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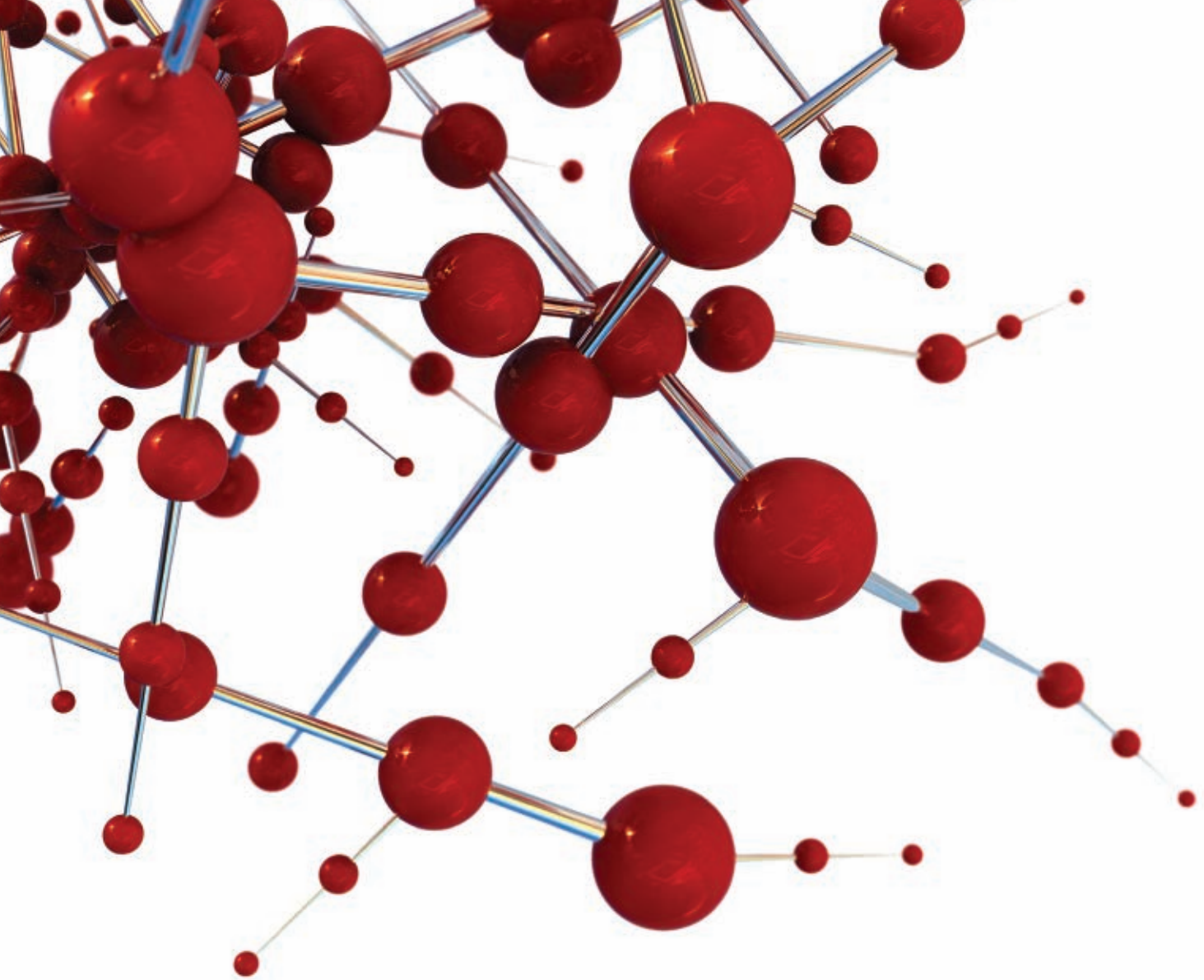
The Waste Manifesto

Cover Story By Victor Margolin

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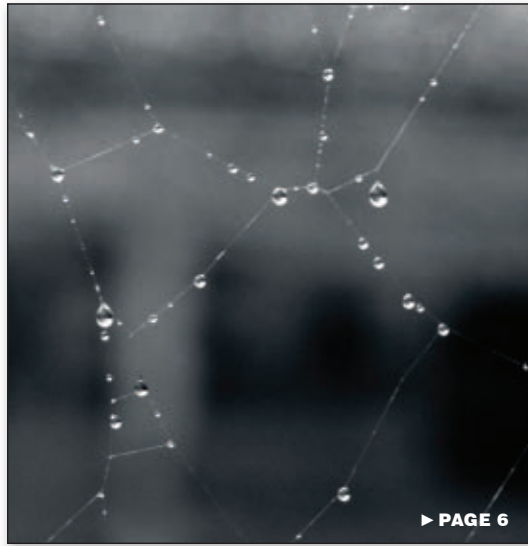
Being Green

Sustainability has moved from a fringe trend to a central way of doing business. These pieces explore the nature of designing for the world.
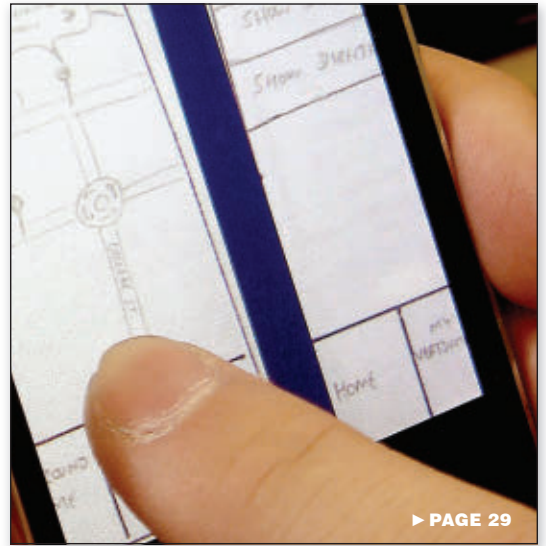
Designing for Time

Interaction occurs over time, and time introduces new challenges—and opportunities— for behavioral design.

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The Value of Culture

We build artifacts, and these artifacts in turn contribute to what we call "culture." This culture has a unique, localized value; these articles explore this sense of value.

At the Foundation

Underpinnings to our culture, behavior, and sustainability practices can be found in our infrastructure, practices, and educational artifacts.

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Interactions:
Time, Culture, and Behavior

▶ Richard Anderson

▶ Jon Kolko

Over the past 10 issues, *interactions* has, with a great deal of conscious repetition, investigated themes of global influence, sustainability, temporal aesthetics, behavior change, and the design for culture. These issues are at the heart of the human condition—whether exploring, solving, or celebrating the relationships between people and society. These themes continually combine to offer a glimpse into designing for interaction—the ability to forge connections and bridge gaps between experiences, people, and technology.

This issue of *interactions* is no different, but it exemplifies a new and subtle duality: impending doom and slight optimism.

"At the end of the world, plant a tree." This advice from the Qu'ran captures what has now become a ubiquitous sense of imminent implosion. However, it offers a glimmer of hope that the impossible is not yet out of reach. Even though the world may be on the brink of collapse, repair is still within our grasp. This notion has been reiterated at design conferences and in design communities with increasing urgency. Our world has dramatically changed in the past six months; the mere thought of continuing down the same path of irreparable consumerism seems tainted and dirty, yet down the path we progress. Impending doom, tempered by a slight optimism.

In these pages we explore this duality through a collection of articles that delve into sustainability, the evolution of practice, and particular methods.

The aforementioned quote from the Qu'ran appears in an interview with Adam Greenfield, head of design direction for service and user-interface design at Nokia. Greenfield carefully explains that he is not optimistic about the future, but instead, hopeful. This sentiment is mirrored by Victor Margolin's cover story, "The Waste Manifesto," in which he demands that we come to terms with our waste. In Margolin's

words, we must "avoid social obesity" and better our ecological footprint.

Hugh Dubberly, Christine Valenza, and Gary Hirsch all offer insight into the interactions between people, which—lest we forget—need not involve complicated information technology. Dubberly, along with Paul Pangaro, investigates the process of spoken conversation, and how ideas are shaped and formed between two people. Valenza parses the visualization of the spoken word, as she describes her work as a graphic facilitator. Hirsch describes how organizational stories evolve, and how one can shape the nature of facts and contradictions through the use of narrative and theme.

Pedro Jorge gives us insight into the conversations occurring in Hong Kong, with the intention of describing how the practice of design is viewed in Asia. In his roundtable discussion, several practitioners vent their frustrations with the speed of action—and the lack of reflective interpretation—occurring in Asian design firms. Equal cultural insight unfolds in Pablo Flores and Juan Pablo Hourcade's description of the OLPC project in Uruguay. They investigate local reaction to the deployment of 120,000 XO laptops to children in this dairy-farming land, and reflect on the consequences of this controversial approach to massive change.

Greenfield explains that he would "rather live comfortably—hopefully not obscenely so—in the years we have remaining to us, use my skills as they are most valuable to people, and cherish each moment for what it uniquely offers." He expresses a sense of quiet hope, and this issue echoes that hope. We trust that you, too, strive for such goals, and that this issue of *interactions* inspires you to reflect on this subtle theme.

—Jon Kolko
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Information System Design as Catalyst: Human Action and Environmental Sustainability

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[1] Winograd, T., and F. Flores. *Understanding Computers and Cognition: A New Foundation for Design*, Boston: Addison-Wesley, 1986.

[2] "Report of the World Commission on Environment and Development: Our Common Future," World Commission on Environment and Development, Published as Annex to General Assembly document A/42/427, Development and International Co-operation: Environment, Aug. 1987; <http://www.un-documents.net/wced-ocf.htm.>

[3] Goodland, R.T. Sustainability: Human, Social, Economic and Environmental, *Encyclopedia of Global Environmental Change*, vol. 5, edited by T. Munn, M. MacCracken, and J. Perry, 481-491, John Wiley & Sons, 2002.

[4] Friedman, B., P.H. Kahn Jr., and A. Borning. "Value Sensitive Design and Information Systems", in *Human-computer Interaction and Management Information Systems: Foundation,* edited by P. Zhang and D. Galetta, 348-372, Armonk, NY: M.E. Sharpe, 2006.

As we enter the 21st century, no issue looms larger than how we stand in relation to the natural environment. Concern is growing over the vast amount of finite resources we consume to maintain our lives. Whether one views humanity as master, steward, or just a recalcitrant member of the Earth's ecosystem, there is recognition that current lifestyles cannot sustain the environment that sustains us. What is needed is no less than a cultural shift in how we view and conduct ourselves in relation to the natural world.

Attending to an observation of Terry Winograd and Fernando Flores, that by "designing information systems we design ways of being" [1], it is clear that information systems can be integral to bringing about this cultural shift. How, then, might we support professional designers of such systems? How might we conduct design research and educate the next generation of designers? And how might we do so in a way that engages the value tensions inherent in environmental sustainability while also revealing tensions that arise from the intersection of environmental sustainability and other important human values, such as equity and innovation?

Granted, there are many ways to talk about what it means to be sustainable. Here, we work within the framework that sustainable interactive technology "...meets the needs of the present without compromising the ability of future generations to meet their own needs" [2]. One must also acknowledge that environmental sustainability is not achievable without serious consideration of social and economic sustainability [3].

This article draws attention to the unique role of information system design in catalyzing a cultural shift. So do our experiences with three projects guided by the "value sensitive design" ethos [4]: design methods that encourage creative thinking about the pervasive and systemic environmental implications of new technologies, design research that involves large-scale infrastructure around energy use, and design education that integrates environmental sustainability into a standard undergraduate capstone course. Taken together, these projects recognize shifting conditions, value tensions, and long-term systemic interactions—all crucial for engaging the challenges of environmental sustainability.

Design Method

The challenge of environmental sustainability belongs to a set of problems that require long-term, systemic thinking [5]. Yet few methods exist for engaging in problem solving for designs that can influence societies for five-, 10-, or 20-year periods. We created Envisioning Cards to assist designers in addressing challenges of this type. The cards are a physical embodiment of four critical envisioning dimensions—stakeholders, values, pervasiveness, and time—identified in previous research [6]. The four dimensions integrate concepts from long-term, successful urban-planning initiatives [7], the edgy perspective of design noir [8], and insights from value-

Stakeholders	Time	Values	Pervasiveness

Changing Hands

Consider reuse. A single product can change hands 1, 2, or more times during its lifecycle. Passed between family members (as a coming of age gift) or across town (charitable donations).

Create a scenario of your technology changing hands. Imagine specific issues an individual might face when wanting to shift ownership. What technical features might make this process smoother?

Stakeholders	Time	Values	Pervasiveness

Crossing Boundaries - Accounting for Culture

Unintended cultural bias can occur when people from one culture make assumptions about the conventions, norms, or practices of other cultures.

List 2-3 environmentally positive practices you imagine your technology might support within your own cultural context. How might those practices be different in another culture? Might the device have a different environmental impact in another culture? What can your team do to alleviate the effects of cultural bias as your system becomes pervasive?

Stakeholders	Time	Values	Pervasiveness

Adaptation

Adaptation refers to the process of changing (states or behaviors) in order to fit current conditions.

Imagine one behavior change related to your technology that would support the ability of future generations to thrive. Is there a condition (at work, on the road, at home) that the technology under consideration could improve by supporting a change to a more sustainable behavior? For example, a device that displays information on the amount of water being extracted from the local reservoir for watering a lawn.

[5] Slaughter, R.A. "Long-term Thinking and the Politics of Reconceptualization." *Futures* 28 (1996): 75-86.

[6] Nathan, L.P., et al. "Envisioning Systemic Effects on Persons and Society Throughout Interactive System Design," *Proc. of 7th Conference on Designing Interactive Systems (DIS 08)*, New York: ACM, 1-10.

[7] Taylor, N. *Urban Planning Theory Since 1945*, Thousand Oaks, CA: SAGE Publications, 1998.

[8] Dunne, A., and F. Raby, *Design Noir: The Secret Life of Electronic Objects*, London: August Media, 2001.

[9] Friedman, B., et. al., *Envisioning Cards: Prototype 2.0.*, Value Sensitive Design Research Lab, University of Washington, 2008; <http://vsdesign.org>.

[10] International Association of Universities, "Sustainable Development–Major Declarations," June 2008; <http://www.unesco.org/iau/sd/sd_declarations.html>.

[11] Petersen, J.E., et al., "Dormitory Residents Reduce Electricity Consumption when Exposed to Real-time Visual Feedback and Incentives," *International Journal of Sustainability in Higher Education*, 8 (2007) 16-33.

sensitive design research [4]. Focusing on each dimension through Envisioning Cards can scaffold problem solving around complex challenges such as environmental sustainability.

The current set of Envisioning Cards is a work in progress [9]. Beta 2.1 consists of 30 3.5x5.5-inch cards. The card includes the title of a concept on one side and an evocative image on the other. The text side includes a brief description and an activity to assist a design team in considering that particular concept in relation to their design project. The design team determines when to use the cards in the design process, how much time to spend with them, which cards to use, and how to use them (e.g., stimulate initial brainstorming, develop scenarios, craft product requirements, conduct focus groups, engage in prototype evaluation).

Individuals working within a short development cycle may feel daunted when attempting to envision how the design they are working with might encourage future cultural shifts. The card set includes a two-minute sand timer that serves to alleviate this pressure, suggesting that even in a short period, the cards can go some distance in stimulating creative solutions.

The cards help designers grapple with the following questions: Might stakeholders' other values conflict with their concern for environmental sustainability (e.g., the desire to accumulate cutting-edge technologies versus reducing consumption)? How might the environmental influence of a design shift as the tool becomes pervasive within and across societies (e.g., laptops use less energy than a desktop machine, but overtime proliferation leads to more toxic batteries in landfills)? On the previous page are examples from the Envisioning Card set, demonstrating how the cards can assist in engaging the issue of environmental sustainability.

We readily acknowledge that the Envisioning Cards do not address extremely difficult questions. For example, will the material and energy costs of creating and maintaining a "green" computing design throughout the design's life cycle be greater than the benefits? That said, the cards can help designers and policy makers consider complex, environmentally oriented design challenges, and begin to address specifics such as functionality requirements, compatibility issues, and context of use.

Design Research

Energy use, for most of us, is hidden and poorly understood. In large organizations such as university or corporate campuses, people consume a considerable amount of energy through their technologies, buildings, and activities. But how much and to what effect?

Hundreds of universities around the world have signed declarations at major environmental conferences, promising to reduce their institutions' carbon footprints as well as promote sustainability within their educational and social missions. At the University of Washington, we are developing the Community Energy Platform so that a wide spectrum of stakeholders can use data on energy consumption, including student designers/researchers, facilities engineers, environmental activists, and artists. We seek to enable people to engage with the concept of energy on their own terms, with their own projects.

The platform is a Web-based system, consisting of four main components: 1. A data service for storing and accessing time series data on energy consumption and other related data (campus population changes, daily temperature, and luminosity readings, among others); 2. Applications for making sense of the data, which will be deployed on Web pages, desktop computers, social networking sites; 3. Online environments for civic inquiry and deliberation, which make use of the applications; and 4. Policies for steering the platform's evolution at the university over the long term.

At the University of Washington, a network of electricity meters was installed in the 1990s, with meters connected to more than 200 main campus buildings. The problem is the data has remained largely sequestered within the facilities department. With the Community Energy Platform, the data will become a public resource for creating presentations that allow the exploration and scrutiny of electricity consumption.

However, even when readily available in the public sphere, graphic presentations of energy use, such as real-time readings, daily and weekly time series, and yearly demand-curve summaries, are not likely to improve the community's knowledge of energy use, much less support desired changes in human values and actions. Such presentations tend to be abstract, technical and large scale, useful to specialists but mysterious to lay people.

In fact, energy projects that clarify and inform through public dialog and activities could have a far greater impact than the presentations themselves. Yet without public and timely presentations of energy-use data, civic inquiry into the purposes and functions of buildings and our energy-related activities are not easily pursuable. Therein lies the need for an open architecture that supports accessible social and technological conditions.

In one illustrative example of collective action, undergraduate students used metering data to examine the energy consumption of a "LAN party." Late in the evening, approximately 20 students entered a computer lab, installed a computer game, and played into early the next day. Students were able to compare the energy consumption of this five-hour period against a baseline measurement, collected in previous days at the same time. They found that they could discern a small impact from their LAN party on the building's aggregate energy consumption. While quirky and rudimentary, this student-directed exploration does suggest how electricity data, when publically accessible, can be used to investigate the effects of our actions on energy use.

As we conduct design research on how best to represent electricity data for public awareness, inquiry, and discussion, we have come to recognize three fundamental issues that must be addressed in the design of the Community Energy Platform:

Design for the long term. We assume that the current electricity data will become more valuable in time—10, 20, and 50 years into the future. If so, what is the best way to represent the data, and what metadata should be preserved so that its meaning is readily carried forward?

Shifting conditions. Metering technology and data-collection systems are subject to the typical forces of IT obsolescence. A key requirement, therefore, is to construct a platform that can unify access to data in systems with varied data schemas and methods of access. In a separate vein, the university campus is dynamic, and is bound to undergo expansions and renovations. The platform must be able to accommodate future building configurations, purposes, and activities. How do we now envision requirements that enable design for future evolution?

Granularity and precision. The platform must accommodate various levels of granularity. Disaggregated data will be crucial in many applications, yet metering at the floor or workspace level might benefit groups of people, if at the cost of individual privacy. How, therefore, can the infrastructure be designed so that the level of granularity of information collection, display, and disposition can be adjusted for different contexts?

These issues mark a design stance. Rather than innovating for the immediate marketplace of products and ideas, this project has prompted us to orient our analysis well into the future. It illustrates, in summary, how the insights of the Envisioning Cards can help establish a discipline for attending to systemic and long-lived elements of information systems—elements that are essential for addressing the problem of environmental sustainability.

Design Education
Cultural shifts take hold when new practices and ways of thinking are appropriated by the next generation. Thus, we are concerned not only with methods for engaging environmental sustainability in design practice and research, but also with cultivating information system designers who will take up these concerns when they leave the university. As a field, we are beginning to explore meaningful ways to introduce students to the issues, design practice, and the technical expertise needed to meet the challenges of environmental sustainability. One form that may be particularly well suited to the pervasive and interdisciplinary challenges of environmental sustainability is the capstone experience. Part of design education is our experience with introducing an environmental sustainability theme into an undergraduate capstone course, taught from January to March 2008 at the Information School, University of Washington. Because the idea of themes was new to the Information School capstone, we encouraged but did not require that student projects address the sustainability theme. In so doing, we were poised to explore how supporting such a theme would influence not only theme-oriented projects but non-theme projects as well.

In the Information School, undergraduate capstones are student-directed projects in which students find and formulate their own problems in

[12] A. Borning, et al., "Informing Public Deliberation: Value Sensitive Design of Indicators for a Large-scale Urban Simulation," *Proc. of European Conference on Computer-Supported Cooperative Work (CSCW '05)*, Springer, 2005, 449-468.

[13] Alexander, C., S. Ishikawa, and M. Silverstein, *A Pattern Language*, New York: Oxford University Press, 1977, 48.

[14] Blevis, E., "Sustainable Interaction Design: Invention & Disposal, Renewal & Reuse," *Proc. of 25th Conference on Human Factors in Computing Systems, (CHI 07)*, New York: ACM, 509.

Acting upon the knowledge that our daily activities have serious repercussions on our natural environment means more than recycling soda cans and toting our own bags to the grocery store.

the fall quarter and design, implement, and evaluate solutions in the winter. Prompted (though not required) to consider environmental sustainability, roughly one-third of the students (29 percent) chose to engage the theme. These students developed projects around questions such as: What are people's understandings for hardware recycling? How can the display of bus schedules be improved to increase ridership in public transportation? How can online maps and social computing be used to encourage people to ride their bicycles more? And how can printing from a Web browser be improved to increase readability and decrease the use of paper and ink?

To support students' thinking on environmental sustainability, while not privileging the environmental sustainability projects, we seeded the class with targeted ideas related to the theme. We expected that all teams would use these ideas, at least to some degree, and that the themes would strengthen classroom discourse. To do so in a meaningful but even-handed way, we developed several new approaches; among them was "environmental ripples."

Environmental ripples bring to mind different ways in which information systems intersect with the natural world. At a minimum, most information systems make use of natural resources, whether ink on paper or electricity to power hardware. At the other end of the spectrum, some information systems, such as the Community Energy Platform described earlier, set out explicitly to address environmental

sustainability. In between these two endpoints exists a vast territory in which information systems designed for other primary goals can be applied or extended to further sustainability (or at least not unduly erode it). The environmental-ripples activity asks students to consider their own and their classmates' capstone projects in light of these possibilities.

We structured the environmental-ripples class activity as follows: First, prior to class we prepared poster-size charts that listed each project by name and provided three columns, one for each type of environmental ripple: connection ("How does this capstone project 'touch' or 'make contact' with the natural environment?"), opportunity ("How could this capstone project be applied or extended to address an environmental problem?"), and impact ("How does this capstone project contribute to environmental sustainability?"). We hung the charts on the classroom walls before class began. During class we introduced students to the concept of an environmental ripple in general and to the three types—connection, opportunity, and impact. Each student received two 4x6-inch Post-it notes and was asked to identify an environmental ripple for his or her own capstone project and one for another team's project (for the second project, students were asked to choose one that did not explicitly pursue an environmental theme). For each Post-it note, students were instructed to write: the project name; type of environmental ripple (connection, opportunity, or impact); the idea (be specific and detailed here...); and his or her name. Then students placed the Post-it notes in the appropriate column for the chosen capstone project.

Few projects came up empty-handed. Given the minimal requirements to qualify as a connection, that result is perhaps not surprising; however, for students it does drive home the idea that even technical projects, which seem far afield from environmental issues, have bearing on the natural environment. More surprising, for those capstone projects that were not pursuing environmental sustainability themes, students identified one or more opportunities for two-thirds (66 percent) and one or more impacts for one-third (33 percent) of the projects. For example, for a capstone project that involved providing real-time information for local concerts and

other events, students identified an environmental opportunity to support efficient route finding, carpooling, and public transportation as part of the application; for another project that developed a preliminary framework for using hand gestures as an input device, students recognized that the use of hands for input would minimize the need for hardware peripherals (e.g., mice, trackballs).

Environmental ripples, simple as they are, do lead students to this kind of creative thinking. It's not that we showed students the environmental implications and opportunities for their work; rather, with appropriate scaffolding, students discovered some of these implications for themselves. More generally, by seeking to make environmental sustainability the central focus of an undergraduate capstone experience through well-chosen activities, we and our students found that concepts related to sustainability pervaded a range of information system designs—in effect, we began a cultural shift in our own thinking about information system design.

Acting upon the knowledge that our daily activities have serious repercussions on our natural environment means more than recycling soda cans and toting our own bags to the grocery store. We need a cultural shift. That shift involves reconsidering what tools we "need," how we design those tools, how we use them, and how we deal with the tools when they are no longer necessary. Information systems—tools for creating, storing, and sharing knowledge—can play a powerful role in achieving and maintaining this shift. In particular, interactive computing tools are well poised to make the connections between our actions and energy consumption visible, connect local communities to geographically distant ones impacted by local choices, and keep a record for future generations so they can better understand our current knowledge and choices and thereby learn from our successes and failures. To achieve these kinds of ends, we need to do no less than reconsider how we think about the design of these technologies, for the long term.

