicability for daily practice. I feel context helps that applicability come to life. For example, Dimitris Grammenos's article is incredibly reflective, but when juxtaposed against the very pragmatic contributions of Whitney and Whitson, we can start to see a way of applying his metaphor in the context of a real-world problem: identity theft. Do you think there is a way to contextualize academic work to make it more... useful?

Richard: I do, and as you've described, I think we are doing pretty well with *interactions*. But I wish more conferences and professional programs did a better job at this. However, not all work useful to academics should be useful, or made useful, to practitioners. And not all of what we publish is about contextualizing academic work, though not all work useful to practitioners is of a nature that we would ever publish in *interactions*.

Mark Vanderbeeken's article outlines several of the issues that we do and intend to address—the data avalanche and human control, distributing technology to distribute power, and the human experience of sustainability. Some people might question how such articles achieve the publication criterion of actionable relevance for practitioners.

Jon: As a practitioner, Vanderbeeken's article resonates for me loudly. At least at frog design, we don't just make "stuff"—there must be a human and emotional impact to what we design. And I know my friends at other major firms feel the same way. The heady and intellectual issues Vanderbeeken addresses become a thematic drive behind the more pragmatic wireframes, use cases, and comps. Designers at all firms are at an interesting milestone: Our role isn't yet recognized entirely as grounded in intellect, but we've successfully moved beyond the simplicity of "craft" and "style." Do you coach your corporate clients to think more intellectually about problems? Do you reference the more academic articles that make it into our magazine?

Richard: Most definitely. And as we discussed in the September+October 2008 issue, design has a critical role to play in addressing such heady issues in addition to all sorts of narrower, intellectual issues—business issues—that companies commonly address. Do designers need someone like Christopher Alexander to step into the limelight to make this happen more quickly?

Jon: I'm not sure. I'm starting to feel that the Chris Alexanders are already out there, and the practitioners are just ignoring them. It might be time to shift the burden: Instead of demanding that academics become more relevant, perhaps it's time practicing designers started paying more attention to the huge amounts of theoretical discourse that already exists. Perhaps it's time practitioners became more thoughtful.

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