Acknowledgments

ABOUT THE AUTHORS   Batya Friedman is a professor in The Information School at the University of Washington. She pioneered value sensitive design (VSD), an approach to account for human values in the design of information systems. First developed in human-computer interaction, VSD has since been used in information management, human-robotic interaction, urban planning, and, most recently, the life sciences. Friedman's work has focused on the values of privacy in public, trust, freedom from bias, moral agency, environmental sustainability, and human dignity; and engaged such technologies as Web browsers, urban simulation, robotics, open source tools, and ubiquitous computing. She is currently working on a method for envisioning and multi-lifespan information system design—new ideas for leveraging information systems to shape our future. She received her Ph.D. from UC Berkeley in 1988.

David G. Hendry is associate professor at The Information School, University of Washington, where he teaches courses in human-computer interaction, information system design, foundations of information science, among others. He is currently investigating tools, practices, and systems that create the conditions for sustainable, inclusive participation in the design of information systems. He is conducting studies with museum curators, counselors in drop-in centers for homeless young people, and facilities engineers at the University of Washington. Hendry has published work focused on information management in design, design education, search, and end-user programming. In 1998, before joining the iSchool in 2002, he created the User Experience Group at Lycos—one of the first Internet search engines—where he conducted user research on a variety of Internet search and communication products.

Lisa Nathan will join the faculty of the School of Library, Archives, and Information Science at the University of British Columbia in July 2009. Currently a doctoral candidate at the University of Washington's Information School, her research interests include information system interaction theory and methods, sustainable interaction design, and value sensitive design. In 2008 Nathan's multi-year ethnographic investigation on the use of information technology in sustainability-oriented communities won second prize in the CHI student research competition. Through field work in Tanzania, Rwanda, and the U.S. she continues to develop methods for envisioning and improving the long-term influence of information system interaction on the human condition.

The Waste Manifesto

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Waste is part of life. Human and animal bodies produce natural waste, whereas societies produce synthetic waste. While we cannot control the level of natural waste as its production is an organic part of biological survival, we can drastically reduce the production of synthetic waste. Natural and synthetic waste come in two varieties—reusable and nonreusable. The aim of a sustainable waste economy is to reuse as much waste as possible, even to the point of reducing waste surplus to zero.

To accomplish this, we would need to create a flow-through society in which all waste—natural and synthetic—is reused. The opposite of a flow-through society is a cul-de-sac society, in which waste flows into dead-end spaces where it cannot be reused. Nonreusable waste is the equivalent of fat in the human body; in excess, it produces social obesity. Because the waste economy is so complicated and so little is known about it, we can best approach the subject initially through metaphors that will help us to envision the consequences of an unsustainable waste economy.

Obesity is a useful metaphor because of its connotations: excessive and sluggish. The image of a cul-de-sac is also helpful because it brings to mind dead ends and useless collections. "Trash" and "garbage" are two terms that we apply to cul-de-sac waste. Both have negative connotations and prevent us from imagining the transformation of waste into new forms. Conversely, the image of a flow-through society helps us imagine a place of movement and transformation, where waste is constantly converted into new, usable forms. Such a society results from an efficient waste economy.

The consequences of an unsustainable waste economy are not only obesity, but also toxicity. Dumping chemicals into public waterways, burying metals in landfills, and improperly sealing and storing refuse from nuclear reactors all pollute the water we drink and the air we breathe. Such actions also poison the food we eat, as we have seen with mercury contaminated fish. Likewise, excessive carbon dioxide through motor vehicle exhaust has contributed to global warming.

To offset these dangerous consequences, we need to construct a sustainable waste economy. This is a daunting task, but it is essential to the long-term survival of human life. Such an economy would counteract the following destructive tendencies:

1. The conversion of large spaces into landfills, which in reality are garbage cemeteries.

2. The high cost of disposing nonreusable waste.

3. The reduction of otherwise reusable waste that could be converted to commoditized products.

4. The toxicity of improperly disposed of waste materials.

5. The medical costs of treating the impact of toxicity on human health.

6. The politics of landfill locations and nonreusable waste disposal.

7. The potential of reaching limits for disposing of nonreusable waste: limits of space, limits of money, and limits of political tolerance.

The simple recognition of an unsustainable waste economy's consequences forces the conclusion that the disposal of nonreusable waste cannot continue forever. When limits are reached, the results of continued unsustainable waste-disposal practices will be widely evident and politically charged.

The first task toward creating a global sustainable waste economy is adopting some terms that make sense and that can be used with a shared understanding of their meaning. First is the term "waste." Waste itself is not inherently negative, given that it is a necessary consequence of biological and social activity. Garbage and trash are its negative synonyms, but waste can have benefits. In the most positive sense, reusable waste can play an important commodity function in a sustainable waste economy. Disposing of waste,

▶ A trash dump in rural North Carolina. All these things could be recycled if the human will and proper facilities were in place.

managing it, and transforming it into new products would provide large numbers of jobs. In a flow-through society, the costs of disposal are returned as waste is transformed into new materials. In a cul-de-sac society, waste-disposal costs become a drain on municipal, state, and national budgets. But the transformation of waste provides a great challenge for inventors, designers, and social managers. In recent years, new uses have arisen for materials that would otherwise have become garbage or trash. The slow development of such uses can be attributed largely to a lack of will and complacency about the future availability of resources.

Manufacturers have found new ways to reuse waste materials to create new products such as recycled paper and parts for automobiles. The costs of manufacturing with recycled materials may currently be steep, but they can surely be reduced as this becomes a mainstream activity.

When we consider the need for an efficient and sustainable waste economy, perhaps the largest obstacle to building such an economy is public ignorance of how it might work. There is almost no public information on where waste goes. We deposit human and social waste in various types of receptacles and then

continue obliviously about our business. Now that we are in the midst of a severe financial crisis, the destructive aspects of the global financial system are coming out, and society is demanding regulation. The earlier relaxation of regulations was due in part to the public's ignorance of what was at stake. Bankers created unsustainable commodities, while the public remained in the dark. Only when the system crashed did we begin to see the negative implications of what had been done.

While the waste economy is not yet on the edge of crashing as a whole, parts of it have already collapsed, particularly through

Photograph by Victor Margolin

unsustainable levels of pollution in our air, land, and water. The accumulation of trash and garbage is also approaching unsustainable levels, where there will no longer be space to bury any more of it, nor will poor countries be willing to take it, even if they are paid well to do so.

To explain to the public how the waste economy works will require a massive education effort, one that politicians would be well advised to support. We must first identify the many kinds of natural and synthetic waste, and then clarify how it is currently handled. Finally, we must understand how a sustainable waste economy would work.

Bits and pieces of this knowledge are already public and have prompted the involvement of activists. Communities have rallied to protest chemical dumping in public waterways, heavy polluting from coal-fired factories, and the inefficient disposal of nuclear waste. As consumers, however, some of us tolerate excessive packaging, insufficient opportunities to recycle, and the manufacturing of products that render our land, water, and air more toxic.

There are also social groups who advocate less consumption and urge the design of products that can last longer. All these efforts are worthwhile but can be strengthened and expanded as we better understand how the waste economy works in a flow-through society and how dysfunctional it is in a cul-de-sac culture.

As a social product, the waste economy calls for a comprehensive design approach. Just as economists are trained to think about the financial economy as a system, we need trained experts who can think about the waste economy in a similar fashion. Designers are essential to enabling the transformation from an unsustainable to a sustainable waste economy. We not only need new products that can last longer, be disassembled, be reconverted, and can function without toxic components, we must also find ways to package products with materials that can be more easily recycled or reused. And finally, we need new systems to generate economic value through collecting natural and human waste and transforming it into new products. A few far-sighted people have

begun to work in these areas, but they mostly lack the ability to link their efforts to those of others in a systemic way.

At stake in attempting to create a sustainable waste economy is the issue of whether or not we can avoid social obesity, something that can paralyze us logistically, physically, and economically.

The current financial crisis has shown us that capable minds are available to consider better alternatives to the failed economic system that has caused such financial havoc. Until we understand that there is a systemic waste economy that is malfunctioning and nearing critical limits, we are not in a position to imagine large-scale interventions. We need to learn more about how waste economies function, clarify for the public the mechanisms of the current system, and assess which can contribute to a new sustainable waste economy and which are the equivalent of toxic financial assets. We also need purposeful action to avert the level of disaster in the environment that we have recently seen in the world of finance.

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Victor Margolin is professor emeritus of design history at the University of Illinois, Chicago. He is a founding editor and now co-editor of the academic design journal *Design Issues*. Margolin has published widely on diverse design topics. He has written, edited, or co-edited several books including: *The Struggle for Utopia: Rodchenko, Lissitzky, Moholy-Nagy, 1917-1936; Design Discourse; Discovering Design; The Idea of Design*; and *The Politics of the Artificial: Essays on Design and Design Studies*. He is currently working on a world history of design.

Steven Heller

"At The End of the World, Plant a Tree": Six Questions for Adam Greenfield

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Tish Shute: Legal scholar Eben Moglen has identified three elements of privacy: anonymity, secrecy, and most important, autonomy. How do you see Moglen's three elements in the context of a ubiquitously networked world? Are there ways we could design ubiquitous systems that might support personal autonomy?

Adam Greenfield: If we accept for the moment a definition of autonomy as a feeling of being the master of one's own fate, then absolutely, yes. One thing I talk about a good deal is using ambient situational awareness to lower decision costs—that is, to lower the information costs associated with arriving at a choice presented to you, and at the same time mitigate the opportunity costs of having committed yourself to a course of action. When given some kind of real-time overview of all of the options available to you in a given time, place, and context—especially if that comes wrapped up in some kind of visualization that makes anomaly detection a matter of instantaneous gestalt, to be grasped in a single glance—your personal autonomy is tremendously enhanced. Tremendously enhanced.

What do I mean by that? It's really simple: You don't head out to the bus stop until your phone tells you a bus is one minute away, and you don't walk down the street where more than some threshold number of muggings happen—in fact, by default it doesn't even show up on your map—and you don't eat at the restaurant whose 48 recent health code violations cause its name to flash red in your address book. And all these decisions are made possible because networked informatics have effectively rendered the obscure and the hidden transparent to inquiry. There's no doubt in my mind that life is thusly made just that little bit better.

But there's a cost; there's always a cost. Serendipity, solitude, anonymity—most of what we now recognize as the makings of urban savoir-faire—it all goes by the wayside. And yes, we're richer and safer and maybe even happier with the advent of the services and systems I'm so interested in, but by the same token, we're that much poorer for the loss of these intangibles. It's a complicated trade-off, and I believe in most places it's one we're making without really examining what's at stake.

So as to how this local autonomy could be deployed in Moglen's more general terms, I don't know, and I'm not sure anyone does. Because he's absolutely right: Bernard Stiegler reminds us that the network constitutes a "global mnemotechnics," a persistent memory store for planet Earth.

I'd rather live comfortably—hopefully not obscenely so— in the years we have remaining to us, use my skills as they are most valuable to people, and cherish each moment for what it uniquely offers.

And yet we've structured our systems of jurisprudence and our life practices and even our psyches around the idea that information about us eventually expires and leaves the world. Its failure to do so in the context of Facebook, Flickr, and Twitter is clearly one of the ways in which the elaboration of our digital selves constrains our real-world behavior. Let just one picture of you grabbing a cardboard cut-out's breast or taking a bong hit leak onto the network, and see how the career options available to you shift in response.

This is what's behind Anne Galloway's calls for a "forgetting machine." An everyware that did that—massively spoofed our traces in the world and threw up enormous clouds of winnow and chaff to give us plausible deni-ability about our whereabouts and so on—might give us a fight-ing chance.

Tish: **Early theorizing of a "calm, invisible" ubicomp seems out of synch with the present-day reality of services like Twitter and Facebook, where active, engaged, contact-driven users continually manage their networked identity. What role will the processes of contact and identity sharing that have cap-tured the popular imagination play in the city that is "here for you to use"?**

Adam: Let's remember that ubicomp itself, as a discipline, has largely moved on from the Weiserian discourse of "calm technology." Yvonne Rogers, for example, now speaks of "pro-active systems for proactive people." You can look at this as a necessary accommodation with the reality principle, which it is, or as kind of a shame—which it also happens to be, at least in my opinion. Either way, I don't think anybody can credibly argue any longer that just because infor-matic systems pervade our lives, designers will be compelled to craft encalming interfaces to them. That notion of Mark Weiser's was never particularly convincing, and as far as I'm concerned, it's been thoroughly refuted by the unfolding actual-ity of post-PC informatics.

All the available evidence, on the contrary, supports the idea that we will have to actively fight for moments of calm and reflec-tion, as individuals and as col-lectivities. And not only for that, as it happens, but also for spaces in which we're able to engage with the other on neutral turf, as it were, since the logic of "social media" seems to be producing *Big Sort*-like effects and echo cham-bers. When given the tools that allow us to do so, we seem to

surround ourselves with people who look and think and consume like we do. The result is that the tools allowing us to become involved with anything but the self, or selves that strongly resemble it, are atrophying.

So when people complain about K-Mart and Starbucks and American Eagle Outfitters coming to Manhattan, and how it means the suburbanization of the city, I have to laugh. Because the real suburbanization is the smoothen-ing out of our social interaction until it only encompasses the congenial. A gated community where everyone looks and acts the same? That's the suburbs, wherever and however it instanti-ates, and I don't care how pre-cious and edgy your tastes may be. Richard Sennett argued that what makes urbanity is precisely the quality of necessary, daily, cheek-by-jowl confrontation with a panoply of the different, and as far as I can tell he's spot on.

We have to devise platforms that accommodate and yet buf-fer that confrontation. We have to create the safe(r) spaces that allow us to negotiate that differ-ence. The alternative to doing so is creating a world of 10 mil-lion autistic, utterly atomic, and mutually incomprehensible tribe-lets, each reinforced in the illu-sion of its own impeccable cor-rectness: duller than dull, except at the flashpoints between. And those become murderous. Nope. Unacceptable outcome.

Tish: **What new imaginings or possibilities do you see when pixels anywhere are linked to everyware?**

Adam: Limitless opportuni-ties for product placement. Commercial insertions and injec-tions, mostly.

Beyond that, one of the places where shallowly Weiserian logic breaks down is in thinking that the platforms we use now disappear from the world just because ubiquitous computing has arrived. We've still got radio, for example—OK, now it's satellite radio and streaming Internet feeds—but the interaction metaphor isn't any different. By the same token, we're still going to be using reasonably conventional-looking laptops and desktop keyboard/display combos for a while yet. The form factor is pretty well optimized for the delivery of a certain class of services. It's a convenient and well-assimilated interaction vocabulary; none of that's going away just yet. And the same goes for billboards and TV screens.

But all of those things become entirely different propositions in the everyware world: more open, more modular, ever more conceived of as network resources with particular input and output affordances. We already see some signs of this with Microsoft's recent "Social Desktop" prototype—which, mind you, is a very bad idea as it currently stands, especially as implemented on something with the kind of security record that Windows enjoys—and we'll be seeing many more.

If every display in the world has an IP address and a self-descriptor indicating what kind of protocols it's capable of handling, then you begin to get into some really interesting and thorny territory. The first things to go away, off the top of my head, are screens for a certain class of mobile device—why power a screen off your battery when you can push the data to a nearby

display that's much bigger, much brighter, much more social—and conventional projectors.

Then we get into some very interesting issues around large, public interactive displays—who "drives" the display, and so forth. But here again, we'll have to fight to keep these things sane. It's past time for a public debate around these issues, because they're unquestionably going to condition the everyday experience of walking down the street in most of our cities. And that's difficult to do when times are hard and people have more pressing concerns on their mind.

Tish: The science fiction writer David Brin sees two potential futures: In the first, the government watches everybody, and in the second everybody watches everybody. (He calls the latter "sousveillance.") Artificial-intelligence enthusiast Ben Goertzel has suggested that providing an artificial intelligence with access to a massive data store fed by ubicomp is the first step toward effective sousveillance. What do you think the role of AI in ubicomp will be? Is it worth thinking about what the first important application of such technologies might be?

Adam: I don't believe that "artificial intelligence," as the term is generally understood—which is to say, a self-aware, general-purpose intelligence of human capacity or greater—is likely to appear within my lifetime, or for a comfortably long time thereafter.

Having said that, Goertzel seems to be making the titanic and enormously difficult to justify assumption that a self-aware artificial intelligence would share

any perspectives, goals, priorities, or values whatsoever with the human species, let alone with that fraction of the human species that could use a little help in countering watchfulness from above. "Hooking an AI up to a massive datastore fed by ubicomp" sounds to me more like the first step toward enslavement…if not outright digestion.

"Sousveillance"—the term is Steve Mann's, originally—doesn't imply "everybody watching everybody" to me, anyway, so much as a consciously political act of turning infrastructures of observation and control back on those specific institutions most used to employing the same toward their own prerogatives. Think Rodney King, think Oscar Grant.

Tish: You seem to be skeptical about the potential role of everyware in sustainable living. And yet at the moment it seems that—in the hacker and business communities, at least—the role of everyware in reducing carbon footprint/energy management, etc., is the great green hope. Will everyware enable or hinder fundamental changes at the level of culture and identity necessary to support the urgent global need "to consume less and redefine prosperity"?

Adam: I'm not skeptical about the potential of ubiquitous systems to meter energy use, and maybe even incentivize some reduction in that use. Not at all. I'm simply not convinced that anything we do will make any difference.

Look, I think we really, seriously screwed the pooch on this. We have fouled the nest so thoroughly and in so many ways that I would be absolutely

shocked if humanity comes out the other end of this century with any level of organization above that of clans and villages. It's not just carbon emissions and global warming: It's depleted soil fertility, it's synthetic estrogens bio-accumulating in the aquatic food chain, it's our inability to stop using antibiotics in a way that gives rise to multiple drug resistance in microbes.

Any one of these threats in isolation would pose a challenge to our ability to collectively identify and respond to it, as it's clear that anthropogenic global warming already does. Put all of these things together, assess the total threat they pose in the light of our societies' willingness and/or capacity to reckon with them, and I think any moderately knowledgeable and intellectually honest person has to conclude that it's more or less "game over, man." That sometime in the next 60 years or so, a convergence of extremely bad circumstances is going to put an effective end to our ability to conduct highly ordered and highly energy-intensive civilization on this planet, for something on the order of thousands of years to come.

So with all apologies to Bruce Sterling, I just don't buy the idea that we're going to consume our way to Ecotopia. Nor is any symbolic act of abjection on my part going to postpone the inevitable by so much as a second, nor would such a sacrifice do anything meaningful to improve anybody else's outcomes. I'd rather live comfortably—hopefully not obscenely so—in the years we have remaining to us, use my skills as they are most valuable to people, and cherish each moment for what it uniquely offers.

Maybe some people would find that prospect morbid, or nihilistic, but I find it kind of inspiring. It becomes even more crucial that we not waste the little time we do have on broken systems or broken ways of doing things. The primary question for the designers of urban informatics under such circumstances is to design systems that underwrite autonomy, that allow people to make the best and wisest and most resonant use of whatever time they have left on the planet. And who knows? That effort may bear fruit in ways we have no way of anticipating. As it says in the Qu'ran, gorgeously: "At the end of the world, plant a tree."

Tish: The concept of autonomy is clear in the title of your next book, The City Is Here for You to Use, and it's a consistent theme in your writing. While you have in the past (notably in Everyware) discussed the possible constraints to presentation of self and threats to a flexible identity posed by ubiquitous computing, your next book signals optimism. What are your grounds for this optimism?

Adam: It's not optimism so much as hope. Whether it's well founded or not is not for me to decide. I guess I just trust people to make reasonably good choices, when they're both aware of the stakes and have been presented with sound, accurate decision-support material.

Putting a fine point on it: I believe that most people don't actually want to be jerks. We may have differing conceptions of the good, and our choices may impinge on one another's autonomy. But I think most of us, if confronted with the humanity

of the other and offered the ability to do so, would want to find some arrangement that lets everyone find some satisfaction in the world. And in its ability to assist us in signaling our needs and desires, in its potential to mediate the mutual fulfillment of same, in its promise to reduce the fear people face when confronted with the immediate necessity to make a decision on radically imperfect information, a properly designed networked informatics could underwrite the most transformative expansions of people's ability to determine the circumstances of their own lives.

Now that's epochal. If that isn't cause for hope, then I don't know what is.

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What is Conversation, And How Can We Design For It?

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Interaction describes a range of processes. A previous "On Modeling" article presented models of interaction based on the internal capacity of the systems doing the interacting [1]. At one extreme, there are simple reactive systems, such as a door that opens when you step on a mat or a search engine that returns results when you submit a query. At the other extreme is conversation. Conversation is a progression of exchanges among participants. Each participant is a "learning system," that is, a system that changes internally as a consequence of experience. This highly complex type of interaction is also quite powerful, for conversation is the means by which existing knowledge is conveyed and new knowledge is generated.

We talk all the time, but we're usually unaware of when conversation works, when it doesn't, and how we can improve it. Few of us have robust models of conversation. This article addresses the questions: What is conversation? How can conversation be improved? And, if conversation is important, why don't we consider conversation explicitly when we design for interaction? This article hopes to move practice in that direction. If, as this forum has often argued, models can improve design, we further ask, what models of conversation are useful for interaction design?

We begin by contrasting "conversation" with "communication" in a specific sense. We then offer a pragmatic but not exhaustive model of the process of conversing and explore how it is useful for design.

What Isn't Conversation?

Claude Shannon developed a rigorous model of a transmission channel used to convey messages between an information source and a destination. While his context was analog telephones with wires highly susceptible to noise, Shannon produced a model that applies to a wide range of situations.

In Shannon's model an information source selects a message from a known set of possible messages, for example, a dot or a dash, a letter of the alphabet, or a word or phrase from a list. Human communication often relies on context to limit the expected set of messages. If you receive a call from a friend (the source) arriving by train, you expect to hear "I'm getting on the train," or "I'm on the train," or "the train is late," and so on—messages that are drawn from a set of possibilities known to both of you. The channel is effective if it enables you (the destination) to select which of the possible messages is currently being transmitted. (Voice communication is more than sufficient for this, and Shannon's interest was highly encoded transmission. But this simplified example draws useful distinctions for the discussion that follows.)

Communication in the sense of distinguishing among possible messages known in advance is important for much of our daily life. It allows us to synchronize a wide range of actions with others. But it has limits. Shannon's model captures a fundamental limit of nearly all human-to-computer interaction: Our input gestures can only activate an existing interface command (select a message) from the preprogrammed set. While we can automate sequences of existing commands, we can't ask for something novel. If our software application does anything novel, we file a bug report!

In Shannon's model, how can we say something novel to one another? The answer is, we can't. It's

[1] Dubberly, H., U. Haque, and P. Pangaro. "What Is Interaction? Are There Different Types?", *interactions* 16, no.1 (2009): 69-75.

not designed for that. We need the capacity for new messages to be generated and the resultant understanding confirmed or denied. We call interaction with these capacities "conversation." Only in conversation can we learn new concepts, share and evolve knowledge, and confirm agreement. To describe how this works, we draw on the efforts of Gordon Pask, specifically his cybernetic models of conversation theory, because they are based on a deep study of human-to-human and human-to-machine interaction and because of their prescriptive power [2].

What Is the Process of Conversation?
Conversation at its simplest takes place when participants perform these tasks:

1. *Open a channel.* When participant A sends an initial message, the possibility for conversation opens. For conversation to follow, the message must establish common ground; it must be comprehensible to participant B.

2. *Commit to engage.* Participant B must pay attention to the message and then commit to engaging with A. Such a commitment may amount to nothing more than continuing to pay attention. For conversation to persist, the commitment must be symmetrical, and either side may break off for any reason, at any time. Put another way, each participant must see value in continuing the conversation, which offsets the personal cost of being engaged; what we call the "bio-cost," or the energy, time, attention, and stress required [3].

3. *Construct meaning.* Conversation enables us to construct (or reconstruct) meaning, including meaning that is new to the destination. Conversation theory has a highly detailed model that we must leave to other descriptions though it is useful even in this skeletal form [4].

Messages are composed with topics or distinctions that are already shared, on the basis of prior conversation or shared contexts, such as common language and social norms. Participant A uses the message channel to convey what these topics are and how they are distinct from one another (descriptive dynamics), along with a kind of "glue" that explains just how these topics interact to make up the new concept (prescriptive dynamics). Participant B "takes all this in" and "puts it all together" to reproduce A's meaning (or something close enough).

This can occur because, first, the descriptive and prescriptive dynamics come together to express an inherent coherence for the concept—they fit together like gears in a watch and only in a limited way or ways. Second, the human nervous system has evolved especially to make sense of the messages that arrive [5]. This "meaning making" (taking all this in and putting it all together) is a mini AHA moment, every time we "get" what someone is saying [6].

4. *Evolve.* Participant A or B (or both) are different after the interaction. Either or both hold new beliefs, make decisions, or develop new relationships, with others, with circumstances or objects, or with themselves.

[2] For a general review of Conversation Theory, see Pask, G., *Conversation Theory: Applications in Education and Epistemology*, Elsevier Publishing Co., Amsterdam and New York, 1976. For a short explication of Pask's conversation structure, see <http://pangaro.com/L1L0/>. For Pask's experimental framework for interaction studies, see Pask, G., *The Cybernetics of Human Learning and Performance*, Hutchinson, London, 1975.

[3] See <http://www.cyberneticlifestyles.com/biocost-treatise.html>

[4] Pask, G., "An Essay on the Kinetics of Language, Behavior and Thought," *Proceedings, Silver Anniversary International Meeting of Society for General Systems Research*, London, August 1979. A summary of the knowledge model, called entailment meshes, is available at <http://pangaro.com/entailments/entailing-v2.htm> and video explanations of entailment meshes are available at <http://www.cyberneticians.com/index.html#pan>

[5] Von Foerster said, "The nervous system organizes the world to compute a stable state." Quoted in Pangaro, P., "The Past-Future of Cybernetics: Conversations, Von Foerster, and the BCL," Chapter 8 in Müller, A., and Müller, K. *An Unfinished Revolution?*, edition echoraum, Vienna 2007, page 9. Preprint download at <http://pangaro.com/HvF/hvf-bcl-abstract.html>

[6] Pask, G., "Developments in Conversation Theory Part I," *International Journal of Man-Machine Studies* (now *International Journal of Human-Computer Studies*) 13, no. 4(1980): 357-411.

Info Source — Message → Transmitter — Signal → Receiver — Message → Destination — Received Signal — Noise Source
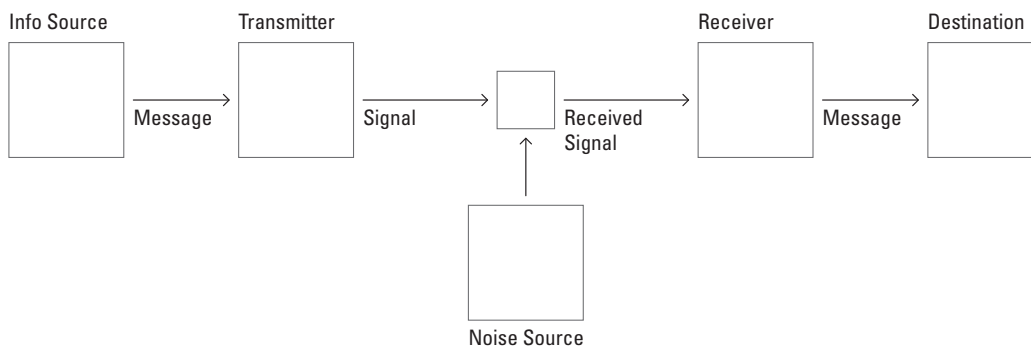
▶ Shannon's Model of Communication: A message flows from an information source through a transmitter that encodes a signal. The communication channel, shown as the tiny square box subject to noise, conveys the signal to a receiver, which decodes the signal into a message that is delivered to a destination.
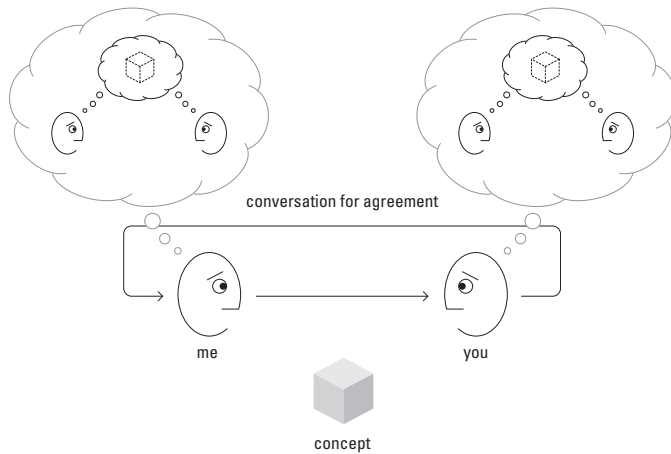
▶ Conversation for Agreement: As a result of conversation, participants agree on their understanding of a concept in that they share a similar model, and they believe that they agree.

Here we define an "effective conversation" as an interaction in which the changes brought about by conversation have lasting value to the participants.

5. *Converge on agreement.* Participant B may wish to confirm understanding of A's concept. To do so, B must create and transmit a different formulation of the topic(s) under discussion, one that captures his model of the concept. On receipt, participant A attempts to make sense of B's formulation and compares it with her original intention. This may lead to further exchanges. When both A and B judge that the concepts match sufficiently, they have reached "an agreement over an understanding." Such agreement may involve a fact about the world or merely shared belief. Sometimes participants agree on the qualities of a song, or that they like each other enough to continue talking.

6. *Act or Transact.* Sometimes one or more of the participants agrees to perform an action as a result of, and beyond, the conversation that has taken place. For example, they may agree to play a game together or enter into a relationship. Or they may agree to an exchange, as when money is traded for a product or service.

Thus we have a simplified description of conversation. All of us experience breakdowns in conversations; it is near miraculous that we understand each other at all. But if you comprehend this, the process of conversation is working right now.

What Does Conversation Offer?
Conversation enables participants to:

1. *Learn.* We learn a great deal via conversation, including conversations with ourselves. We learn highly valuable life lessons, for example, ways to avoid being run over by a bus. At an opposite extreme, what we learn might seem simple: Our partner prefers drinking noncarbonated, room-temperature water; registering a credit card on a website saves time when buying airline tickets. Trivial as these examples may seem, learning basic things may save time later, freeing our future attention for other, less trivial, things. This is a valuable benefit of interactions that have memory and that evolve into relationships.

2. *Coordinate.* We spend a great deal of time with others not merely synchronizing ("You've arrived, so let's start!"), but also coordinating our actions in ways that are mutually beneficial. Anytime we negotiate one favor for another, we use conversation to reach an agreement to transact:

Me: "I'll pick up the laundry if you stop for
     groceries, OK?"
You: "No, you have to take the car in for servicing."
Me: "I can do both, but you'll have to cook if
     you want to eat on time."
You: "That still works for me."
Me: "OK, good."

In practice, society is a complex market of coordination based in conversation. Money is often used in the transaction, but not always. Subsets of the population agree to perform some actions (grow food, manufacture products, educate children, enforce the law) paid for by others who are free to do what they do, for (hopefully) mutual benefit.

Individuals and society become more efficient by coordinating work. This frees resources for other activities—including the design of more efficient products and services, in a recursive and generative process—which supported the Industrial Revolution. Conversation is the primary mechanism for complex human social coordination. It is a highly effective form of bio-cost reduction and therefore an engine of society.

3. *Collaborate.* Coordination of action assumes relatively clear goals, but many times social interaction involves the negotiation of goals. (Horst Rittel believed this to be a fundamental challenge of design [6].) We may want to eat together,

but one of us prefers Italian food, while the other doesn't want to spend too much or listen to opera while eating. Or, we need to redesign our Web service but have conflicting demands for features, quality of experience, and development time. Or we would like to see a more equitable health care system. Conversation is a requisite for agreeing on goals, as well as for agreeing upon, and coordinating, our actions.

What Are the Limits To a Conversation?
When designing for conversation, it is critical to consider what cannot happen. What can't be talked about can't be learned, conveyed, agreed on, or transacted. Conversations may be limited in two fundamental ways:

1. *Conversational infrastructure.* We are frustrated when we can't open a channel for conversation or when the channel is full of noise (experienced by

questions and testing understanding

conveying concepts

me   you

conversation as a means to convey concepts
and to confirm agreement
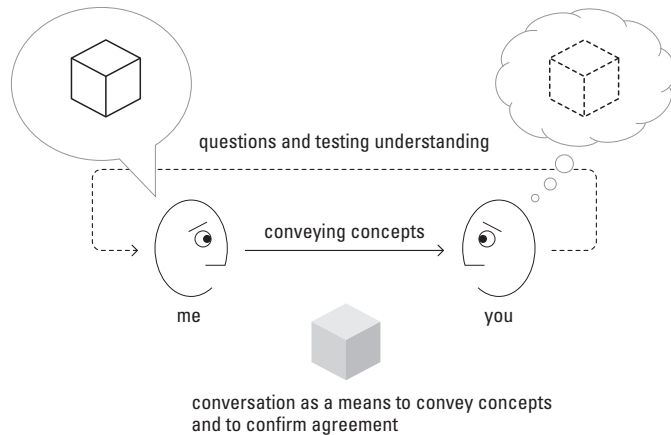
▶ Conversation to Learn: Conversation is a means to convey concepts and to confirm agreement. When a conversation changes one of the participants, we say the participant has "learned."

Conversation to agree
that you will act to achieve my goal;
in exchange, I will compensate you.
(Receiving compensation is one of your goals.)

me   you

Agreement leads to acting in the world.

me   you

No
Then I should not compensate you.

? Have you completed the action that you agreed to take?

Yes
Then I should compensate you.

Have I completed the action that I agreed to take?

? No
Then I should complete the action.

Yes
Then you should compensate me.

▶ Conversation to Coordinate: Participant B agrees to trade an action for payment from participant A. B performs the action and confirms that his action has created the correct result. A confirms her goal is achieved and compensates B as agreed. Compensation may be monetary, return of favor, barter, etc.

Conversation to agree on a goal.

me

you

Agreement leads to...

may lead to a new...

me

you

Conversation to agree on action.

me

you

Agreement leads to acting in the world.

Was the action completed? **?** No
Then we should complete the action.

Yes

Did the action achieve our goal? **?** No → Have we exhausted reasonable options for action? **?** No
We should discuss how to adjust our actions.

Yes

Yes

We should discuss how to revise our goals.

Move on to another topic.

▸ Conversation to Collaborate: Agreeing on goals and coordinating actions to achieve them.

every U.S. mobile phone user). Or we're frustrated when we can't use the available interface functions to get what we want. So, when software is the connection between participants, we ought to ask, "How well does the infrastructure support the conversational connection?"

2. *Conversational participants.* Inherent in the capacities for a given conversation are the indi-

vidual limits of its participants. Individuals contribute both what they know in depth and breadth and their style of interaction. Given a specific group of participants, conversations may go nowhere—they have no value; they create no lasting change in the participants. Other conversations create their own energy and go places—they are generative, have momentum, and lead to new

and unexpected knowledge. We prize the individuals with whom we achieve this. When assembling a design team we ought to ask, "What expertise and what collaborative style(s) do we need? What variety is required to succeed?"

Types of Participants

A human participant in conversation is usually a single person, although Pask suggests additional possibilities [7].

Conversations may take place between groups. For example, different political parties, religious groups, or nations interact with each other—they send messages, commit to engage (or not), evolve each other's beliefs, and sometimes lead to transactions such as trade or war.

Similarly, we often have internal conversations—conversations with ourselves. I explore alternative perspectives, exchange points of view, come to a stable viewpoint about a belief or action (or, when I can't, remain conflicted)—all inside my own mind.

We generate new ideas by combining old topics in new ways. This is important to interaction design because we spend so much time in front of screens talking to ourselves. Interaction design is as much about connecting humans across the murky "Internet cloud" (fostering community and conversation) as connecting an individual with his or her own capacity to explore what is possible and generate new possibilities (supporting internal conversations).

Why Does Conversation Matter?

Conversation matters to any community of interest (including our community of a single mind), but nowhere is the value of conversation more clear than in commerce, because commerce cannot flourish, or even exist, without conversation.

But many products and services, on and off the Web, connect individuals for broader reasons. Social networks such as Facebook and LinkedIn

match two ends of a channel for mutual benefit, whether or not money changes hands. Sometimes what occurs is a sharing of interests, ideas, or even intimacy. But in all these cases, conversation is required.

Summarizing, conversation is infrastructure for commerce because:
- Long-term success means ongoing commerce.
- Ongoing commerce needs ongoing trust.
- Ongoing trust is built via ongoing relationships.
- Ongoing relationships are built via agreeing on goals and actions.
- Agreeing on goals and actions is possible only through effective conversation. So, effective conversation is essential to commerce.

What Can Designers Do?

If conversation is important to "users," we should explicitly model conversation as we design. Here are four broad proposals:

View every user (persona) as a participant in a conversation, and every scenario as a conversation to define or achieve one or more goals. Use models of conversation to make design decisions, such as:

1. What channel is being opened to begin the conversation? Is the interruption reasonable in how and when it intrudes? What is the bio-cost of the intrusion relative to its benefit? Are there better ways to interrupt?

2. Is the first message clear? Does it offer something to the recipient?

3. Once accepted, does the ongoing exchange convey the potential benefits in continuing the engagement? Is there learning or delight? Is curiosity or interest stimulated? At what bio-cost? How can it be improved?

4. Is meaning easily understood; that is, do the messages speak to the participants' context, needs, interests, values, and in their language? How difficult is it for users to "put together"? How can messages be made more efficient or clear or entertaining, as appropriate?

[7] Pask, G., Scott, B. C. E., and Kallilourdis, D. "A Theory of Conversations and Individuals (Exemplified by the Learning Process on CASTE)," *International Journal of Man-Machine Studies*, 5, no. 4 (1973): 443-566.

REQUIREMENTS FOR CONVERSATION	MARKETPLACE EXAMPLE FROM USER PERSPECTIVE
Establish environment and mind-set—context	What's new in mobile phones?
Use shared language	How is this like a Blackberry?
Engage in mutually beneficial, peer-to-peer exchange	Can I use this in Europe? What will that cost?
Confirm shared mental models	Yes, this product suits me.
Engage in a transaction—execute cooperative actions	I accept your price and terms; here is my payment.

5. How can users convey intention and meaning to the software? Are those means sufficiently expressive or easy or delightful? Where do they fall short?

6. Do participants evolve during the interaction? Aside from entertainment or delight, do they acquire something useful, learn a new point of view, or gain new knowledge? (This applies to human participants as well as software, which may evolve a model of the user for the sake of having more effective or more efficient conversations in the future.)

7. Do both sides agree? Can the participants agree to disagree?

8. Can sharing or exchange or transaction continue beyond this conversation, whether in the form of commerce or barter or simply agreeing to continue the conversation at a later time? In other words, has the conversation begun or continued a relationship?

Invest in a better understanding of conversation:

1. Review past projects and recast them as conversations: How could design outcomes be improved?

2. Look at new technologies or techniques in terms of conversation: Do they help generate more effective conversations?

3. When developing new projects, do models of conversation help in choosing technologies or techniques?

4. Can we design for conversations that directly improve trust, and therefore create stronger communities or greater lifetime customer value?

Investigate trends, tools, and technologies that will change online conversations in the next five years:

1. Personal journeys: How do physical age and technology exposure change predilections for media, modes of collaboration, and personal values?

2. Social computing: How will conversational technology transform individuals and organizations?

3. Portable and secure identity tools: How do OpenID and equivalents create secure and controllable online identities? How do they build trust? What can't they do?

4. Cloud computing: How can we deliver the same experience everywhere, at lower cost?

5. Sensors: How does a seamless "network of objects," when capable of conversational interaction, better extend our capacity for learning, coordinating, and collaborating?

Invest in design of conversations via prototyping:

1. For stakeholders: Build trust and value for employees, shareholders, clients, partners, competitors, and communities of interest.

2. Inside the organization: Instill coevolution as the process for understanding the market, defining and delivering the offering, and increasing customer satisfaction and shareholder value.

3. Across organizational and cultural boundaries: Explore a "marketplace of ideas."

The Impact

Imagine a design movement that takes conversation seriously. Could it create a revolution?

The Industrial Revolution harnessed physical machines to extend and enhance our muscles. The Information Revolution harnessed virtual machines to extend and enhance our nervous systems. A "Conversation Revolution" would harness the existing infrastructure of physical machines and virtual machines to create a mesh out of "networks of objects" and networks of individuals and organizations. Such a mesh would enhance coordination and collaboration and create wealth by introducing new efficiencies. It would also expand opportunities to generate new knowledge.

Imagine a search engine designed for effective conversation, with all the knowledge on the Web participating. We would no longer be focused on "search," nor would we be using an "engine." What should it be called? Who will build it first?

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"Paper in Screen" Prototyping: An Agile Technique to Anticipate the Mobile Experience

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Prototyping is widely recognized as an effective method for quickly generating cost-effective designs and efficiently gaining user feedback early in the product life cycle [1, 2]. Over the past decade, the method has also been adapted and extensively used for mobile interfaces and devices [3]. Because the design of handheld devices (e.g., PDAs and cell phones) involves complex software functionality as well as a need to be integrated with the customized controls and interaction of the physical device, it requires hardware and software prototyping that is challenging. Celine Pering argues that one of the greatest issues of prototyping is to be efficient with the full range of tools, such as paper or high-fidelity prototypes [4]. For interaction designers to overcome a range of prototyping challenges, they first must recognize that each new and greater level of functionality in prototype development means more implementation time. This article introduces a hybrid method of prototyping that utilizes paper and mobile device technology

that is both quick to create and agile to use in the early stages of design without the need to implement a fully operational high-fidelity prototype.

A disadvantage of paper prototypes is that they usually require a facilitator, i.e., someone who has a comprehensive understanding of the application and can adequately demonstrate it to the test participant [5]. In other words, a full interaction experience is limited because the participant relies on the facilitator to provide feedback (e.g., changing paper screens) during the command simulation sequence (e.g., clicking

[1] Arnowitz, J. *Effective Prototyping for Software Makers*. San Francisco: Morgan Kaufmann Publishers, 2006.

[2] Snyder, C. *Paper Prototyping: The Fast and Easy Way to Define and Refine User Interfaces*. San Francisco: Morgan Kaufmann Publishers, 2003.

[3] Schultz, D. "Usability Trips & Tricks for Testing Mobile Applications." *interactions* 13, no. 6 (2006):14-15.

[4] Pering, C. "Interaction Design Prototyping of Communicator Devices: Towards Meeting the Hardware-Software Challenge." *interactions* 9, no. 6 (2002): 36-46.

[5] Rudd, J., K. Stern, and S. Isensee. "Low vs. High Fidelity Prototyping Debate." *interactions*, 3 no. 1 (2000): 76-85.

Applying "Paper in Screen" Prototyping

With respect to traditional paper prototyping, where—according to the user's selection—a different paper screen is shown (within a limited range of possibilities), the screen sequence is predefined and fixed. This requires the facilitator to verbally indicate to the user the nature of the next step in the scenario sequence ("now you can go to the green chart"), but without specifying the label or button to click on. These conditions enable the evaluation of the overall scenarios in terms of utility of content and functionality, fitness with the requirements and user's needs, navigation flow, and interface understandability.

The cost, in terms of time spent, of transforming a traditional paper prototype into a "paper in screen" prototype is of course proportional to the number of pictures that need to be edited and organized. But about one hour of work is needed for every seven or eight screens.

We have tested the creation and use of "paper in screen" on the iPhone. However, the technique can be applied to any mobile devices enabling interacting (through touch or hardware commands) with a sequential full-screen set of digital pictures.

Based on our experience, here is a summary of the key steps in creating a fully working "paper in screen" prototype:

1 Begin by designing the paper prototype itself. This can be done by following existing guidelines and practices on the subject. The paper prototype should result in a number of representative screens designed around key task scenarios.

2 To digitalize each paper screen, a good-quality digital photograph (at least 5 megapixels) may be enough. In this case, the shot should zoom in close enough for digital editing later. As an alternative to a digital picture, the paper can be easily scanned and imported for image editing.

3 Modify each picture to fit the screen of the mobile device to be used during testing. Any photo-editing software can do the job. For example, a picture needs to be resized to 320x480 pixels to fit the screen size of an Apple iPhone.

4 Export your resized image as a picture file supported by your mobile device (PNG, JPEG, GIF). Ideally, the image's borders should merge with those of the device screen.

5 Organize the screen images into photo albums or sets, where one album or set corresponds to a specific scenario to be tested, i.e., a salient sequence of screens corresponding to a task or storyboard sequence.

6 Upload your photo albums to the mobile device, and the "paper in screen" is ready.

7 Explain to the user how to navigate through the images, whether by pressing a "next" button or flicking the photos with a finger sweep. While carrying out each scenario, users can think aloud and articulate comments about the interface and the sequence of screens.

▶ Step 1. Draw the paper prototype.

▶ Step 2. Take high-quality digital pictures of the prototype screen shots.
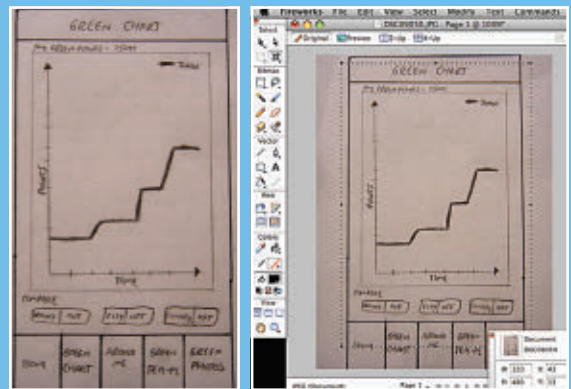
▶ Step 3. Edit the digital screen shot.

▶ Step 4. Organize the digital screen shots into sets corresponding to task scenarios

buttons or icons), and to constantly remind the user about how the various elements of the design would eventually fit together in the envisioned product. Without human intervention, the participant is unclear about how the system should respond. On the other hand, paper prototypes do provide a quick means for testing basic interactivity that may be essential for specific design decisions [5]. Tools for agile prototyping and electronic sketching are also increasingly available to support quick design iteration [6, 7].

Conversely, fully interactive high-fidelity prototypes (created with Visual Basic, Flash, HTML, among others) are neither easily nor quickly produced.

Paper prototyping relies on the exclusive use of paper-based artifacts, which are physically detached from the use of any real device or digital interface. High-fidelity prototypes, although difficult to quickly develop, allow test participants to easily enter data and execute commands, while being much less dependent on the facilitator.

Emotion, Design, and Prototyping
When it comes to prototyping and evaluating a mobile touch-screen interface, understanding the emotional response of the user is imperative to better evaluate the quality of design. In particular, not only the appearance of the interface (which can be well anticipated by current prototyping tools and practices), but also the physical holding, feeling, manipulating, and touching of the device are important factors in determining the quality of the user experience [8]. For this reason, standard paper prototypes, though useful and quick to gen-

erate, are very limited in delivering the depth of user experience necessary to adequately inform design iteration.

In discussing the relationship of user experience and design, Don Norman states that the "visceral" (or physical) level is the simplest and most primitive cognitive process [8]. With regard to handheld devices, visceral is all about look, feel, and sound, i.e., how a device, including the interface, looks and feels in the hand of the user. The iPhone is one of the greatest examples of the visceral experience. It was designed, in great part, for the visceral level of cognition—Apple designed for visual and physical impact. Evaluating the mobile user experience without considering visceral factors is like evaluating the quality of a meal by looking at the menu. A lot can be said about the dishes, but the experience is not there. It is a challenge, of course, to anticipate this experience in early prototyping.

Beyond the visceral experience, the "behavioral" level of cognition is about designing device interaction or behavior to reflect human behavior [8]. In other words, device design becomes intuitive in the way it complements one's implicit assumptions about how it might work. Last, to design for the "reflective" level of cognition is to appeal to one's aesthetic sensibilities, uniqueness, and cultural preferences [8]. From such a design perspective, people relate to and acquire a personal adherence to a device as part of their identity and self-expression.

Understanding these three levels of cognition is extremely relevant, because emotional engagement at every level strongly

influences human-interface interaction from a physical, aesthetic, and usability perspective. Moreover, if we need to take into account these emotion-centric factors early on in the life-cycle of device design, it is clear that paper prototyping cannot deliver the necessary insight into a full visceral and behavioral experience of the interface in the context of handling the physical device. In other words, if we only use paper separate from its actual relationship to the physical device, we may bypass important elements of the user's emotional experience. As a consequence, inadequacies of this kind may lead to highly artificial (and ultimately irrelevant) evaluation results. To date, producing high-fidelity electronic prototypes or beta-version releases appear to be the only viable way to have users test or try out mobile applications on their devices. We, however, recommend another intermediate solution.

If we could anticipate the mobile user experience (testing the interface with a device), yet spend minimal effort in implementing high-fidelity prototypes, we would have found a far more efficient way to prototype mobile applications with a much higher ROI in time, energy, and valuable user feedback.

So, how can we arrive at a prototyping technique that can deliver development speed, with both visceral and behavioral user experiences that far exceed the use of paper, but without the need to develop high-fidelity prototypes?
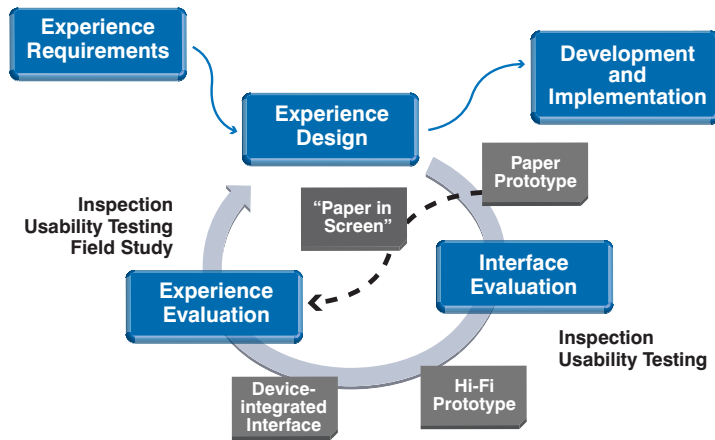
Anticipating the Mobile Experience
We propose a simple and straight-

[6] DENIM: An Informal Tool For Early Stage Web Site and UI Design, <http://dub.washington.edu:2007/denim/>.

[7] Balsamiq Mockups, <http://www.balsamiq.com/products/mock-ups>.

[8] Norman, N. *Emotional Design: Why We Love (or Hate) Everyday Things*. New York: Basic Books, 2003.

▶ Figure 1. "Paper in Screen" enables anticipating the evaluation of the mobile user experience. This can happen long before a high-fidelity prototype has been integrated into a mobile device.

forward technique: placing the paper prototype inside the device. It is possible to quickly generate a paper prototype (using traditional guidelines and best practices) and efficiently digitalize it in a form suitable for integration and interaction within a mobile device (see page 29). Designers can then ask users to use an actual mobile device (e.g., an iPhone) to try out the prototype, by looking at and flipping through the digitalized papers, thus envisioning a richer mobile experience.

The "paper in screen" approach has important benefits. Users can hold the actual mobile device while interacting with the digitalized paper prototype. And users can interact with the digital prototype in a way that is intimately integrated with the physical experience, thus capturing a fully emotional and true-to-life usage.

The only drawback (to meet the requirements of an "agile" prototype generation) is that the digitalized paper is not fully interactive. The only supported interaction is moving from one screen

to another. This sequential navigation can be easily controlled through the most elementary interaction command available on a mobile device (tapping, sliding, flipping, or using a single button). In other words, the papers are not made interactive, but they become interactive on a more generic and basic level through the use of a standard device command. With minimal initial explanation, users point their finger on the actual interface link they need to activate and slide/flip the screen to move to the next page. The digital paper prototype is still provisional, malleable, thought provoking, and expressive, but at the same it enables the user to experience it within the real mobile device, with all its affordances for an interaction experience that is both tactile and visceral. And all this can be done at a very limited cost.

From Interface to Experience Prototyping
The cost and feasibility of the paper-in-screen approach should be considered in the context of

the design life cycle. In a simplified picture of the established practice of interactive application development, iterations often occur between the experience design and interface evaluation (see Figure 2). Paper prototypes typically serve well in this phase; they can cheaply externalize the reification of the design vision into an interface, more or less refined. Paper-based interface prototyping easily lends itself to a subsequent usability evaluation that can be done through various techniques (usability tests, inspections, or walkthrough). Besides the important details of the interface elements, the conceptual flow of the overall navigation and task support can be evaluated. Still, everything is focused solely on the interface as an artificially separate artifact from the overall user experience. After a reasonable number of insightful iterations, low-fidelity paper prototypes are typically improved, refined, and eventually solidified into more interactive, electronic, partially implemented applications that can be integrated as they are into a mobile device for more lively validation and demonstration. This is the stage in which users can actually try out a mobile application using a real device, and designers are able to finally evaluate their user experience. Besides full usability inspection and lab testing, on-the-field observations can be performed, as all the enabling elements of the user experience are there. Using "paper in screen" provides a straight shortcut to make this process much more efficient (see Figure 1).

In just a few minutes a digital version of the paper prototypes can be made available on a

mobile device, to be experienced and tested by users and designers. This inexpensive yet rich anticipation of the interface integrated in the device is a form of "experience prototyping" [9], as the malleability and provisional character of the anticipated situation still embeds some core ingredients of the final, natural experience—users interacting with the mobile interface while holding the device. A paper-in-screen prototype lends itself to "experience evaluation," that can be carried out—as with fully higher-fidelity interfaces integrated in the device—also through field observation.

In essence, using paper-in-screen enables designers to reconstruct very early in the life cycle the synthetic aspect of the user experience, which is typically lost in the separation—due to pragmatic purposes and established practice—between interface design and device integration. Although this separation of concerns (interface and device) is practical and reasonable, the envisioning of the user experience traditionally suffers from the fact that this chasm is not reconciled until an implemented prototype is ready.

Enabling Feedback from Users and Designers
The nature of user feedback enabled by paper-in-screen prototyping needs proper consideration. As we have emphasized its potential of anticipating visceral elements of the mobile user experience, we also acknowledge its limited interactivity, due to the trade-off between cost (time and effort) and prototype refinement. Still, the direct transposition of paper prototypes into digitalized

form integrated in a mobile device generates an interesting outcome. In our experience, users interacting with paper-in-screen are surprisingly able to abstract from the limited interactivity of the prototype (as they consider it part of the work in progress) and raise issues on interface labels, content organization, and affordance, using context to provide suggestions for improvement. Interestingly, the elementary, though viscerally engaging, interactivity with the sequence of screens, provides the real-life experiential context not only to focus on the interface usability, but also to facilitate the discussion on the overall utility of the application for realistic mobile scenarios of usage. The provisional and paper-like characteristics of the interface stimulate feedback on information architecture, navigation affordance, underlying business model, content, and requirements (behavioral level). It is clear that only higher-fidelity prototypes with more refined design will elicit other issues concerning, for example graphics, layout, colors, and elements visibility (reflective level).

From this perspective, paper-in-screen can serve well not only traditional user-based evaluation settings, but also expert reviews (heuristics inspection or walkthroughs), and participatory design activities. Experiencing the partial use of the application within the mobile device is helpful to stimulate discussion in the design team, to support individual inspections, or to enable bodystorming (enacting real-life situations of use).

With the increasing demand for mobile applications and their decreasing time to market, we

believe that strategies are needed to anticipate the mobile experience in as many aspects as possible and yet meet the time and budget constraints for agile prototype development. The paper-in-screen technique is an innovative proposal to meet this design challenge.

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Anthony Faiola is the executive associate dean of the School of Informatics, Indiana University, Indianapolis (IUPUI). He is also an associate professor and director of the human-computer interaction program. Faiola's HCI research interests are twofold: First, in the area of cross-cultural computer-mediated communication, specifically related to cultural cognitive design and its impact on interaction and information design, as well as the social and cultural influence of "flow experience" on gaming and virtual worlds. Second, related to biomedical informatics, with a focus on health information technology (HIT) design and usability, which aims to contribute to improving its usability and provide the intelligibility of HIT concepts to users through human-centered research.

[9] Buchenau, M., and F.J. Suri. "Experience Prototyping." In *Proceedings on Designing Interactive Systems: Processes, Practices, Methods, and Techniques.* August 17-19, 2000. New York: ACM Press, 424-433.

Time, Temporality, and Interaction

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[1] Fricke, D. "Frippertronics." *Synapse Magazine* 3, no. 2 (1979): 24.

[2] Jones, J.C. *Design Methods*, second edition. New York: John Wiley and Sons, 1992.

[3] Hallnäs, L., and J. Redström. "Slow Technology—Designing for Reflection, Personal and Ubiquitous." *Computing* 5 no. 3 (2001).

[4] Lim, Y. et al. "Interaction Gestalt and the Design of Aesthetic Interactions." *Proceedings of the 2007 Conference on Designing Pleasurable Products and Interfaces* (2007): 239-254.

[5] Djajadiningrat, T., S. Wensveen, and J. Frens. "Tangible Products: Redressing the Balance Between Appearance and Action." *Personal and Ubiquitous Computing* 8, no. 5 (2004).

[6] See Seow, S.C. *Designing and Engineering Time*, Boston: Addison Wesley Professional, 2008. for a full HCI-approach on the topic

Theo had just discovered the musician Robert Fripp, who is famous for recording himself while playing and then playing it back—in effect, playing along with himself [1].

Theo: *"What if we do that in interaction design?"*
Me: *"…?"*
Theo: *"What if we use time as a kind of design material?"*

The question kick-started an intense brainstorming session and a project that was to last for a couple of months. Theo has a point. Most of the time we do not start out by considering time in our designs; we let other parameters steer design and let the use of time become a consequence. "The time dimension, if we may call it that, is left to take care of itself," wrote design method guru John Chris Jones [2]. For instance, when the user goes for lunch and leaves the *interactions* article she is writing behind in Word, was it actively decided that the time "in" Word should stop? Or, that if she later needs to open an older version of the document, time must back up and restart? What if, we asked, time "in" a program really does pass? How would this affect use? And design?

Time in Movies, TV, Games, and Interaction Design

Our approach was not as original as we first thought. Looking around, we found creative examples of time use all around us. "Eternal Sunshine of the Spotless Mind," for instance, a film in which two lovers erase but nonetheless rediscover their love story, features time in fragmented moments along a distorted timeline. In another movie, "Time Code," separate but converging storylines play out simultaneously across a four-way split screen. The TV series "24," about reckless—and sleepless!—federal agent Jack Bauer, takes a totally different stance. Here, a minute is a minute both for Jack and for the people viewing him. Each season consists of 24 one-hour episodes (including commercial breaks), ultimately composing one full day. The same take is used in the online game World of Warcraft, where game-world time passes regardless of whether or not you are logged in, and where the annual Feast of Winter Veil is celebrated in December. Here, time is live, unlike tycoon or simulation games, where the player can stop time when building or play it forward at any pace she or he

wishes. Or why not look at the new and original game Braid, in which the user has to manipulate time in different ways. In one version the player cooperates with an earlier version of himself, in order to solve some quests.

As for creative use of time within interaction design, Lars Hallnäs and Johan Redström have experimented with time in their slow technology program. In the "Sound Mirror," a microphone connects to a speaker that plays back what is recorded [3]. The recordings are played at a later time, ostensibly at random. However, in general time tends to be discussed rather than used in the interaction design community. Youn-kyung Lim and her co-researchers touch upon time when presenting attributes of interaction gestalt [4]. One of the attributes is related to time, namely "time depth"; two others are speed and pace, which are related to movement over time. In accordance, Tom Djajadiningrat with colleagues consider "timing rhythm and flow" to strongly influence the aesthetics of interaction [5]. In HCI, time is of course measured, added, quantified, applied, and visualized [6].

Temporal Themes

Looking at these examples, we can discern different themes of time use. Similarly to how Lim and company discuss interaction gestalt using a language of attributes such as pace, directness, and orderliness, we think one can discuss temporality—the relation to time—in terms of these themes.

• *Live time* is the time we live by. It passes regardless of what the user does, like in World of Warcraft, or the live broadcasting of the Super Bowl (a rerun would not be live time though!).

• *Real time* is the theme used in "24"—a minute is a minute, but it has no connection to time in the "real world."

• *Unbroken time* is when time passes in an unbroken sequence, but the speed of time may be altered or even stopped, as in Zoo Tycoon or Sim City. Many software programs use this theme. If the user does not do anything, the program (or the time in the program, seen in terms of changes) "stops."

• *Sequential time* is when events are still in chronological order but some events are skipped, i.e., scenes that jump in time by a couple of days or weeks, something that often occurs in movies and TV series.

• *Fragmented time* is when events are shuffled in time. This too is frequently done in movies, books, and TV, e.g., when a person remembers something from their childhood. It's the equivalent to opening an earlier version of a document; in a sense you are now jumping back in time.

• *Juxtaposed time* is when events that originally happened after each other are shown
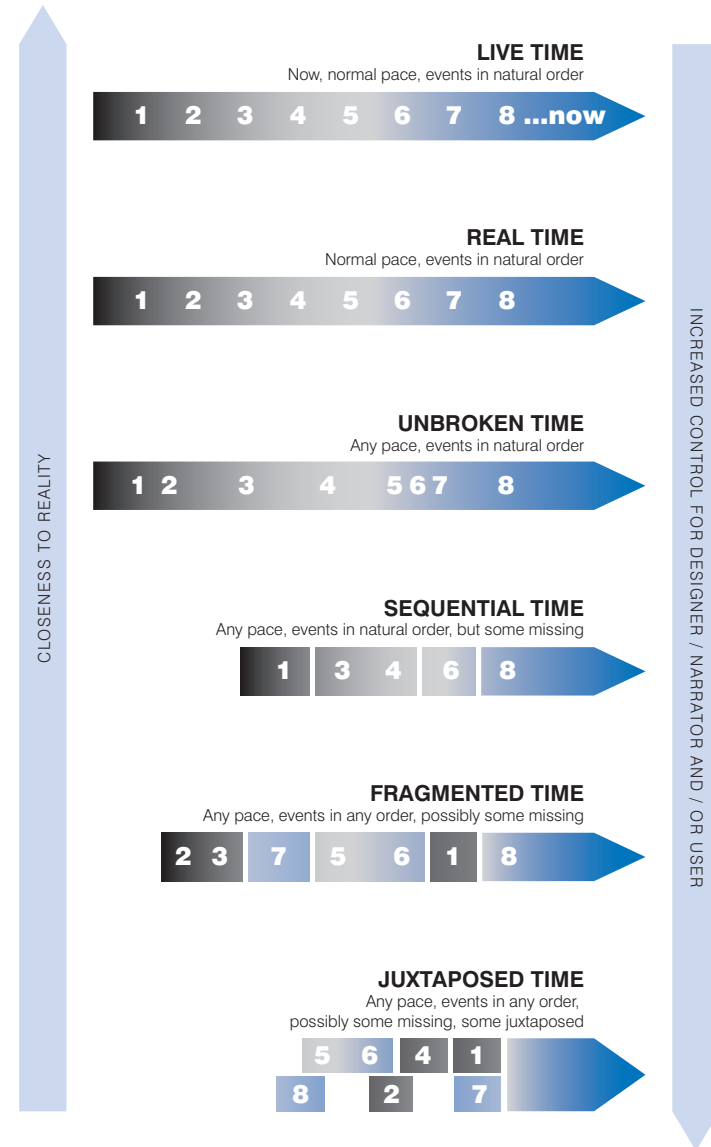
simultaneously, like when a time traveler meets himself.

This list is not definitive. One could identify many more steps in between, and one could also make the case that some of the types of time we list here are similar enough to fall into a single category. However, these six themes may well serve as

a basic set of concepts that we can use when discussing how to apply time.

First, note how they distribute themselves along two parallel scales: one describing how close to reality the use of time is, the other denoting the level of control that the author, designer, or perhaps even user
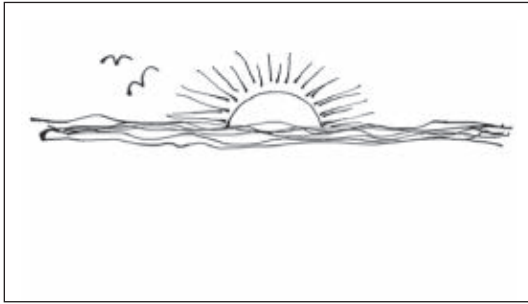
▶ Perspective 1. Drawing of a sunset and birds...

▶ Perspective 2. ...and a couple of lovers at the beach, while the sun slowly sets— or rather shrinks—into the ocean.
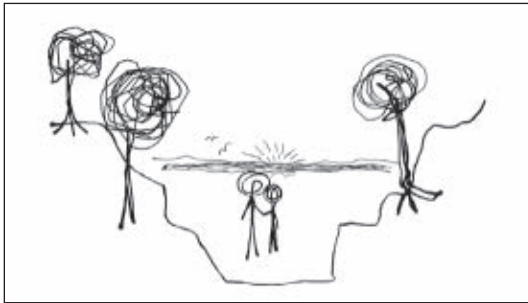
▶ Perspective 3. Now the sun is almost gone. There is space around and behind the couple where hills and trees appear.
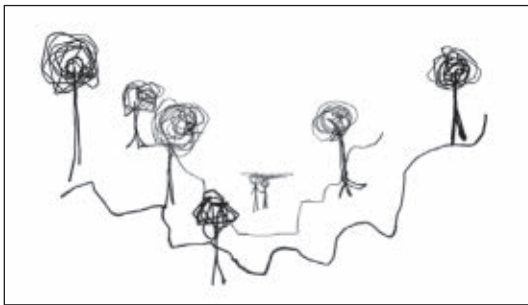
▶ Perspective 4. More hills and trees are added as the couple becomes more distant.
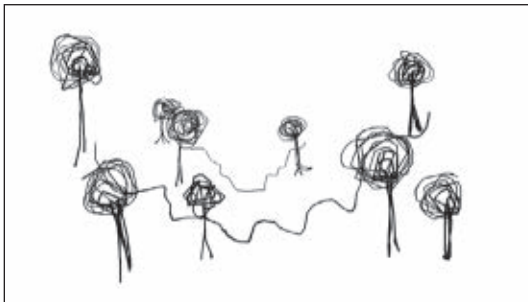
▶ Perspective 5. All the initial parts of the drawing are gone, and the scene has changed from a romantic evening at the beach to a rocky desolated hillside.

has. We all know that we as users often prefer a certain amount of control, but do we need as much control as in juxtaposed time? There is something to gain in staying close to reality too; World of Warcraft is mesmerizing in part because battles are fought whether or not you are there to participate.

Using Time in Design

To answer Theo's original question, and to explore the themes, we imagined a small, simple drawing application that would allow the user to do only one thing: draw lines. Then we asked, what if? What if one applies fragmented time, real time, or any other one of the themes to this very basic application?

The result was four drawing applications that apply time in different ways. We tested them ourselves but also let others try them; four users have tested each one, plus a class of 10 interaction designers. If you want to try visit http://demo. iconara.net/temporal-paint/ and let us know how it goes!

In the first application, Echo, the lines you draw gradually fade away by becoming thinner and thinner (unbroken time) until they disappear completely. After a more or less random interval, they reappear as "echoes" (fragmented time), only to again fade away, and come back, and so on. This was quite frustrating to the users, first because it took a while before they understood how the application worked, and second, because the user had no control whatsoever over when a certain line would reappear. A common strategy was to draw

the same lines over and over again to make sure they would "stay," or rather that some instance of them was echoed at every moment in time. Only a few test subjects utilized the echo-effect by creating something that could be described as a mix between an animation and an association game; once some lines had disappeared, new lines were added, changing the motif from, say, a house to a flag. When we later added the possibility of drawing static lines by pressing Ctrl, the application changed drastically. We instantly developed a technique to draw animated scenes, such as drawing a static cloud and echoing lines as "rain" under it.

The second application, Perspective, was inspired by perspective drawings. Thus, the lines in Perspective slowly move toward the center of the canvas (real time), shrinking in the process, so that it appears if the user is zooming out. This zooming effect is almost immediately visible, and most test subjects quickly understood what happened. Also, the pace is slow enough for the users to plan what they wanted to do. Since the effect was predictable, most users felt at ease in a way that we did not see with Echo. All but one user worked with the effect, drawing typical perspective drawings, such as a long street stretching toward the center of the canvas. Again we added a feature, by allowing users to change the direction and/or speed of how lines moved (changing the theme to unbroken time), but in this case the change did not encourage any entirely new drawing approaches.

The last two applications toyed with changes in color. In ColorWheel the color changes continuously, whether or not you are drawing (real time), but in ColorPen the color changes only when you draw (unbroken time)—all the red color has to be used up before you can use the orange color. Apart from the color of the line, none of the applications gives any other indication of the current color; the only way to discover it is to draw. As it turned out, users had a difficult time understanding how or why the colors changed, which made most of them ignore the color when drawing, and ultimately ignoring the temporal effect entirely. Others drew in different parts depending on the color they got (when blue, sky; when green, grass).

Temporal Themes as a Thinking Technique
There seems to be a connection between how visible the temporal effects are and how easy it is to work with an application. In the case of Perspective, perhaps the most liked of the four, the effect is immediately apparent, but in ColorPen and ColorWheel, the underlying logic is hidden—it's quite hard to figure out what's going on. Echo falls somewhere in between. One of the effects, the fade, is obvious, but the other, the echo, has a randomness that makes it impossible to predict. Of course this has to do with control issues; if users understand how the effect works, they can perhaps create strategies to utilize it, as in Perspective. This, the possibility to utilize and work with the

effect in some creative way, seems to be another key factor when applying temporal effects to a design. Again, the small change in Echo, where one can draw static lines, increased control and resulted in a somehow better product. Note also that this version of Echo was the only application where we allowed users to control the use of time rather than just analyzing and utilizing the effects of it. A possible next step would be to study how users react to different ways of controlling time.

Our work was experimental, so one may well ask, is it even possible to make "usable" products this way? Well, let's imagine adding a database and "fragmented time" to a search engine; now we can make searches for different points in time to see how the hit list changes and how some hits appear, disappear, and/or climb. Or let's add "real time" to Word and decide that newly written text is blue, however slowly fading to black after a few hours of active (unbroken) time. Or combine this effect with live time, letting the color of the text depend on the time of day, so that we easily can find that paragraph we were working on before lunch, and so on. These effects could be very useful for work in long documents, such as, a dissertation, in which the user frequently jumps back and forth. Note that even if we started with a very simple application as a basis for idea generation and development, there is no reason for the applications to be simple and easy to use. But from our limited testing, it appears that

at least too much uncontrollable or unforeseeable behavior makes the experience less enjoyable.

Notably, most of our inspiration came from the entertainment sector, and it may be the case that unusual uses of time work best in noneffective applications. On the other hand, this may just be an old habit that's hard to break. We seem to have no problems at all dealing with fragmented time or even juxtaposed time in these contexts, so it may be a matter of letting creative use of temporality expand into new disciplines, such as interaction design.

Why should we leave such an intriguing way to enhance, steer, and/or inspire interaction to the game industry alone?

ABOUT THE AUTHORS
Sus Lundgren is a Ph.D. student and teacher at Chalmers University of Technology in Gothenburg, Sweden. She has spent a ridiculous amount of live time writing her Ph.D. thesis on teaching aesthetics in interaction design, and hopes to successfully finish by the end of 2009. With a background in GUI design and gameplay design, Lundgren is now shifting her focus toward interaction design didactics and design methods.

Theo Hultberg is a rich Internet application developer based in Gothenburg, Sweden. The aspect of interaction design he finds most fascinating is time, yet he never seems to find any to spend completing his master's thesis.

Understanding Visual Thinking: The History and Future of Graphic Facilitation

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with Jan Adkins
The Jan Adkins Studio| vizthink@gmail.com

Graphic facilitation—facilitating a meeting by taking continual, visual notes on a large scale—demands both attention and suspension. It's the most intense work I know. Listening isn't enough; drawing isn't enough. It's a high-wire act that taxes nerves, and after a session my wits are fried.

So when someone walks up in the pleasant hubbub of a break and says, "Great art! I wish I could draw like that," it reminds me that one should always carry a loaded cream pie.

Although tempting, throwing a pie at a meeting participant is against the ethical guidelines of graphic facilitation. "Drawing" isn't what's been frying my brain. The work isn't about drawing or art. The work is about graphically projecting ideas on a realistic worldview—as big paper on the wall. It's about understanding how the interplay of conference ideas is shifting a view, reflecting participation back to the group, helping to explore and document the new path, and making the change of direction graphically plain.

The Challenge
On a good day a graphic recorder's hand, ears, eyes, background, brain, and long-suffering feet are working independently and together, like the instruments in an orchestra. However, the work on the wall should feel effortless. Simplicity is the hard part; the drawing and color are minor tools.

The graphic challenge isn't verisimilitude or decoration. It's representing ideas as icons and placing them in context with other ideas. It also uses words—phrases, titles, topics, quotes, buzzwords—as graphic symbols on the same field. In this graphic world, the lettered words "ZERO DEFECTS" can become a calligraphic representation of an entire concept. Calligraphy allows the concept to interact spatially, graphically, conceptually with iconic symbols of production: churning factories, busy production lines, measuring yardsticks, assembling screwdrivers, or inspecting flashlights. In this abstract and plastic world, graphic facilitators use a "bucket"—a shape, color block, or geometric form to "hold" a word, quote, symbol, or even list. That bucket can represent its broader concept and be interposed significantly on a plane of understanding with other ideas.

The graphic facilitator records a conference's topics and statements in a changing, evolving, connecting reality beyond typed words or drawn pictures. This synthetic idea-galaxy is in a dynamic state of creation, becoming a parallel world to the conference it reflects, but real enough to invite meeting members to glance up to see their own words and concepts progress in time and in relation to other ideas. This abstract galaxy records more than facts; it embraces conflict and shifts of understanding. It follows the cerebral track that brings a group's relationship to a new place. It traces the inevitable, inexorable flow of change, which can be too elusive to record in a paragraph.

The medium is important. It seems low-tech and, materially, it is. We're talking about paper taped to the wall in front of the working group. It's big; generally four feet high by eight feet long. The big paper presents ideas in human scale. It's a generous arena, large enough to show relationships between ideas, and long enough to hold the thoughts of an hour or more of conversation.

The linear narrative, tabular data, and graphs of a written report are inadequate for embracing the map of ideas and the balance of topics. Simple flip-chart recordings, pictures, and bubble charts can't carry the conceptual content that goes onto big sheets of paper taped to a meeting-room wall. Big paper offers scope in recording and communicating the flow of a meeting for your broader organization. Corporations can realize a monetary value from this enhanced understanding and interrelationship of ideas expressed distinctly and memorably with big paper.

The History of Graphic Value

The worldview of the Middle Ages was linear and vertical: man at the muddy bottom gazing up at the unreachable rungs occupied by priests, warlords, bishops, minor kings, and the pope. Society was rigid, fixed by circumstance of birth and by noble favor.

The Industrial Revolution imposed a new worldview of business. Its web was a complex pyramid of authority with workforce at the bottom and money at the top, and many horizontal levels of supply, transport, decision, and regulation. Each link was a route to opportunity for a person with drive and ability.

We've entered a new age of information and global decision. Our worldview is not parochially two-dimensional, but vastly encompassing and nonlinear. The Industrial Revolution's pyramid organizational charts, with peons at the bottom and big cigars at the top, are relics. The instant communication of transformative technology and update of data relentlessly drive the flux of personnel and supply. Contemporary business is no longer cast in iron; it's complex, diverse and dynamic.

There is always a reluctance to leave comfortably known models when new data or attitudes demand a shift. Clinging to pyramids, bubble charts, and antiquated business structures can cripple our ability to reach further and change more gracefully. The medium affects the message; the visualization affects understanding.

If the medieval model of connection is the vertical ladder, and the industrial age model is the flat web, what is the global economy model of connection? An apt guess might be the neuron—that three-dimensional nexus of nerve endings that connects billions of signals in the brain,

routing them in every direction. The neuron is an elegant metaphor for near-instant communication plugging into all levels of a problem and solving for multiple variables. Our brains' neuron networks make up—singly and, arguably, as a group—a nonlinear processor of data responsible for human ingenuity and creativity.

The speed of transactions is now measured in nanoseconds. Corporate structure is contemplated in humanist concern for all the corporate parts—workers and managers. Corporate decisions are increasingly informed by more people embracing environmental, sociological, and ethical concerns. Business has become interactive, more fluid, less rigid, and more answerable to voices outside a hierarchy that would be imposed by an antique pyramid.

In the 1950s, the leading tool of business interaction was probably the flip chart. It was used to record ideas, make lists, display and alter titles. It was easily refreshed and constituted a running record. We had the physical tools of graphic facilitation then, but we hadn't yet developed the graphic and intellectual worldview to retask old tools and create a facile medium.

During this time businesses began, almost reluctantly, to utilize the psychological advances of the earlier 20th century. The National Training Laboratory was at the center of "corporate learning" in its use of Gestalt awareness, acknowledging the curious world of new, and less mechanistic, physics that had, after World War II, trickled into mainstream consciousness. The T-Group and experiential learning awakened a generation of new leaders.

Peter Drucker, the author of *The Future of Industrial Man*, published in 1942, was an early prophet of profound postwar change. His book could in retrospect be titled *The Birth of Systemic Thinking*. Other key publications driving new corporate awareness were Kurt Lewin's *Resolving Social Conflicts*, Ronald Lippits' *Group Dynamics and Social Action*, and Drucker's *The Age of Discontinuity*. In 1957, Chris Argyris' *Personality + Organization* explored the way organizations "learned" and changed, and advocated experiential learning. Ludwig von Bertalanffy's General System Theory (GST), an overarching, interdisciplinary method of examining the influence of individual actions on group behavior, influenced the need to perceive the patterns of business interaction. The fluctuat-

TRANSACTION TIME: A few months to a few years ... ... measured increasingly in

1940s   1950s   1960s   1970s

Looking at the HUMAN SIDE of BUSINESS

West Coast SILICON VALLEY INFLUENCE

NTL National Training Labs

Three Steps of TRANSFORMATION — Lewin

Take Part Workshops — The Halprins

Interactive MEETINGS — Doyle Straus

Group Graphics Interactive Graphics — David Sibbet

Influence of VISUALS IN ORGANIZATIONAL DEVELOPMENT

PREFERRED VISION — Lippett

THRIVING INVENTIVENESS

STRATEGIC MODEL BUILDING — Lippett

Wall Scroll MEDIA — Fred Lakin

Group MEMORY — Geoff BALL

Generative GRAPHICS — Joseph BRUNON

STANFORD SRI

GROUPS

"Social Dynamics"

Gestalt

"The brain is a PATTERN MAKING machine"

Scenario Planning

MIND MAPS — Tony Buzon

INFLUENCE of ARCHITECTS

Ground breaking PUBLICATIONS

The Future of INDUSTRIAL MAN — Peter Drucker's FIRST Book

Personality & Organization — Chris Argyris

Lateral Thinking — Edward de Bono

General SYSTEMS THEORY — Von Bertalanffy

VISUAL THINKING — ARNHEIM

How to MAKE MEETINGS WORK — Doyle & Strauss

A PATTERN Language — Christopher ALEXANDER

Experience in VISUAL THINKING — McKim

Impactful "NEW" TECHNOLOGIES

FLIP Chart

BIG PAPER

Post Its

White Boards &

Print BOARDS

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ing nature of reality viewed from the perspective of changing data fit the spirit of contemporary quantum physics.
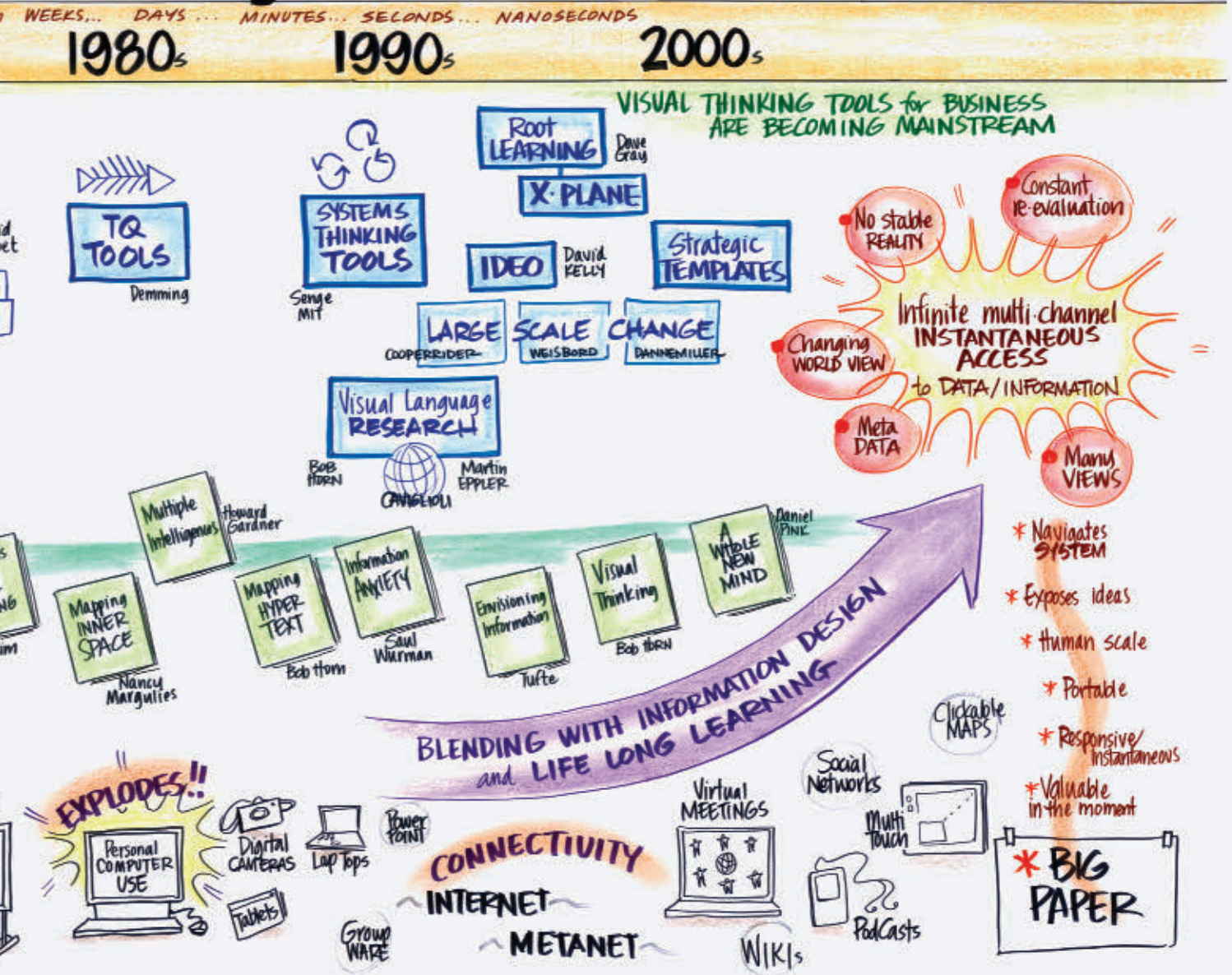
Physician Edward de Bono developed a "cure" for linear decision making and encouraged creativity in problem solving with his concept of "lateral thinking"—a fresh method of drawing creativity out of predictable sources. Applied to corporate planning, lateral thinking seems to inherit its loose-limbed flexibility from Gestalt therapy and new cognitive science.

We might consider the poster session in a basic but fecund business milieu, as a typical cooperative corporate tool: An ad hoc group of like minds hosts a table between conference lectures to propound a view with assembled graphics, numbers, and arguments.

As the 1950s morphed into the socially reactive and expressive 1960s, Geoff Ball's "group memory" techniques for team building, group learning, and collaboration influenced organizational development. Architects Michael Doyle and David Strauss used their visual training and architectonic pattern awareness to collaborate on *How to Make Meetings Work* in 1976. Their concept of a facilitator actively shepherding meetings toward conflict- and problem-solving interactions shaped their consulting group Interaction Associates. Doyle and Strauss required a visual record in real time of all meeting ideas, effectively separat-

WEEKS... DAYS... MINUTES... SECONDS... NANOSECONDS

1980s **1990s** **2000s**

VISUAL THINKING TOOLS for BUSINESS ARE BECOMING MAINSTREAM

TQ TOOLS — Demming

SYSTEMS THINKING TOOLS — Senge MIT

Root LEARNING — Dave Gray

X·PLANE

IDEO — David Kelly

Strategic TEMPLATES

LARGE SCALE CHANGE — Cooperrider · Weisbord · Dannemiller

Visual Language RESEARCH — Bob Horn · Martin Eppler · Cambgioli

Multiple Intelligences — Howard Gardner

Mapping INNER SPACE — Nancy Margulies

Mapping HYPER TEXT — Bob Horn

Information ANXIETY — Saul Wurman

Envisioning Information — Tufte

Visual Thinking — Bob Horn

A WHOLE NEW MIND — Daniel Pink

No stable REALITY

Constant re-evaluation

Changing WORLD VIEW

Infinite multi-channel INSTANTANEOUS ACCESS to DATA / INFORMATION

Meta DATA

Many VIEWS

* Navigates SYSTEM
* Exposes ideas
* Human scale
* Portable
* Responsive / Instantaneous
* Valuable in the moment

BLENDING WITH INFORMATION DESIGN and LIFE LONG LEARNING

EXPLODES!!

Personal COMPUTER USE

Tablets

Digital CAMERAS

Lap Tops

Power Point

Group WARE

CONNECTIVITY INTERNET METANET

Virtual MEETINGS

WIKIs

Social Networks

Multi Touch

PodCasts

Clickable MAPS

* BIG PAPER

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ing content from process and allowing the focus on process to make content more malleable and accessible. A handful of graphic recorders and facilitators emerged, mostly in the San Francisco area. They were either influenced by David Sibbet's large-paper approach and his proprietary formats, or Michael Doyle's flip charts recording running dialogue, augmented with large info-graphic images.

Technology was shifting almost too quickly beneath corporate foundations in these years. During the 1980s, when the personal computer, networking, and the Internet expanded world-view, corporate innovation began to pivot on Silicon Valley. Interactive graphics to support group process were being explored by Geoff Ball (who coined the phrase "group graphics") at Stanford, Joseph Brunon (a pioneer in family dynamic therapy) at UCLA, and David Sibbet at the Coro Foundation in San Francisco.

During this furor of rapid change and helter-skelter retrenching, management shifted in ways that conventional A = B logic did not govern. People realized that corporations were similar to human entities—subject to more complex motives, stressors, and failures. Business didn't follow linear patterns.

As self-help books became a staple for publish-ing, management pundits had fully embarked upon explaining how American commerce ran,

how it could change, and what improvement was available. In an age that was coming to accept alternate lifestyles, alternative medicine, and alternative technology, half a dozen books offered fresh ways to facilitate better corporate culture and promote management communication, including Tony Buzon's *Mind Maps*, Peter Senge's *The Fifth Discipline*, and Robert Horn's *Mapping Hypertext*.

Richard Saul Wurman's groundbreaking *Information Anxiety* came out in 1989; Wurman coined the term "information architecture" in reaction to massive amounts of information collected daily with little care or order. He founded the TED Conference in 1984, which brings together the world's most fascinating thinkers and doers, who are challenged to give the talk of their lives—in 18 minutes. TED has a large online presence and archive. Rudolf Arnheim's *Visual Thinking* disputes the separation between seeing and thinking, perception and decision. Robert McKim's *Experience in Visual Thinking* is a workbook for expanding the experience of thinking in new ways and applying neurological realities to creative problems.

In the 1990s many business management consultants developed large-scale change methods to involve wider groups of stakeholders in the process of creating fresh decisions—David Cooperrider, Marvin Weisbord, and Kathleen Dannemiller. Bill Smith's Six Sigma concepts of flying squads, heroes, black belts, and quantification brought a new approach to change from within. *The Fifth Element* is a contemplative approach to allowing a corporation to reinvent itself over and over, becoming a "learning corporation" by practicing "systems thinking." Horn's follow-up to his hypertext discussion was *Visual Language: Global Communication for the 21st Century*, a scholarly contemplation of how words and images should work together.

The godfather of visual data, Edward Tufte, offered *Envisioning Information*, explaining the syntax of visual language, making an indelible contribution to graphic thinking. His academic discussions, however, don't address group interaction or organizational learning. But the appearance of infographics on the front page of *USA Today* tells us something about the mainstream recognition of graphic data.

One of the principal concepts of the 1980s was "total quality management." It became part of the "Japanese miracle," practiced across the Pacific with success, but with a rigidity unfamiliar to American firms. The core of the idea first appeared in Edward Feigenbaum's 1951 book *Quality Control: Principles, Practice, and Administration*. Today we still esteem this expat-come-home, but some perceive tones of the Industrial Revolution in the way total quality management is measured and practiced by rote.

The Visual Now

This caution prompts a question: Just how enlightened has business become? Has corporate management changed with the tools available to it? Or does stubborn authoritarian hierarchy still regard business systems as static machines? We can attend conferences, read books, mouth buzzwords, and still return to Scrooge and Marley's counting house, over and over.

It almost seems as if the corporate model has become post-revolutionary, but before the revolution has ended. The Age of Innovation continues. We deal with global networks, entirely new disciplines, instant news, unparalleled (and uncontrolled) connectivity, clickable-map awareness of geography, major transactions at blurring speeds, and new modes of work—flex time, part time, the paperless, water-cooler-less, officeless office.

Our connectivity has progressed to virtual meetings and online chats. Our visual senses have never been as keen or as necessary.

This raises another question: What is the most facile tool of reflecting and influencing corporate change? For grace and subtlety in expressing complex and multifaceted corporate plans, I advocate using big paper on walls.

Here we arrive at the heart of my matter. With a competent graphic facilitator interpreting, bridging, recording, and connecting, there is no tool as facile or succinct. A good graphic facilitator brings the tools of cognitive understanding to the process, so that the moving form of the graphic actively nurtures clearer statements and fresh directions from the meeting members.

Vocalized ideas are merely bits of vibrating air. When I fix these ideas on paper in the visual language that has excited and illuminated communication, they stand symbolized beside other lateral ideas.

I know that nothing is as understandable, logically connected, or as fast as my hand. I also

know that the language in which I work is the way human beings encode thought. We don't imagine in words but in images; we can only think graphically.

The imperfect nature of my strokes makes the big paper human and touchable. In a lively meeting, the big paper demands collaboration, correction, and controversy. Its value is in the moment it crystallizes, and in the passage of time and thought it chronicles, and in the connections it makes. It becomes a member of the meeting in its own right.

With digital camera technology, I can record and download the big paper on the wall almost instantly, so that every meeting member takes away a record, a map of the ideas traversed.

It's worth noting that the big paper transmitted digitally—though a duplication of what everyone has seen—remains interpretable. It is a tool of lateral thinking and new, better, wilder, more focused, less rigid, or simply different thought. Post-meeting ideas spring out of the big paper when it's exposed to a broader audience, and its good effects continue, weeks after it was recorded.

More graphic facilitators with sophisticated abilities distilled from new infographics and graphic design are emerging from many disciplinary backgrounds—architecture, illustration, journalism, and business—so the field is in an undefined stage that is still fresh and flowing.

What are my medium's shortcomings? Because the paper records hand strokes, calligraphy, icons, and purely graphic shapes and tones, it doesn't respond to a digital search. Ideas in shape and color aren't searchable until handwriting recognition reaches a much more advanced level. It's currently possible to notate the big baper's image after the fact with referencable hypertext, though this requires an extra, time-consuming step. Though these hypertext interpretations are searchable, there is the danger of fixing them too narrowly and losing the evocative nature of graphics that suggest nonlinear associations. One of the "killer apps" of the next decade may be a graphic recognition and archiving program that can search both handwriting and drawings.

Big paper on the wall is artful, not art. It doesn't concretize ideas; rather, it exposes them.

One of the most important things big paper records is the participation of the meeting atten-

dant who saw it being created. What is on the big paper is what was discussed. Is there something that should have been said? Some connection that should have been made? Was there an objection that some dissenting voice should have registered? The big paper is a reminder to every member of the meeting, evidence of the meeting's success, and of any failure to change the big paper. In this way the big paper's image encourages continued interaction and follow-up.

Big paper on the wall gives the graphic facilitator scope—on that broad field a gifted recorder can use the tools of iconography, calligraphy and information architecture to map the flow of group thought and decision.

Paper, invented in China in another millennium, became commonly available to working people only in the 18th century. I tape big sheets of it to walls. My other tools—markers, chalk—are old and simple. The only cutting-edge materials I use are fresh visual language, a knowledge of group dynamics, and contemporary business and meeting process awareness. What I create is a sea surge of words and colors and shapes. I believe my medium is the most important tool of collective thought in the continuing Age of Innovation.

ABOUT THE AUTHORS Christine Valenza has been a strong contributor to the growth of her profession. She was one of the earliest facilitators to connect learning styles, meeting dynamics, and visual thinking in graphic recording, and to translate ideas into graphics as active catalysts for creative and strategic thinking in meetings. Her evocative art has helped many corporations make fresh, innovative decisions. Valenza is the co-author, with Nancy Margulies, of the award winning book *Visual Thinking; Tools for Mapping your Ideas*. See more of her work and understand more about the art of her communication at www.christinevalenza.com.

Jan Adkins is sometimes called the "Explainer General." He uses illustration and words to trace the shortest, simplest, and often the most entertaining route to understanding. He's written and illustrated 40 books—most of them non-fiction—and hundreds of articles for mainstream magazines. For nine years he was an art director at *National Geographic* explaining everything from Soviet space shots to deep-diving submarines. In both text, image and graphic design he expresses simplicity with graceful style. Learn more at The Jan Adkins Studio; www.janadkins.com.

Valenza and Adkins are cofounders of Visual Thinking Labs.

Stories That Inspire Action

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We hear stories all the time. We tell stories. We are stories. Think about your own name, for example. Why did your parents give you that name? Does your surname have special meaning? Do you have a nickname, and if so, how did you get it? We have asked hundreds of people these questions and have been captivated by moving, funny, obscene, sometimes unforgettable stories. Here is one of our own:

"When I was on the freshman basketball team at Lincoln high school, my teammates Rawlin Nolte and Eddie Peterson gave me the nickname 'Doof.' Mostly it was because I walked around with my mouth open and a blank expression. I somehow managed to turn this name into a huge compliment. For four years people called me 'Doof' or 'The Doofer.' Somehow, though, I differentiated those two names from the more pejorative 'doofus.' If anyone ever called me that, I would immediately correct them and say, 'Hey, it's Doof.'"—Brad Robertson

Stories are told in business, too: by managers, by co-workers around the water cooler, by consumers upon leaving a store. Stories are told pretty much everywhere except in those silent elevators.

But unorganized stories may not be enough to inspire either internal or external organizational action. They need a structure, so that people better understand what the stories are about and how the stories can help catalyze action. This article explains how we created the "Story Plotter" and how you might use it to organize your stories and inspire action within your organization.

A Snow Story

About three years ago we were working with a large group of managers at a global overnight shipping and delivery company. They were talking about excellent personal customer service. Indeed, one of their stated brand attributes is being personal. When asked what that meant, a few people recited the tagline on the printed internal literature. But when asked to tell a story about this language in action, a woman in the back of the room grabbed the microphone:

"I work in the Rocky Mountain region. One of our carriers responded to a pickup call halfway up a mountain in a remote area. There was an author who was working in one of the cabins who needed his manuscript to get to New York the next day. The driver arrived just as a typical Rocky Mountain snowstorm was assaulting the cabin. Indeed, when he tried to start his truck in the cabin driveway after picking up the package from the author, he discovered that his truck was quite stuck. The driver calmly looked at the author and asked, 'What is your shoe size?' The author replied, '9.' The driver then asked if the author had any skis. He squeezed his size-9.5 feet into the author's downhill skis and skied the package down the hill to the road. It was delivered on time the next day."

This story was news to most of the people in the audience, and someone on the other side of the auditorium even stood up and said, "We did that? That's fantastic!"

The snow story got us thinking: How many other stories were embedded in the company? How many other stories would generate a similar inspired response? How could we help get these stories told? And, once told, how could they inspire similar action?

The Use of "Fat Words"

Instead of utilizing stories, organizations often try to drive action by developing phrases or words they hope will inspire and motivate. The global overnight shipping and delivery company had developed a values-based language they hoped would inspire good customer service. They used words like "connecting, simplicity, and certainty." Our friend Brian Lanahan (who was once a brand manager at Coke and now collaborates with us through a consultancy called Character) describes such language as "fat words;" words that are so universal that they can mean something different to anyone using

them. These words don't arrive in a vacuum; they can be based on real beliefs, founder visions, and organizational philosophy. But the words alone fall short for several reasons:

• Often this language is aspirational, describing what the organization wants to be rather than who they currently are.

• From company to company, the language all sounds alike (for example, most advertising agencies say they value creativity). So the language does not help differentiate the organization or brand from any other.

• This language doesn't seem to help the people internally make decisions, respond, and act.

• Last, the customer knows the difference between talk and action. Consumers in the information age are more knowledgeable and savvy, and they have access to more information than ever before. The wall between consumers and the brand has become much more transparent. Consumers do not experience the intention of the brand no matter how honorable; they experience what the brand does. So if a company says they are caring but then underpay their employees, the public will find out. Today a brand is as strong as its relationship with its customers. To create a strong relationship, there must be alignment between what an individual, brand, or organization says and what it does, In the end (as the saying goes), actions speak louder than words.

Story Plotter

We developed Story Plotter to help the handful of our clients who had realized fat words are not enough. We worked with a professional basketball organi-

zation that wanted to bring its brand values to life by finding distinctive actions to exemplify these values throughout every level of the organization. A few years ago we helped a global advertising agency that was interested in finding other ways for its clients to communicate who they are to their consumers, looking beyond brand communication and focusing on internal actions. We worked with our friend and collaborator Arnie Jacobson and his research firm, QRC (they bring to life a whole other set of stories, that of the consumer), to help a Hollywood studio find new actions for its character-based consumer products division.

To assist these clients, we asked them to tell stories of things that happen in the company. We heard stories of gritty reality, stories illustrating failure, communicating learning, and acting as a warning. As these stories emerged, we asked ourselves a question: Could there be a simple, sensible way of organizing and classifying stories that could be useful in helping organizations live their brand, find alignment, discover new actions, and look beyond language? The Story Plotter, a taxonomy for organizing stories, emerged from this inquiry. We identified four kinds of stories and designed the Plotter to help organizations and brands do the following:

• Talk about who they are by telling stories of what they do.

• Learn to be more of a listening organization, by incorporating consumer stories and input into company communication.

• Share knowledge internally and externally.

• Find meaningful new actions for exemplifying values.

IMPROVISED STORIES

Our take on stories comes from the world of improvised theater, where stories are made with no script, plan, rehearsal, budget, or, on occasion, talent. The job of the improviser is to instantly create stories and scenes that engage and enthrall the audience. One of the many skills that help an improv actor survive under these seemingly impossible conditions is an ability to create vivid and authentic characters. It is vital that the audience knows as much as possible about these instant characters so they can become immersed in the story.

When I was first studying to be an improviser, I was convinced the best way to tell a story was to tell the audience all about my character; what was important to him, what he wanted, and so on. I might start a scene with another performer by proclaiming: "Hello, I am the honest baker," speaking more to audience than to the other actor. "Welcome to the Honest Bakery. Do you like our new uniforms with 'HONEST' written across the chest?" I figured if I simply told people who I was, then I could get on to the funny stuff. One of my acting coaches pulled me aside and said:
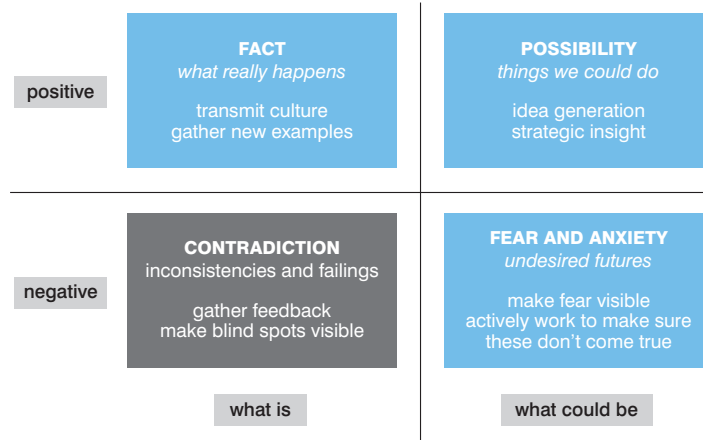
"It's not like your characters are an ad for floor cleaner or running shoes. It's not convincing or very engaging to say you are honest, or reliable, or nimble, or inspiring. Your characters need to communicate who they are through what they do. If you are an honest baker, then behave honestly, tell people what's in the muffins, return the wallet that was left on the counter. Let the customer know that she has a piece of spinach in her teeth. You don't have to tell the audience anything. They are smart. Simply be it." —*G.H.*

STORIES OF ACTION

While waiting for luggage at the Phoenix airport, a friend of mine had an encounter that inspired our quest to find more stories of alignment. Here is what he told us:

"At baggage claim I patiently watched the empty carousel go around when I suddenly heard a 'clunk' behind me. I turned around to see a large surfboard being unloaded at the oversize-baggage area. A surfboard in a landlocked desert state? A gray-haired older gentleman in a suit walked up to claim the oblong baggage, and I asked him what he was doing with the surfboard. He smiled at me and answered in a thick Australian accent, 'Oh mate, not sure where I'll surf but I'll find someplace. I have to… it's in my contract.' He went on to explain that he was the CFO of an Australian surfboard company and it is written into every senior executive's contract that they must surf at least once a month. This gentleman was on a three-week business trip, so he took his board.

STORY PLOTTER

	FACT *what really happens* transmit culture gather new examples	POSSIBILITY *things we could do* idea generation strategic insight
positive		
negative	CONTRADICTION inconsistencies and failings gather feedback make blind spots visible	FEAR AND ANXIETY *undesired futures* make fear visible actively work to make sure these don't come true
	what is	**what could be**

• Develop aligned ideas, products, positioning, and communication.

• Discover new touch points with the audience.

• Make conscious deliberate choices instead of knee-jerk ones.

• Follow through on promises.

• Demonstrate authenticity.

• Understand how internal and external audiences see and understand the brand.

• Transmit their culture, especially to new hires.

• Identify areas of strength and weakness.

Story Plotter emerged as a structure for organizing stories and action. The left-hand column captures stories of the current reality, what is happening now. The stories in the right-hand column capture what we would call future stories—stories of new possibility, new ideas, new action, and future fears and anxiety. The top row describes stories and action worth keeping and cultivating. The bottom row captures stories and actions that might be most constructive if stopped or discouraged from coming into fruition.

Stories of Fact. These are stories of things that have actually happened (even if they have been embellished in the telling). These stories capture actions that flesh out and make real whatever language the company uses to describe itself. One company we worked with valued integrity. A story of fact they told us described how they realized they had made an error in a shipment. In this case the train had left the station, literally, with thousands of mislabeled packages. They had a choice: ignore the mistake and hope their retailers didn't notice, or call the train back, unload it, be a week behind in fulfillment, and fix the error. They also told us that their retailers often made similar labeling errors when sending shipments back. Our client never complained. But of course, this is a factual story about integrity. They turned the train around, relabeled the boxes, and apologized for the shipment being late without revealing the extra effort they put in to get the shipment there correctly.

Stories of Contradiction. By contrast, these stories capture actions that contradict or work against what the organization says it is. A manager at a large U.K. mobile phone company recently told us a story of contradiction. The stated value was honesty. He noted that his company charged by the minute.

But how honest was this? That meant that people were charged one minute for a five-second call. By making this visible, the company had a choice: continue the practice and be out of alignment, or change the policy.

Stories of contradiction point out areas of inconsistency and make them visible. They do not always lead to reversible action. The NBA team we worked with wanted to live the value of being more open. However, they had no desire to reveal their draft considerations. They knew this contradicted their stated values but decided that this was fine and made good business sense.

Stories of Possibility and Revolution. This is where brands explore and play with the future. We ask a lot of "what if" questions. Using a host of improv-based exercises, ideas for new actions and possible futures spring to the fore. Stories of possibility are "quick wins"; they capture actions that really ought to be happening and for some reason, possibly a trivial one, aren't. By asking people to create new stories of possibility, you can find the cheap and easy things that are obvious to somebody in the organization but that no one has yet put into action. Here is an example:

The baggage handlers at American Airlines knew something no one else had realized: The bags that go into the plane first are the last to come out of the hold. The handlers suggested that the first-class bags be put in last so the first-class passengers could get their bags first upon arrival. The company implemented the idea immediately.

Stories of revolution are stories of what could be, not what

is. They are much further ahead and more of a stretch than stories of possibility. For example, British Petroleum asked, "What if we were no longer in the oil business?" By asking people to tell stories, you free them up to think more laterally and creatively about the kind of things that would really embody the organization's identity.

Stories of Fear and Anxiety. These are stories of things that you do not want to happen (at least at the present moment). They uncover possible or impossible futures and let the teller play out the details and nuances of their own fear and anxiety. These can flow from stories of possibility and revolution. We use these within our own organization. We often author future stories that capture a particular fear we might have, such as one of our partners being courted by a large megabrand consultancy. We use the practice of sharing stories with our partners. We find it is a helpful tool to bring concerns to the surface and helps us communicate around difficult issues.

So those are the types of stories, but what do you do with them?

1. *Transmit the Culture.* You can identify potent stories of fact and tell them. In doing so you are transmitting the culture and values in a much more immediate and powerful way than through a manual or presentation. And as you tell these stories, you can appeal for more. The stories you get back will clarify whether people have properly understood the stories. If they have, their examples will furnish you with new stories, so that you aren't just transmitting in one direction, but interconnecting stories and

actions from all over the organization. With one organization it became important to find a home for these stories and others. They created an evolving book, one that is constantly growing as new stories are discovered. This book can be used as a reference for being-the-brand behaviors without management being prescriptive and dictating, and it can be a resource for new employees to help them understand the history, norms, and actions of the company.

2. *Change Behaviors.* Stories of contradiction can help you discover places where behavior should change. These are often easy "wins;" you can decide to simply stop doing something you were previously accustomed to doing. Correcting your behavior can lead to new stories of fact.

3. *Generate New Action.* You can generate stories of possibility and revolution. This is a simple and direct way of exploring what could be done, either near or far in the future, and of seeing how the company's identity would play out in different scenarios. This gives you a tool to generate new ideas that could even grow into new products, processes, or services.

4. *Reveal the Anxiety.* Finally, by asking people to make stories of what they are afraid of, you can allow them to release a ton of tension. They can open up in ways that enable them to express and explore without fear of judgment. At On Your Feet we regularly ask each other for future stories of things we worry about in order to open up dialogue.

Story Plotter provides a framework within which stories can be told and gathered to help an organization live its

brand more effectively. It can be used to help people in different places, departments, and roles understand what the brand means and how it affects them. By hearing and telling stories, they can translate whatever language is used to describe the brand into action and behavior, including their own. Stories are not prescriptive or patronizing; individuals can interpret them in their own context. And by using a grid we give structure to the stories. This structure gives guidance and form to what would otherwise just be seen as anecdotes of incidental importance. It thus helps both the individuals and the organization to learn, improve, and communicate through action.

ABOUT THE AUTHORS
Gary Hirsch is a rabid illustrator, improviser, and cofounder of On Your Feet. He has designed and led programs for Nike, FedEx, Disney, Warner Bros, Intel, and others. Hirsch has been teaching and performing professional improv for 15 years. He is the founder of Super Project Lab improv (www.superprojeclab.com), and has served as a visiting faculty member at Templeton College at Oxford University, Portland State University, Oregon Graduate Institute, and at "12," the graduate school at Wieden + Kennedy advertising. Visit him at www.oyf.com

Before joining OYF in 1999, Brad Robertson was first the snow-cone king of Portland (really, it's true) and then the director of the business outreach program at Portland State University, where he taught courses in small business consulting, organizational behavior, improv and business, and dialogue. Recent clients include Starbucks, Nike, Intel, Wieden + Kennedy, Lucent Technologies, and Saatchi & Saatchi.

Supporting Healthy Aging with New Technologies

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[1] Mynatt, E. D., A.S. Melenhorst, A.D. Fisk, and W.A. Rogers. "Aware Technologies for Aging in Place: Understanding User Needs and Attitudes." *IEEE Pervasive Computing 3*, no. 2 (2004): 36-41.

[2] Melenhorst, A.S., W.A. Rogers, and A.D. Fisk. "When Will Technology in the Home Improve the Quality of Life for Older Adults?" In *New Dynamics in Old Age: Individual, Environmental, and Societal Perspectives*, edited by H. W. Wahl, C. Tesch-Römer, and A. Hoff, 253-269. Amityville, NY: Baywood Publishing, 2007.

[3] Rogers, W.A., I.A. Essa, and A.D. Fisk. "Designing a Technology Coach." *Ergonomics in Design* 15, no. 3 (2007): 17-23.

[4] Fisk, A.D., W.A. Rogers, N. Charness, S.J. Czaja, and J. Sharit. *Designing for Older Adults: Principles and Creative Human Factors Approaches* (2nd ed.). Boca Raton, FL: CRC Press, 2009.

Information and communication technologies (ICTs) have the potential to enrich many aspects of our lives. The power of wireless computing and networks allow us to connect anytime, anywhere with everything and everyone. New applications and gadgets grow at such a phenomenal rate that technologies aid us in almost all of our everyday activities. By using mobile devices, we can find information in seconds on just about any topic. We can securely store personal health information online to be accessed from anywhere. We meet others with similar interests around the world without leaving the comfort of our homes.

While these experiences are commonplace for many, especially among younger adults and teens, this trend is in fact resulting in a greater divide with older adult generations. Some older adults are familiar with and even proficient at using ICTs, but their use of advanced technologies continues to lag behind younger adults, perhaps limiting their options to maintain independence and health. As many countries, including the United States, face a marked increase in their older adult populations, it is imperative that we design ICTs to assist older adults to remain independent in their own homes, to recognize the benefits of such technologies, as well as how to use them effectively.

Designing ICTs to help adults function independently as they grow older is certainly not a new area of research. However, if not done effectively, these technologies will not be successfully adopted. A number of factors affect the use of such technologies by older adults: functionality, value, design, cost, privacy, trust, and acceptance. All of them require a multidisciplinary approach.

At Georgia Tech, there are several active research programs considering the older adult population, including the design of: technological applications to support aging-in-place, mobile health applications, livable communities, and safer home environments. Moreover, there are studies that examine the needs of older adults, as well as their perceptions and acceptance of such technologies. These research efforts are leveraging the knowledge and expertise of others on campus, as well as those at other universities. One project receiving great recognition in the area of aging research is the Aware Home Research Initiative (AHRI)—a multidisciplinary group of researchers exploring technological applications in the home. For more than a decade, new designs and technologies have been developed from a multidisciplinary perspective to understand the perception and use of ICTs in the homes of older adults and how interfaces and devices should be designed to enhance the acceptance of these technologies. Exemplar projects have focused on a number of topics, including technologies to support communication between family caregivers and older adults (The Digital Family Portrait) [1]; cognitive reminder systems for medication management (The Memory Mirror); cooking practices (The Cooks Collage) [2]; and assistive devices that coach individuals step-by-step through interacting with technological medical devices, such as a glucose meter (The Technology Coach) [3]. The projects demonstrate the use of noninvasive and state-of-art technologies like motion sensors and cameras to adapt to the needs of older adults

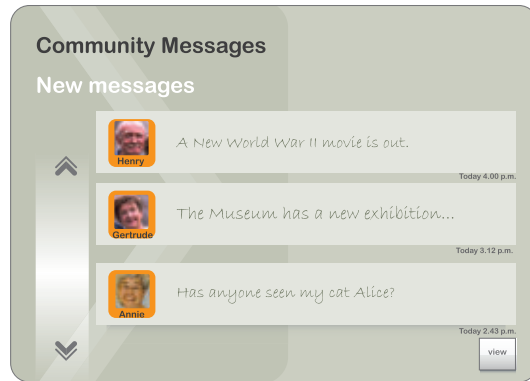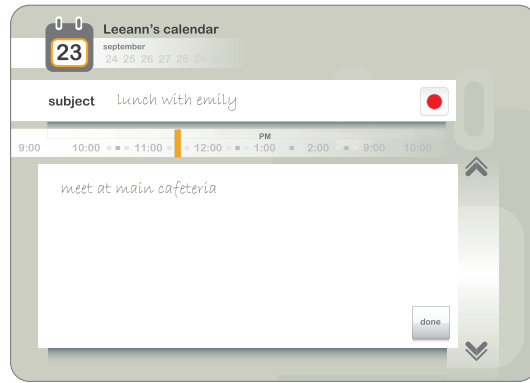without threatening the successful adoption of such technologies.

AHRI projects have benefitted from knowledge of the factors affecting seniors' technology adoption. The Human Factors and Aging Laboratory at Georgia Tech has been examining the psychological factors surrounding the adoption of technology by older adults. Through a series of research projects funded by the National Institute on Aging (NIA) through the Center for Research and Education on Aging and Technology Enhancement (CREATE), this group of engineering psychology researchers has conducted in-depth studies on how privacy, trust, perception, and acceptance of technologies play a role in adoption. Their findings have been influential to designers, from research universities and industry alike, aiming to improve successful adoption of ICTs intended for older adults [4].

New efforts in the area of aging both at Georgia Tech and its surrounding community have resulted in greater opportunities for multidisciplinary research. The Enterprise Innovation Institute began to develop outward-reaching relationships with retirement communities, developers, and other city, regional, and state organizations with a goal of more livable and sustainable design of such communities. These connections have built the foundation of a much richer research environment and encouraged other research domains to get involved.

The need for a more organized approach to address different aspects of aging resulted in the Design and Technology for Healthy Aging Initiative (DATHA). This initiative brings together researchers, industry, practitioners, and service providers to identify, develop, and implement new design and technologies that encourage healthy living for older adults. With efforts ranging from better community design to designing technologies for individuals aging in place, DATHA serves as a catalyst for a major shift in the way design and technology for older adults are conceptualized and implemented.

▶ The 2-Link device from Georgia Tech's DATHA Initiative.

Leeann's calendar
september
24 25 26 27 28 29

23

subject   *lunch with emily*

9:00   10:00   11:00   12:00   PM 1:00   2:00   9:00   10:00

meet at main cafeteria

done

Community Messages

New messages

Henry   *A New World War II movie is out.*

Today 4.00 p.m.

Gertrude   *The Museum has a new exhibition....*

Today 3.12 p.m.

Annie   *Has anyone seen my cat Alice?*

Today 2.43 p.m.

view

▶ 2-Link allows residents in some of Atlanta's retirement communities to share schedules, messages, and photos.

In the ICTs domain, DATHA's efforts have already begun through courses educating students from industrial design, architecture, applied psychology, and computer science to focus their research on the needs of the aging population. With support from Presbyterian Homes of Georgia, earlier educational courses concentrated on identifying the technological needs for Continuing Care Retirement Communities (CCRCs) in the Atlanta area. Students considered many aspects of the CCRCs, including independent residents, assisted-living-facility residents, memory care residents, and health and community management. They were able to visit residents in the community and at their homes to document observations of their experience with ICTs to better design technological devices. Their process involved consulting with experts to produce an informed outcome resulted in 2-Link, a portable device focused on connecting community residents through scheduling, messaging, and photo sharing. The uniqueness of the concept was based on advancing technological solutions while considering the

simplicity of the task. The concept offered the solution of a dual screen to physically represent the split between the personal side and the community side.

In addition to a number of lessons learned, the earlier courses served as evidence for the need to leverage the expertise available both at Georgia Tech and Emory University as well as within the CCRC to educate students on the convergence of aging, technology, design, and community. Moreover, it represented the first steps toward developing a comprehensive multidisciplinary effort of transgenerational education focused on responding to the real needs of older adults and a humane and inclusive approach to design within the technological realm.

An illustration of this concept is a recent project sponsored by the GVU Center and the Health Systems Institute (HSI). The Sympathetic Devices Project, a study of inclusion across housing options, aims to identify communication needs of older adults living independently across a range of housing options. More important, it seeks to design and develop inclusive communication devices to help older adults maintain personal and social connections. The project comprises an iterative series of applied action research studies to assess, inform, evaluate and implement the design of communication technology devices—sympathetic devices—for the aging population. The most interesting aspect of the research was how the students in the classroom and the aging community were unified in the process of assessing the state of technologies and identifying current infrastructures for rapid implementation and adoption of technologies. Through interviews and focus groups with older adults, students were able to understand: Specific needs related to isolation; that successful communication patterns can be defined by the amount and type of social activities; and the additional importance of intrapersonal communication—that is, the effectiveness of communicating with oneself.

Jitterbug cell phones, which are simple cell phones specifically designed for older adults, were one of the data-collection tools. Training sessions were held prior to the data collection. The most interesting finding over the course of the research was that older adults stayed in touch with the students after completing their research protocol. There was a natural and mutual interest in aid-

ing the design process with communication by design. It was truly integrative evidence on how to design for inclusion and communication technologies. As a result of the interactions, affordable designs and everyday technological communication devices were created to fit the lives and preferences of older adults. A series of prototypes were developed using creatively simple technologies and interfaces to achieve everyday tasks. Concepts ranged from remembering (designing memory aids), eating (addressing the issue of eating alone), learning (developing e-learning tools), and moving (advancing incentive devices for activities). At the end of the process it became apparent that aesthetics and inclusive design

indeed play a significant role in the design of a good technological system for older adults.

The major aspect of these educational efforts is the transition of research from investigator-initiated and technology-centered to a needs-driven, user-centered approach. In many of the aforementioned initiatives and courses, the projects have provided great opportunity not only for the community of interest to be integrated in the research outcome, but also to serve as educational tools for students to understand some of the aspects of designing technologies for older adults. This format of transgenerational education serves to advance the students' awareness of aging as well as the older adults' awareness of technology development. Research is crossing its practice boundaries by including the users, industry, and the classroom in a unified process. These groups have advanced a much-needed awareness to think differently about technologies and how they change who people are, what they can do, and translate lessons learned for our HCI community to more grounded and inclusive applications.

For More Information:

The Digital Family Portrait (DFP)
http://www.cc.gatech.edu/fce/ecl/projects/dfp/index.html

The Memory Mirror
http://www.cc.gatech.edu/fce/ecl/projects/dejaVu/mm/index.html

Cooks Collage
http://www.cc.gatech.edu/fce/ecl/projects/dejaVu/cc/index.html

The Technology Coach
http://www.awarehome.gatech.edu/projects/The_Technology_Coach.pdf

CREATE
http://www.create-center.org

Human Factors and Aging Lab
http://www.hfaging.org

Aware Home Research Initiative
http://awarehome.imtc.gatech.edu

Design and Technology for Healthy Aging (DATHA)
http://www.datha.gatech.edu

Presbyterian Homes of Georgia
http://www.phgainc.org

Jitterbug
http://www.jitterbug.com

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Wendy A. Rogers is a professor of psychology at Georgia Institute of Technology. Her research interests include cognitive aging, skill acquisition, human factors, and technology acceptance. She is codirector of the Human Factors and Aging Laboratory, funded by the National Institute on Aging through the Center for Research and Education on Aging and Technology Enhancement. She is involved in the Aware Home Research Initiative and is the editor of the *Journal of Experimental Psychology: Applied*.

One Year of Experiences with XO Laptops in Uruguay

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[1] One Laptop Per Child. <http://laptop.org>

[2] Hourcade, J.P., D. Beitler, F. Cormenzana, and P. Flores. "Early OLPC Experiences in a Rural Uruguayan School." *Extended Abstracts of CHI 2008 Conference* (alt.chi). New York: ACM Press, 2503-2512.

[3] Republica Oriental del Uruguay, Instituto Nacional de Estadística. <http://www.ine.gub.uy>

Nicholas Negroponte launched the One Laptop Per Child (OLPC) Foundation in 2005 with the goal of providing poor children with low-cost laptops designed to enhance the learning process. While much of the press about OLPC has focused on the cost of the laptops, their design incorporates many novel elements in both hardware and software [1]. In some ways OLPC may be the largest experiment in the history of human-computer interaction. Yet apart from minor exceptions [2], little is known about the project and its progress aside from press releases and reports from OLPC. Here, we describe how Uruguay, one of the first countries to follow the OLPC vision, has been using the XO laptops.

The OLPC initiative set out to design a laptop that could provide functionality similar to that of a mainstream laptop in areas such as processing power, connectivity, and multimedia capabilities while making it rugged, low-cost, highly mobile, and energy efficient. The resulting XO laptops weigh 1.45 kg and measure 24.2x22.8x3.2 cm. Their rugged features include the use of flash memory instead of a hard disk, and a keyboard made of rubber to protect against spills and dust. The laptop incorporates a video camera, supports WiFi connectivity, and can be used in handheld mode by rotating the screen and folding it atop the keyboard.

The laptop's Sugar environment (XO's Linux-based OS) aims to support educational activities and provides a very different user experience from that of current mainstream operating systems. For starters, there are no windows. Instead, all applications run in full-screen mode. And there are not really applications; instead, there are activities. The laptop disregards the "office" metaphor, favoring concepts more familiar to children, such as friends, neighborhood, and journal.

Uruguay As An OLPC Candidate

In many ways, Uruguay seems like the ideal candidate for OLPC's ideas: high-speed Internet connections are accessible throughout the country; there are no major problems with civil unrest or crime that could threaten implementation; and Uruguay has had free, compulsory elementary school education for more than a century, leading to high literacy rates (near 98 percent, as of 2007) [3]. Because Uruguay is a Spanish-speaking country, the children have access to large amounts of content they can read on the Web, and interface elements in English can still be vocalized.

The Uruguayan government implemented the Ceibal project to provide every child in public elementary schools (grades 1-6) with a laptop by 2009. As of August 2008, approximately 120,000 XO laptops had been distributed, with an estimated total of 350,000 by the end of 2009. The children own the laptops; they take them home from school each day and get to keep them upon graduation.

We started by teaching children and instructors the basics of using the XO laptops, focusing primarily on emailing and blogging. Villa Cardal, a small dairy-farm town of about 1,200 inhabitants, was one of the first areas in Uruguay to receive the XOs. During the first four months of Ceibal in 2007, we visited the school 11 times. Since then, we have conducted five workshops with parents of children who received laptops at various localities, and spoken with eight groups of teachers from several schools as they received training before and after receiving the laptops.

▶ The XO laptops distributed by the Uruguayan government have benefited local children at school and at home. The Ceibal project is one of the more successful implementations of the One Laptop Per Child initiative.

Photograph Courtesy of One Laptop Per Child

Children and adults have responded to Sugar very differently. While adults find it difficult to adapt their WIMP (window, icon, menu, pointing device) approach to Sugar's interface, most children find Sugar intuitive and feel free to explore the environment.

Use of the Hardware

The children have great affinity for the XOs; some even prefer them over existing computers at home. This is partly due to their sense of ownership, but it's also a result of the laptops' toy-like aesthetic. The same is not true for adults who are often frustrated at trying to open the laptop, using the touchpad, and trying to type on the small keyboard.

The characteristics that have proved most advantageous are the XO's mobility, camera, screen, and handheld mode. By being light, small, rugged, and energy efficient, the laptops are very mobile, making it easy to conduct collaborative classroom activities. Mobility also makes it possible for children to carry their laptops during field trips. Moreover, the laptops have an impact in the home, as parents and siblings can also use them. It is not unusual to see children with their families browsing the Web right outside the school after school hours. The children are very

motivated to use the camera, which, in turn, has been useful for teachers in assigning activities to gather information outside the classroom. The screen has proven effective, with children able to use it outdoors on sunny days without problems. It took time for the children to become comfortable using the handheld mode, but after a few weeks they preferred it for reading, taking pictures, and playing games.

The characteristics that have caused the most problems are the heavy-use input devices: the touchpad and the keyboard. The touchpad was supposed to have dual modes, so it could also be used as a stylus area for drawing. This feature was tested in Villa Cardal but later disabled because it was rarely used, probably because most of the available software did not take advantage of it. Furthermore, using the sketch mode caused additional problems, as children sometimes pushed stylus-type items too hard against the touchpad and ended up breaking it. Aside from this problem, the touchpads have been very unstable, frequently losing calibration. While undamaged keyboards work well in terms of preventing liquids or dust from entering the computer, children often make holes in them with their fingernails, pencils, compasses, and other school supplies. The most unusual case involved a parrot who picked out several keys in a child's home. It is also easy for children to get ink on the keyboards, which can be very difficult to remove. In addition, there have been several cases in which the keyboards stopped working without any visible physical damage.

Use of the Software

Children and adults have responded to Sugar very differently. While adults find it difficult to adapt their WIMP (window, icon, menu, pointing device) approach to Sugar's interface, most children find Sugar intuitive and feel free to explore the environment (see Figure 1). However, some problems remain with the software. These include problems with the critical feature of mesh networking (it fails often, especially in classrooms with many children), copy-paste (you cannot copy text from the Web browser into the text editor), and Web browsing (you cannot load Flash movies). Beyond these problems, the stability of the system is similar to that of popular platforms such as recent versions of Microsoft Windows.

► Figure 1. Home screen in Sugar.
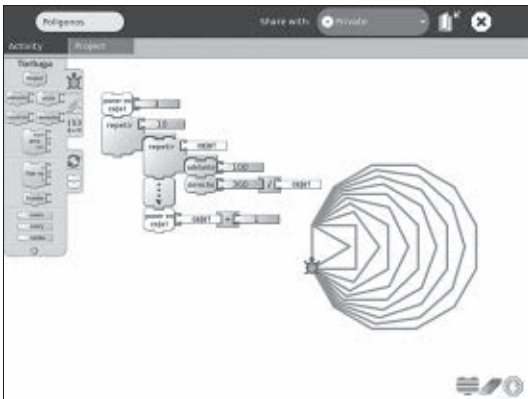
► Figure 2. A screenshot of TurtleArt.

The most common activity is the use of the Web. According to teachers, it has motivated children to read more, as they can find previously inaccessible content of interest. Worth noting is that the highest bandwidth usage per child has been registered in rural areas and poor urban areas. Google is the most popular destination for children and teachers searching for information. When training teachers, we emphasized how to deal with large amounts of information and how to distinguish valuable information from untrustworthy sources. Blogs have been a great motivator for children, who are always excited about sharing content they create for everyone to see. Children have also uploaded videos to the Web, with one showing a cow giving birth surpassing 100,000 hits on YouTube (http://www.youtube.com/watch?v=BOzBTGGVWNg). Email has rarely been used, likely due to the fact that only a poorly designed Web-based email client was made available to the children. One of the problems with this and other Web applications is the difficulty children have using anything that requires usernames and passwords.

Aside from Web access, common activities include the use of the text editor, the drawing program, and the camera. Another popular activity is TurtleArt, a visual take on the Logo language that teachers use for math and geometry lessons. Even though many of the activities included a blend of English and Spanish in the user interface, this did not seem to deter the children (see Figure 2).

While it is too early to draw conclusions on the long-term impact of the XO laptops, thus far the experiences have been mostly positive. In particular, the laptops' mobility and connectivity have encouraged collaboration in the classroom, extended the impact of the laptops beyond the classroom, and motivated children to read and write. The problems we discussed, while currently posing some barriers, should be easy to fix in future versions of the hardware and software. The early success of XO laptops in Uruguay suggests that devices with similar mobility and connectivity, such as netbooks, may provide advantages for children over traditional school computer laboratories and even larger laptops. This is because XO laptops and netbooks are more mobile than larger laptops and desktop computers, yet still provide full keyboards and a large enough display to support a wide set of activities.

ABOUT THE AUTHORS   Pablo Flores is a computer engineer, adjunct professor, and research scientist at the Universidad de la República in Uruguay. He specializes in project management for computer networking and telecommunication projects. He helped coordinate technological and educational aspects of the introduction of XO laptops in Uruguayan schools during the first year of deployment. Flores is currently part of Flor de Ceibo, an outreach project of Universidad de la República to support Plan Ceibal. He also participates in research about 1:1 projects in Latin America and is a founding member of Ceibal Jam, a civil association for software development for Plan Ceibal.

Juan Pablo Hourcade grew up in Uruguay and is now an assistant professor at the University of Iowa's Department of Computer Science. His main area of research is human-computer interaction, with a concentration on technologies that support creativity, collaboration, and information access for a variety of users, including children and older adults.

The Incidental User

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Traditionally, the focus of HCI has been designing for people who actively use applications or interactive products. These individuals, commonly referred to as users, may be bank tellers operating a banking application, pilots setting parameters of an autopilot system, or customers using ATM machines. This viewpoint neglects a vast number of cases in which human interactions with computerized systems are less active and often unplanned, yet still meaningful. People's needs are routinely ignored in these situations and the effects of information systems on their lives often go unnoticed. We term these people "incidental users."

While not "users" in the traditional sense, incidental users are affected to various degrees by the system and by those who directly interact with it. They have considerable interest in the information presented by the system, usually as the recipients of a service. Incidental users may also be an important source of information for the system, thus taking the role of "co-user." Yet they are also "transparent users" in the sense they are rarely considered during the design process. As designers and researchers, our user-centered concerns typically include the operator (i.e., primary user), the supervisor, the administrator, and the person who installs the system or maintains it.

All of us have been incidental users of information systems. In fact, we suspect that there are more instances of people being incidental users than there are of people being conventional users. We want to draw attention to this phenomenon and to the responsibility of the HCI community to address it.

Characteristics of the Incidental User
Incidental user situations are everywhere. The customer at a store depends on the cashier to correctly record the items she wants to purchase. To verify her bill, she relies on whatever feedback the system offers. Can she see any data at all? Oftentimes she can see only the back of the display. Even if a display is pointed toward her, given the font size and the rate at which the information on the display changes, can she verify this information is correct?

Consider McDonald's cash registers. In the past, a customer could see information on only one item at a time. New registers allow the customer to view the entire order simultaneously, including the price of individual items making it easier to confirm the purchase or request changes.

In another context, the incidental user may be a customer who is evaluating several mortgage plans with a bank clerk.

Depending on the customer's specific needs, the clerk suggests alternatives and discusses the pros and cons of each, showing the customer the expected payments over the years. While the decision lies with the customer, the bank clerk (i.e., the active user) has both the domain knowledge and the expertise in operating the system. Thus, the customer and the clerk cooperate to reach the best decision. Often in these cases, the clerk turns the monitor to present the data to the customer. This type of "workaround" may be a nice gesture, but it also indicates that the incidental user was not considered during the design process.

Consider a different context: Today's in-flight systems allow passengers to monitor the progress of their flight using a predefined sequence of textual and graphical displays. More advanced systems (e.g., the new Airbus A380) even allow passengers to watch the outside view on their personal infotainment system. This demonstrates design solutions that increase the range of information accessible to the incidental user, in this case the passenger.

These examples illustrate a major characteristic of the incidental user: interest in the information with limited (or no) control over the interaction with the

system. In some cases, the incidental user cannot communicate with the system, while in other cases the active user (e.g., the cashier) moderates the communication. In addition, the user often has very limited control over most aspects of the information presentation, such as the content and its format, lighting conditions, viewing angle and distance, pace of change, and volume.

The inability to control how information is processed and presented often results in uncertainty about the situation. Uncertainty is detrimental to our functioning. Cognitively, it hampers our understanding of the environment. Emotionally, it increases anxiety and discomfort. To reduce uncertainty, we actively seek information and develop information technologies. But with poorly designed systems, incidental users are more susceptible to the detrimental effects of uncertainty and to frustrating experiences.

A critical part of the designer's role is to promote the interests of the service providers without neglecting those of the service's recipients. Designing systems with incidental users in mind and providing information to reassure them of a problem-free experience will reduce unpleasant feelings, insecurity, and anxiety. An improved sense of control will instill trust and confidence, an obvious benefit to both parties. We believe it is the responsibility of the HCI community to facilitate this partnership between service providers and their customers.

The Context: Services
At some point in time we all find ourselves in the position of the incidental user, usually while

receiving a service. This is not surprising, as services now represent a whopping 80 percent of the U.S. economy according to a 2006 census report, with a similar representation in other developed countries. Large companies (e.g., Disney and FedEx), each handle millions of service encounters daily [1]. With services becoming the leading selling proposition, there is an obvious need for end-to-end improvement of business processes.

An emerging academic field, Services Science, calls for the appropriate design of services by applying scientific methods in merging technology and business processes [2]. The field stresses the need to satisfy and retain the customer because it is less expensive to do so than to invest in advertising to attract new customers [3]. The consequences of using IT to improve customer satisfaction are evident, for example, in the growing attempts to customize services to individual customers (e.g., Lands' End's system of ordering customized apparel online) and to increase the transparency of the service process. Here, a well-known example is FedEx's tracking system, which makes the service more transparent to the customer. Clearly, organizations using IT should consider the needs of their customers—the incidental users—and design systems to communicate information effectively.
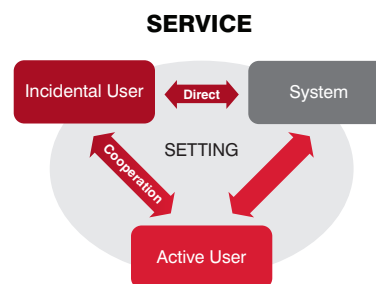
Aspects of Incidental Usage
Obviously, there are various types of incidental use episodes. Figure 1 depicts the key players in situations of incidental use: the IT system, the active user, the incidental user, and the setting in which the service occurs.

The figure offers a general framework for discussing these episodes.

Several aspects influence the incidental use scenario. For the incidental user, interest and familiarity are key factors. Additional factors are the cooperation between the incidental user and the active user, the level of control a person has and the setting itself.

• *Interest.* People's interest in certain information depends on numerous factors, including perceived importance or relevance; domain-specific knowledge; and task characteristics such as time pressure, allocation of attention, and boredom. Passengers on a long flight have plenty of free time to watch the progression of their flight, thereby both passing the time pleasantly and satisfying curiosity. A person undergoing a medical procedure, on the other hand, might have a high level of interest and a great need to reduce uncertainty. However, she lacks knowledge regarding the medical procedure and has limited attention resources to devote to the information presented by the system. Thus, the level of interest, though an important factor, is not sufficient to determine a person's ability to benefit from the presented information.

• *Familiarity.* The degree of

SERVICE

▶ Figure 1.
Framework for incidental usage.

► Figure 2. Interaction level (input/output) for situations of incidental usage. Design solutions under curve B represent service improvement over designs under curve A.
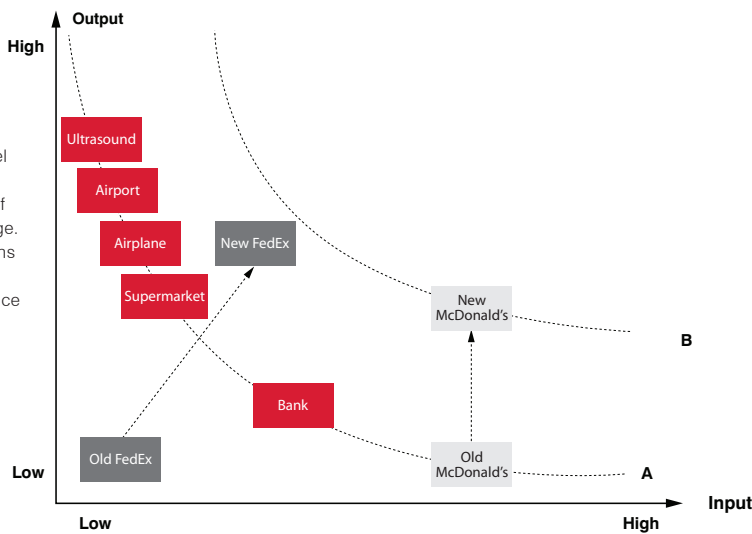
familiarity is influenced by domain knowledge and experience. Incidental users may experience a service as a one-time (or first-time) encounter, a sequence of encounters, or as a series of repeated, similar service encounters [1]. An example of a one-time encounter is a young couple experiencing their first prenatal ultrasound—most couples will not decipher the images and data that appear on the monitor. Having an indication of what is being measured could help couples feel more involved and informed, making the experience less stressful. In addition, the added information may open a channel of communication between the physician and the couple. Conversely, a patient coming back for a weekly treatment might gradually gain enough knowledge to understand the information presented on the monitor.

• *Cooperation.* In incidental use situations, cooperation between a primary (active) user and the incidental user are the heart of the service provided to the customer. Cooperation can take place on two levels. One level is functional, where the primary user is in charge of a system that the incidental user cannot

(or may not) operate—using a cash register to ring up groceries. The other level is where the primary user is a domain expert, contributing his knowledge to the service—a physician filling in a form or interpreting medical information during an appointment.

• *Interaction and Control.* In the purest sense of the phenomenon, the incidental user is completely passive in terms of his ability to interact with the system. Under other circumstances, however, the incidental user has some ability to control the system's input and output. Such control can range from communicating with the active user to directly interacting with the system (e.g., typing in a parcel's tracking number in the FedEx online tracking system, or selecting a seat on a commercial flight).

Limited system output prevents incidental users from providing relevant input as feedback to the system. Improved information display, as in the new McDonald's registers, enables customers to verify the data, thus signaling transparency, promoting trust, and improving the service experience.

Figure 2 presents examples of incidental usage, mapped according to the level of output and input opportunities available to the incidental user. In many service situations, good design solutions can push the envelope of available opportunities, e.g., from curve A to curve B, improve the incidental user's level of control over the situation, and reduce uncertainty.

• *The Setting.* As with any design problem, it is important to consider the context in which service occurs. For example,

► Figure 3. Gathered information as function of user's level of control.
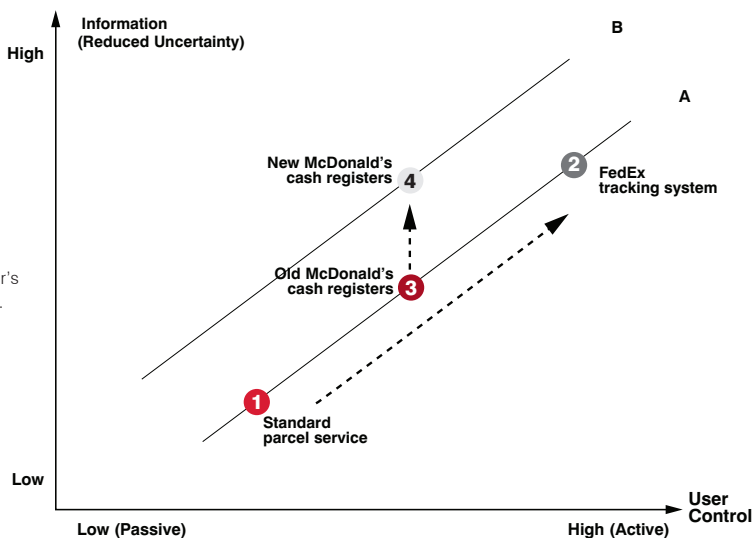
when individuals receive a service, privacy is often an important consideration, one that requires certain design solutions. On the other hand, when a crowd receives a service, the goal is often to optimize the presentation of information to many people simultaneously, which may entail completely different design approaches (consider displays at sports events, or arrival and departure displays at the airport).

Implications for Design

We have only introduced the problem of the incidental user. Clearly, there is ample room for further exploration of this phenomenon. Here are a few approaches for devising design solutions. First, while incidental usage is entirely passive in its purest form, in real life this is not necessarily the case (nor should it be). The issue of passivity can be described using two dimensions: the need to reduce uncertainty and the ability to control the information. This idea is illustrated in Figure 3, which suggests that, *ceteris paribus*, the more control the incidental user has, the more likely he or she is to gather the relevant information and to reduce uncertainty in the operating environment. Thus, one design approach is to allow the incidental user more control over the interaction (i.e., moving to the right along the X axis in Figure 3). FedEx reduced the level of uncertainty of its customers by allowing them to become more active (by interacting with FedEx's website). In Figure 3 this is represented by moving along Line A from Point 1 to Point 2. Another approach is to improve the range of design solutions (e.g., from A

to B), leading to more information (and less uncertainty) for a given level of user control (or passivity). An example of such a shift would be the new design of McDonald's cash registers, which provides more information for the same level of customer control, thus shifting the interaction from Point 3 to Point 4.

Another potential design approach is to facilitate partnership. Improved collaboration can benefit both parties. A simple form of collaboration and inspection (the incidental user observes and corrects inaccurate actions or information) can significantly enhance a service by making the process more transparent, thus contributing to the relationship between service provider and recipient.

The various dimensions of the incidental user problem imply a need for contextualized solutions. The three generic design approaches shown in Figure 3 outline possible directions based on those contextual factors. Is it reasonable to expect the user to become more active? Is there a way to improve information presentation without requiring the user to be more active? Can privacy be preserved as we provide more detailed personal information to our customers? While responding to the challenges of incidental use may require ingenious solutions, we suspect that recognizing the issue and using the generic design approaches can lead to relatively simple and easy-to-implement solutions that would foster better services and experiences.

We have portrayed the phenomenon of the incidental user, one that we feel has not received practical or theoretical reference

in HCI to date. The importance of designing for the incidental user has grown with the increasing share of services in the economy. Designing for the incidental user improves customer satisfaction and loyalty by reducing uncertainty and by increasing customers' control over the information in their environment.

Understanding the role of incidental users in this broader context could extend the borders of HCI by reaching beyond the traditional paradigm of designated users to include the realm of incidental interactions. The extended view suggests that transparently communicating information as an integral part of service delivery and improving the overall experience will benefit service providers and customers alike.

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Around the Table: A Review of Working in Hong Kong

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"What's it like to do design work in Asia?" It's a question I'm often asked.

Hong Kong is a rather small territory with 7 million inhabitants. The city and surrounding area have generally accepted technology as a way of life; in Hong Kong the words "design," "innovation," and "experience" are used commonly in business conversation and are generally associated with worldwide fashion brands and the professions of industrial and interior design. The nature of the work and the challenges one faces vary a great deal, as do the individual designers' skills and proficiency. Designers work not only in the Asian market but also on projects for countries outside Asia. While design has commonly meant "visual" or "skin" design, the notion that design can affect behavior and support goals is slowly dawning in Hong Kong, where local companies are beginning to hire interaction designers. The recent addition of a one-year interaction design program at Hong Kong Polytechnic University has helped raise awareness of this discipline.

Thus, when thinking about what it's like to design in Asia, a common response is: "Asia is a very busy place that is advancing at a fast pace, but design is held back by subtle cultural nuances related to cost, features, and speed."

To keep up with the pace, a number of designers, product planners, usability practitioners, Web developers, and managers from various user experience disciplines have been meeting informally to share and discuss their learning at work, and to present their thoughts and challenges.

In an attempt to give you a flavor of the design field in Asia, especially in Hong Kong, below is a review of these discussions in a roundtable format. The names are fictional, but the comments are not, offering an accurate representation of what it's like to work in Hong Kong (HK).

Work Environment and Struggles: How Quick Is "Fast"?
Alexis: When I compare working in other countries with working in Hong Kong, the first thing that is surprising is the language; most of the dialogue is conducted in English, with a few Chinese words thrown in. One thing that I appreciate is that even if there is one non-Chinese speaker in the room, the meeting will be held in English. While the language is English, the working environment and the discussions are much quieter here than in the West. There are many discussions, but the focus is on deciding, not on brainstorming or discussing different views. Although a quiet environment allows you to focus more on your work, dialogue is essential for communication and idea development.

Our clients are generally very diverse. The key differentiator is how much they understand the practice we offer and how much they are willing to trust our approach and the recommendations that come from it. I have had to do a considerable amount of preaching about the principals behind user experience to the majority of clients here—trying to describe how and why focusing on experience is important. It is advantageous when you have clients who know the value we bring to their online channel, yet who also challenge us. This has been helpful, as it keeps us on our toes and enables us to push our research and our designs further.

Kent: I see larger differences between companies, not between cities. The company culture will shape how workers behave and how colleagues work with each other. I have worked in Hong Kong with European companies as well as with Chinese-owned com-

panies. The value structure is different; it's obvious that the way the company is run—from the organizational structure to the marketing activities—is affecting the staff. For instance, in some companies, engineers are leading the product concept while in others they are executors. Companies with peer-to-peer performance reviews drive individualism, whereas when the company performance is part of the personal review, individuals tend to work more as a team.

The value structure sets different working paces. We see a lot of fast-paced work because of the nature of consumer electronics industries, which are fast moving with a high degree of competition. You also can see this in some U.S. companies producing consumer electronic products. In Hong Kong there is a high demand for new products with a short turnaround; therefore, business is less open to new ideas. Quite often I need to sacrifice quality in order to produce a "speedy" product.

I find that people in the United States are more laid-back. They really value a "work-life balance," whereas in Hong Kong and in Taiwan, often work is more important.

Patrick: Everything in Hong Kong has to be done yesterday! That is the way things work here, and it will take time to change habits. I tend to attribute this to a lack of exposure to the kind of problems that require creative thinking and problem solving—problems that require design. The economy in Hong Kong has been growing thanks to property and financial investments, manufacturing goods, and trading for the past few decades. These businesses valued quick decision making and networking over creative thinking and innovation. To me, the situation in Hong Kong today is a legacy of this past, a past that promoted certain types of people who were made into heroes in the eyes of others, people who are now eager to reproduce that same model. Unfortunately, the world has changed, and to succeed, Hong Kong has to become

▶ The hustle and bustle of Hong Kong's regularly overcrowded streets.

a more creative and innovative place overall. Perhaps I'm generalizing too much here, but that's my feeling about the situation in Hong Kong.

Sue: I think the clients here have less background in interaction design, so they need a bit more education (specifically on the design process). I think in general, the feeling is more "businessy" when dealing with clients in Hong Kong as compared to California, where clients or teams are more patient in going through the education process. I feel that our Hong Kong clients don't necessarily want to understand how you do it, as long as they see the results.

The pace is fast in both markets (HK and the U.S.), but it is true that project schedules and demands are sometimes much more ridiculous here. Essentially, HK clients are more "daring" when giving you impossible deadlines. The fast pace becomes the norm. Hong Kong is a metropolis, like New York or Tokyo, so it's reasonable to expect this pace. It's an expectation embedded in the HK culture—a way of life and practice. Anything slower will make a client think you are less capable or unskilled. People expect things to be highly efficient (look at our airport and Mass Transit Railway systems), and sometimes I am quite proud of that.

James: I have been living in Hong Kong for a decade, and there is a different work style here than in other cities. Besides being a fast-paced city, Hong Kong is a city that likes a move toward "action." Part of this comes from a "can do" attitude. However, the speed can sometimes result in a lack of quality in and around the output. So sometimes it is fast for the sake of being fast, which is not always the right strategy in the right context. Sometimes it's OK to stop and think about the problem before moving toward "action."

Hong Kong took some time to adjust and find its own personality after the handover in 1997 and in working or learning how to work with mainland China. Nonetheless, it is a fortunate

place to live for a number of reasons, which makes working here easier. The city is an efficient business center, has a relatively responsive government, is entrepreneurial in spirit, is rated as one of the most free economies in the world, is well placed geographically to do business in the region, and has a wonderful mix of people from all over the world.

Patrick: I agree that people are quick to take action, but the entire process takes forever. In my perception, in the U.S. work is characterized by fast thinking and action, while here work generally involves little thinking and quick action. Everything is flexible and temporary, so one can always rediscuss an issue and change the decision later. This constant back and forth with lengthy negotiations (along with education of the user experience) should have been done during early phases in design, such as sketching and prototyping, not when projects are supposed to be almost finished.

I remember a case where our solution was deemed "impossible" to produce. After explaining how poor the user experience would be if we didn't use the proposed design, the supplier "magically" found a way to make it possible.

Similarly, the interaction designer commonly gets involved in design after the industrial design has been agreed upon, resulting in an inferior design because the hardware elements were already decided at the time of the industrial design.

Alexis: Quite often the business requirements are too

aggressive, and business needs to act quickly. On the other hand, there is sometimes little appreciation for how much work is actually involved in completing the design of these projects. Many decisions have to be made on the spot. Any thinking or planning is labeled "over-thinking." Forget about researching, or even finding data to confirm decisions. The only thing that is done is competitive analysis, and that is usually very superficial. In the end, we just put Web products out there and see how it goes—or we don't even see how it goes since we are already working on the next project. It is a world where only phase one of all projects gets implemented. After a while, I noticed I was trying to pack as many things into phase one as possible, as I knew the other phases would never happen and that if the product after phase one were not successful, then it would be just thrown away.

User Research
Patrick: Most of the research that is done in Hong Kong comes from marketing. User research is pretty much non-existent, as product cycles are too short. This leads to a lack of direction when designing a product. Design by committee becomes prevalent. Paradoxically, it seems that the products still sell well because we offer lower price points. The price point—along with packing a device with many features—seem to be the main influencers when defining a product. So I find it really difficult to include user observation in our process and try to design for

specific needs; most products just do almost everything possible by the platform but offer awful user experiences.

Alexis: In my work there is always some sort of research that occurs at the beginning of each design project. Some of the research can be very in-depth and within the project budget. Other times, when the budget does not permit, ad-hoc research is conducted. Nothing is done without some research of some sort. Making assumptions is too limiting.

Sue: There is always research to be done, and it's always part of our process. In a previous job, it was not a common practice for "efficiency" reasons. In the states, I often had one to two months for researching, drafting, and reviewing. In HK and Taiwan, clients want things within a day or two, sometimes a week if I'm lucky. When a client asks me to quote a time, I usually quote a longer period of time and cut back if he bargains.

What Can Be Done?
James: As one stays longer in Hong Kong, one needs to balance work with traveling— getting as far away from work as possible and managing client expectations. The main question to me is, why is there an expectation for jobs to be completed yesterday? In some cases, people feel pressure from their management because HK has a legacy of being fast (which is a good thing!). On the other hand, it may also be that people want to move on to the next and best thing. This is certainly a trend you see in HK, where people constantly

demand the next new thing (you only have to look at how people buy and discard mobile technology) or how they want to buy new things all the time. Look at the cars people drive in HK: It's rare to see anything older than the mid-1990s.

Patrick: This trend makes me wonder how quality is addressed. Indeed, we are all struggling to get people to recognize our work here. It all seems like an assembly line. The other day a friend from Europe was buying a leather bag in HK, and to her surprise the sales person said, "Miss, this is real leather! Don't worry, it'll last for at least a year." My friend was rather confused, as she expects a leather bag to last at least 10 years (regardless of her using it that long). In another case, while she was buying a mobile phone, the shop assistant said: "I change my mobile phone every six months." I recall hearing this comment quite often in HK, while in Europe I quite often heard a different story: "I'd like a very simple to use yet good-quality phone that does phone calls and SMS well." Although this is not shared by everyone in the respective cultures, this serves to make a point on the two extremes: new, fully featured products to be used for a few months versus simpler products doing what I need well.

Alexis: Users here always end up buying a cheap product that doesn't necessarily meet their needs over a costlier product that is exactly what they want. That's my take from discussions with business and marketing. However, my manager

would say, "Well, the thing is that we need to stick with the budget, we cannot get all the research that companies do in the U.S. or Europe…"

Sue: The story might be true, but not entirely. You might want to know that eye-track studies tell us that "the Chinese prefer a presentation if [it is] loaded with visual stimuli." [1] The ads and other pop-ups are treated as information, while Westerners would see them as annoyances and bad design.

Kent: On the other hand, in the seminar organized by the HK Business of Design Week in 2008 in reply to the question, "How do we keep up with the speed to innovate before the competition," Larry Keeley said that if we are working with tight deadlines, then most probably we are doing very similar products as the competition—no innovation at all—thus the need to rush [2]. By doing your own projects you will have some lead time to explore the concepts, try and test them, and develop without trying to launch before another company, because your proposition is more compelling and innovative.

James: That's where research can help a lot. After all, if you don't know about what you are going to design, you won't find a good solution. I think we need to buy into the idea that research requires strategic movements and identification of implications to the design and user experience, and it ultimately adds value to the product. Besides finding new niches, one must identify needs that are not yet met.

Conclusion

In this highly challenging context, one can conclusively identify a tendency of companies wanting to jump straight into design without asking themselves if there really is a need for an endless number of products.

On the other hand, our consumer society seems to not question this, and is demanding more variety than ever. Nonetheless, Hong Kong is a vibrant market ready to try out new business. There is lot of action, but too little reflection. Maybe interaction design should be discussed around dim-sum tables more than in meeting rooms.

Acknowledgements

ABOUT THE AUTHOR Pedro "Adler" Jorge is an interaction designer with a background in design, technology, and user research. He has designed Web-based collaboration tools and led international workshops on interaction design and participatory design. Currently at Philips Design in Hong Kong, Adler is working on multimedia devices and desktop applications. In his role as a senior interaction designer, he also questions current design processes and the integration of design, business, and engineering to improve the company's UX strategy. Time permitting, he would like to continue his research work on design processes for collaboration, as well as learn the piano.

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Designing the Infrastructure

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We live embedded within a supporting network of technology, much of it invisible but essential to our existence. Some of it is mundane, such as the structures that provide water, gas, and electricity and carry away waste as sewage or garbage. Some is more profound, such as the institutions of business, government, and education. But all are sustained by an ever-growing network of services and facilities. The result is colossal and threatens to overwhelm society. Huge expanses of earth paved over for cities and highways, for parking lots and playgrounds. Under the streets lies an entangled mess of wires, cables, pipes, and passageways [1].

We tend to ignore the infrastructure when we design. Infrastructure is often ugly—the mass of wires overhead or the pipes and valves in front of many buildings. Its visibility forces us to think about things we would prefer to ignore. We would rather design our new devices without concern for the wires and cables that support them.

Infrastructure must be serviced, upgraded, or superseded, and with time, it becomes increasingly expensive, difficult, or even impossible to maintain. Eventually, we become slaves to old-fashioned infrastructure, for once the fabric of a technological architecture has been established, society is so dependent upon it that it is difficult or impossible to replace, even when far better technologies exist.

Often multiple standards and techniques arise for the same service. Agreement upon a common standard can be difficult, fraught with technical, political, and business prejudice. As a result, we tend to end up with multiple, noncompatible standards for the same goal. For example, today there is a wide variety of ways to pay for things. I just spent a month in Korea, where one could pay for a taxi ride with an interesting variety of cash alternatives: cell phones; bank credit cards, and cards for the public transportation system. Transportation cards with embedded chips could be placed upon a pad to transfer funds; cell phones with embedded chips could be placed on a different pad to transfer funds; and certain bank credit or debit cards lacked the chips but had a scannable magnetic strip. The payment system also included a digital taxi meter that displayed the fare and a printer that provided receipts.

The infrastructure for payment had so many separate pieces of equipment that there was little room left for anything else. Still, as Figure 1 attests, the driver still managed to add a navigation system and water bottle to the built-in infrastructure of radio, clock, HVAC controls, and driving controls. The infrastructure continues outside of the taxi: Within seconds of payment via my debit card, I received a text message on my phone from my bank, confirming the payment.

Ah, infrastructure. Without it, we couldn't function. It is the hidden underpinnings of modern society. Under the streets we have sewers, water and gas lines, and cables for telephone, TV, and electric power. Some of it is outside—massive wires crossing the otherwise pristine terrain. The hidden infrastructure is not so hidden. In part because it is so massive, in part because each year some other technology emerges that requires its own infrastructure. Putting the infrastructure in place is a daunting exercise. Maintaining it is even more so, and oftentimes not carried out, at least not until our bridges collapse, water mains burst, sewage overflows, and power and communication fail.

Even nature plays a role. Recognize the infrastructure in Figure 2? With one rather small exception, everything in that photograph is infrastructure. Roads and curbs, bike and walking paths, light poles, traffic light, direction signs, traffic light controller, pedestrian crossing markings, and the Korean flag, for this was taken

[1] Hayes, B. *Infrastructure: A Field Guide to the Industrial Landscape.* New York: W.W. Norton, 2005.

► Figure 1. Taxicab Fare-paying Infrastructure in Korea. *(from the center bottom, moving up)* The pad where one touches a credit or transportation card with transaction chip; the taxi meter, with calculator keypad for entering the amount of cash payment; the pad where one touches the transaction-enabled cell phone; just to its right, the credit card–reading device for normal credit cards with magnetic stripe, complete with keypad, which I assume is for manual entry or security codes; just above the credit card reader, a printer to provide receipts for any of the payment methods; at the very top center, the navigation system, this time displaying map information instead of a television show. I have skipped over the auto's infrastructure, including radio, tape, and CD player, HVAC controls, shifting controls, and steering wheel, all of which are also visible in this photograph.

just after a national holiday. The trees, too, are infrastructure. They have been carefully planted in these locations and artistically trimmed. Even the birds get into the act; the big clump toward the top of the tallest tree is the infrastructure for the magpie: its nest.

Some of the infrastructure provides the necessary affordance for others: The poles provide the supporting affordances for the lights, wind turbine, solar cells, and signs. Some infrastructure serves as signi-

fiers. The signs are deliberate, intentional ones. The magpie nest is an unintentional signifier, for wherever the nest is seen, it indicates there are apt to be a pair of magpies in the vicinity. If you examine the figure carefully, you can see one of the proud owners of the nest perched at the very top of the tree. The magpie is the only item that is not infrastructure in the picture. Even the background, barely visible in the figure, is of a river and flood plain, which also pro-

vides jogging, bicycling paths, and picnic and playing fields during nonflood times. Just as the trees are artificially placed in their location for aesthetic purposes, the river is carefully controlled as well, with high banks and numerous dams and spillways. The river serves several functions as essential infrastructure for the waterway and flood control. Finally, on the opposite bank of the river (dimly visible in the background), one can see buildings, roads, and other infrastructure

of modern life.

If we do not tend to the appropriate design of infrastructure, it is apt to collapse. Every year infrastructure requirements grow. This is for many reasons: more people demand services; more services are developed and provided to people; competitive forces provide new ways to distribute old services but require new infrastructure; existing infrastructure needs maintenance; and what maintains one class of infrastructure often damages another. Thus, adding a new underground service requires digging up roads and sidewalks, disrupting foot and vehicle traffic. The digging can accidentally cut power or communication cables and puncture water, gas, or sewage pipes. As a result, whenever one element of infrastructure undergoes service, numerous other providers have to be on the alert. Getting permission to service, maintain, upgrade, or install infrastructure often requires coordination with numerous local, regional, and national government agencies as well as the many different service providers. In cases of emergencies when there are accidents or deliberate sabotage, the number of agencies that must be involved is so great that their responses are hampered by coordination and communication difficulties. Often there is insufficient space to provide the new services, so political fights erupt over who has rights. Citizens demand the services, as long as the infrastructure is not visible to them. "We want better cellular telephone service," they say, "but don't you dare put that ugly and dangerously radiating antenna near me." Hence the term NIMBY: not in my backyard.

What is the designer to do? We must turn our attention to infrastructural needs. We must insist on standards, or where we lack the political power to enforce them, invent methods that allow competing systems to coexist without a proliferation of technologies. We can, for example, insist upon standard plugs and cables, even if the signal structure carried by them differs (although it would be best to solve that problem as well). We must pay attention to the A's of infrastructure: aesthetics, access, and affordability. If we fail, our technological societies might very well come

▶ Figure 2. Nature as Infrastructure. An intersection in Korea.

tumbling down. We will devote more space, time, and energy to providing and maintaining infrastructure than to the services they are intended to provide.

The infrastructure of our computer technology can be overwhelming. My computer's infrastructure gets more complex each year, and all this complexity requires attention: upgrades and security modifications; password changes for many accounts; an up-to-date list of passwords synchronized across all my computers; the need to reboot, defragment, do continual scans for viruses and malcontent software; the need to renew batteries and accounts and file backups. It seems that every day I spend considerable time on infrastructure.

Because the ability to maintain infrastructure is seldom designed with care, each simple activity can become daunting. Each new device requires installation, complete with registration, agreeing to unread but undoubtedly onerous legal conditions, and finding space and sockets for all the communication and power cables. Did I mention that these invariably require stopping all work, saving everything, and rebooting, after typing in a long, complex registration number?

I am reminded of the ways in which our physical infrastructures get modified. No sooner does a street get paved than a new set of workers arrives to cut holes and trenches into it so they can add their own sub-street layers. Each trench requires a myriad of permissions. The trench is dangerous, so warning signs must be posted. In some cases, the signs themselves can be dangerous, so they require attention-drawing flashing lights. Even that is not enough, so sometimes it is necessary to add signs warning of the warning signs.

Infrastructure is taken for granted, but it's time to pay it as much attention as the primary applications. Otherwise, maintaining the infrastructure will itself become our primary activity. In an earlier column I proclaimed Norman's Law:

The number of hours per day spent maintaining our equipment doubles every 18 months.

Spend an hour a day maintaining infrastructure, and within five iterations—slightly over seven years—the day will be completely filled.

It is time to work on our infrastructure, which threatens to dominate our lives with ugliness, frustration, and work. We need to spend more time on infrastructure design. We need to make it more attractive, more accessible, and easier to maintain. Infrastructure is intended to be hidden, to provide the foundation for everyday life. If we do not respond, it will dominate our lives, preventing us from attending to our priority concerns and interests. Instead, we'll just be keeping ahead of maintenance demands.

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The Golden Age of Newsprint Collides With the Gilt Age of Internet News

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Sitting in an economy-class seat on a United Airlines flight, I ducked for the third time as the gentleman next to me struggled to turn the page of his newspaper.

While he was perusing the day's events, I was contemplating the unfortunate juxtaposition of two iconic forms—the oversized broadsheet newspaper and the undersized airline seat—and the current state of two industries in deep financial trouble.

News stories. Crosswords. Horoscopes. Book reviews. Political cartoons. Recipes. Ink-stained fingers. Papier mâché. Stuffing sodden shoes. Wrapping fish and chips. Ad hoc packing materials. Starting bonfires. These are things that I think about when I think of newspapers. And despite the fact that I could never quite physically control a broadsheet without the aid of a table, I cannot believe this everyday artifact may go away. But according to my friends here in the digiphilic environment of San Francisco, it is inevitable—you can't walk into a coffee shop, never mind turn on a TV or the radio, without hearing someone opine about the economic crisis that newspapers are facing and the likely disappearance of the daily rag. I am as shocked and

mortified by this as I was by the 2003 news story that bananas may be extinct by 2013.

Broadcast radio in the 1920s was low cost, with broad distribution and timely content delivery. The newspapers responded by adding content that was not so easily represented through audio waves, providing more in-depth and visually vivid coverage of key stories. As the 1940s and 1950s came around, television appeared as the main challenger. Newspapers again responded, lifting from television the short, pithy story format. Newspapers like *USA Today* responded with graphics and color. More generally, news publications started diversifying their content, mixing human-interest stories with puzzles, crosswords, book reviews, cartoons, recipes, and all the good stuff we have grown to love. Newspapers became about browsing, grazing, sharing, and surfing content that satisfied immediate information needs and longer-term general interests. And so, despite radio and television, newspapers managed to retain their position in the information value chain.

Not so anymore.

There are three interrelated causes for this shift in the information ecosphere: Internet-

related innovations in news dissemination; new digital devices that are changing how content is produced and consumed; and a once healthy business model that is no longer viable.

Let's quickly look at these in turn. It is obvious that the Internet has revolutionized news dissemination. Speedy transmission of information around the globe means news can reach us as events are unfolding—hot off the keyboard rather than the press, with images and video for that "being there" feeling. "Citizen journalists" give us the layman perspective on events that journalists cannot or have not yet reached. Iraqi weblogs told us more about the impact of events as they were unfolding, and in more detail, than our daily papers could have hoped to offer. For many, the first reports of various disasters—from the fires in California to the shootings in Mumbai to the plane crashes in Denver and New York City—came through Twitter, the micoblogging service. The efficiency and effectiveness of this interconnected Internet world are undeniable.

Production and consumption of news has also been transformed by the explosion of lightweight, wireless, Internet-

enabled recording and reading devices, plus the proliferation of computers in the home and in offices. I can record an image or a video of an event, upload it, and within seconds it is there for the world to see. News large and small is shared this way—from events of global importance to publicly shaming and castigating men who flash women on subways. A few years back, I found out about the London subway bombings from my Flickr stream; my friends' images came flooding in prompting me to seek out official press reports, which did not appear till sometime later.

Finally, the old business model is failing. For decades, the U.S. newspaper industry has been generating most of its revenue from advertising. The global recession and the resulting decline in advertising revenue have dealt a possibly fatal blow; the Newspaper Association of America reports that in

2008 total advertising revenue declined 16.6 percent, to $37.85 billion, representing a $7.5 billion reduction in numbers from 2007. This is reminiscent of the roller-coaster ride the music industry has been experiencing as it struggles to modify rather than abandon its own anachronistic business model. Proposals on the table for saving the newspaper industry now include micropayment schemes plus bailout and/or government subsidies.

I don't feel qualified to assess whether micropayments or government bailouts will save the news industry. And I will not argue the obvious—securing the future of good journalistic practice. Instead I refer readers to the cogent arguments of writers such as Ethan Zuckerman from the Berkman Center for Internet and Society at Harvard Law School, Clay Shirky from NYU, and Princeton University's Paul Starr; they eloquently cover the issues.

I am, however, screaming for a better news-reading experience on my desktop and mobile devices. Certainly I love having access to so much information, but the reading experience is just not the same as the structured, well-designed experience of newspapers. News websites are like buckets of Internet storm-drain runoff, all laid out in some distorted version of their print counterparts.

Ethan Zuckerman blogged about his experience browsing the *New York Times* site: "… counting possible links (using a search for anchor tags in the source HTML), there are 423 other webpages linked from the front page. A more careful count, ignoring ads, links to RSS feeds and links to account tools for online readers, gives 315 content links, possible stories or sections a reader could explore from the front page." He's right. I replicated his analysis with three online newspa-

▶ Citing an unsustainable business model, many newspapers like the *Ann Arbor News* are exclusively focusing on online content.

Photograph by Mark O'Brien

pers. It isn't just the glut and the "I can't see the wood for the trees" problem; it is the link to nowhere problem. I click on a link and it takes me to nothing interesting, usually just a few lines of some banal story from several years ago.

As a child I used to love getting lost in the Hampton Court Maze, squealing with excitement when I hit another dead end and then running back to where I started, hopeful the next turn would lead me a little closer to the prize. Somehow a link to nowhere does not hold the same fascination. No wonder I don't venture too far off my well-worn paths, especially when reading from my phone.

Is it possible to take the best of what we have in newsprint and create a good digital news-reading experience? Here are some basics I would like to work on:

1. *Information collection and presentation.* Let's actively design better technologies for production and presentation of the news by citizen and professional journalists and editors. Can we provide better tools for the collection and management of information gathered on the ground? Can we improve the representation of information—graphics, fonts, layouts—to enable more effective skimming? Can we offer better guidelines for the coupling of different media types (text, image, video) and avoid gratuitous visuals? Let's improve navigation of well-filtered and segmented content online.

2. *Information architecture design.* Let's think about how to do a better job of recommending "related" stories. Many search engines reveal items that are

generally popular—that are highly ranked. Certainly we should design better filters, but we should also design better automatic information sniffers and surfacers that seek out stories of interest. Can we design better relational models so we can surface relationships between stories that are actually meaningful instead of the "also see" hyperlink that takes me to a story from five years ago that somehow got linked to the current one? Can we do a better job of making explicit the relationship between events at the local, national, and global levels? Can we design better tools for following story developments over time—even those stories that have non-sensational endings? Let's stop aggregating and dumping stuff onto a page because it is easy to do so, and start filtering and designing for more effective and enjoyable readership. I suspect our computational recommendation models are missing the point; they just aren't as good as a human being. Great journalists, editors, and documentarians are capable of making links, extracting lessons at various levels of abstraction, and at spinning a yarn out of a selection of stories. Let's get our imaginations flowing and think about how stories are told and interlinked, and aim for that level of quality—not just what is easily engineered.

3. *Design for time-appropriate reading, and for use and reuse.* Can we design a better way to earmark content than the current, simplistic URL bookmarking? What are better ways to support different temporalities of information and different consumption paces? Can we design ways

There are three interrelated causes for this shift in the information ecosphere: Internet-related innovations in news dissemination; new digital devices that are changing how content is produced and consumed; and a once healthy business model that is no longer viable.

for slow-burn stories to linger, while fast-burn stories are updated with new content?

4. *Device design.* My phone screen is just too small for me to really luxuriate in a good story, and layouts are not designed for effective skimming. Yesterday I cursed out loud as I gave up on a page that was taking way too long to load—although the story was tantalizingly titled it was beyond my reach, thanks to a combination of a slow network and a lot of pretty but slow-to-download content. I am curious what comes after the Kindle? Is electronic paper or Xerox's promised reprintable paper going to be a reality? I want the large-gesture, embodied experience of the broadsheet and decent screen real estate for laying out content.

I am not alone in wanting some good design heads on these problems. We should better understand the variations that exist in how people read, share, tell, and retell news. In addressing people's everyday news-consumption practices, a 2008 Associated Press ethnographic study cited email and Internet-based sources as a mainstay in many young people's news experience. However, these interviewees, like many in a study I am currently running in the Bay Area, all talk about the "work" of reading the news online and say that "news fatigue" is increasing. What this seems to boil down to is that there are plenty of places to find news on the Internet. But in this bacchanalian information glut, the shallow story dominates; it is often difficult to find the follow-up to a news item; and there is a lot

of repetition. To the last point, the Project for Excellence in Journalism observed in its 2006 "State of the News Media" report that though 14,000 unique stories were found on a news-aggregating site in one 24-hour period, there were in fact only a handful of discrete news events. There is vastly more content available, of course, and things have improved somewhat since 2006, but that other content is, relatively speaking, hard to find.

In design terms, online news is mimicking the advancement of the automobile, and we are in the equivalent of the late 1800s and early 1900s—in shape and form reproducing the horse-drawn carriage, not yet having found an aesthetic reflective of the new technology's infrastructure and capability. I laughed out loud when the U.K.'s *Guardian* announced on April 1, 2009, that it was going to abandon its print publication in favor of Twitter-based, 140-character stories. Whoever came up with that joke understood the issue at hand—and prompted me to think about media fads and how we need to move across the available channels and representational forms, and match the media and the story for best effect. Many forms of a story—summary, snippet, and in-depth coverage—are needed to really engage and inform a populace. It's not just about dissemination; it's about information, communication, and channel design.

Newspaper companies are on board with enlisting others to aid in the design of the next generation of news forms. In early 2009, the *New York Times* Developer Network hosted its first API seminar to start

designing and building new forms of content provision. The aim is to make the entire newspaper "programmable." Programmers will be able to mashup the paper's structured content—reviews, event listings, recipes, and so on. This is a great opportunity for those immersed in information and experience design.

I love the materiality of a good broadsheet newspaper and the magazines that I read. It annoys me just a little that, thanks to my beloved Kindle, I don't have newspapers lying around the house to stuff my rain-sodden shoes (yes, it rains in California, too!). But I am also looking forward to a world with better designed digital news formats. What we need is some technical savvy, a design sensibility, and a deeper human-centered understanding of the gestalt of news consumption between and across representational forms. We need something more than the current state of the art, which offers us only the most superficial and easy-to-implement of technical convergences. We need more than the horseless carriage of digital news.

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Ships in the Night (Part II): Research Without Design?

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In Part I ("Design Without Research?" *interactions* May + June, p. 68) we looked at some different approaches to design that do or do not succeed by omitting research. Here, we examine some of the limitations of doing research without design.

A startup approached us just before it began manufacturing and asked us to do a last-minute check with target customers to verify that it was going in the right direction. The company was developing an iPod accessory that would provide protection and allow connections to a range of other devices. Not until the kickoff meeting was I able to see what our participants would be evaluating: a raw, unfinished model made of thin plastic, painted a flat gray. There was a visible gap between the various pieces, and it squeaked when the parts moved. It contained no electronics, so it weighed only a few ounces; in short, it was a far cry from what the startup intended to manufacture.

Not surprisingly, when people looked at it next to their glossy iPods, they were unimpressed. It wasn't attractive, it gave no appearance of sturdiness (especially when the pieces separated as I handed it to them!) and no amount of reassurance—"the final won't look like this" and "the actual product will be made of sturdier plastic"—was successfully persuasive. We even brought in renderings of the final design, showing the level of finish, but once participants had held this development artifact in their hands, this aspect of the design was impossible to discuss seriously.

The research was far from worthless; it was effective in surfacing issues around the possible role of the device. Seeing this rough prototype (although our client corrected me in one user session by explaining that in fact this was an "appearance model," not a prototype) led people to question just what this thing was and why they would want it. Indeed, our client had articulated only a specification, not a use case, and the reactions pointed clearly to the work that we needed to do: come up with the story for this product. While we were able to gain some usability feedback, we were mostly testing the design and implementation of the prototype, not the product. It was a good lesson learned, and fortunately, we were able to identify the most important (if previously unasked) question: What is this thing, and why do I want one? As of this writing, the client is trying to license its product out to another manufacturer, so we await the final answer to that question.

Our client had the right idea—get feedback on something unfinished in order to improve the finished product. Unfortunately, aspects of the object were so unfinished that people were unable to make the leap from the prototype (excuse me, appearance model) to the real thing, and the outcomes shifted away from usability and aesthetics toward high-level concept validation. Given that, there's always the opportunity to create something specifically to provoke people around the deeper issues we want to explore. Imagine a mobile phone that is the size of your thumbnail; while not easily manufacturable or usable, as a concept intended to gather a reaction, it can be remarkably effective. In this engagement, we might have chosen different prototypes to better explore the questions our client was trying to address.

Another client approached us last year with an interesting challenge: It had developed a set of alternative designs for an installer application, and the company wanted to understand which one was easier to use. Additionally, in order to appropriately allocate development resources, the client wanted us to identify some measure of how much easier to use one was over another. We quickly negotiated a methodology, a budget, and a

timeline, and set about preparing the research activities. When we asked for the design artifacts to be tested, we received a set of raw materials: the existing software, an interactive prototype from previous research, and a high-level narrative describing the key differences between each version. We pushed the client hard to clarify exactly how each of these solutions should look and work. Extracting these details was such an extensive process that this was one of the few times we've ever had to tell a client that it exceeded the agreed-upon scope and we had to revisit our budget.

By the time we had a bare-bones representation for each of these alternative designs, we were down to the wire for conducting the actual research, and even though there were some obviously quirky aspects of the sample screens, there was no opportunity for further refinement. We showed the designs to people, and the sessions weren't for naught—we learned some interesting things (for example, the presumptive best design wasn't always preferred). We also identified some key principles for designing a piece of software: provide feedback, make the choices clear, provide information to support choices, and other heuristic-style feedback. We uncovered no-brainer principles that any good UI designer already knows.

Our original research question was to identify the usability differences between several alternative designs. But the unaddressed, "low-hanging fruit" UI shortcomings distracted people from that key question and introduced bias (as these shortcomings were not consistently distributed across the various prototypes).

Ultimately, we recommended that in the future the client put in some design effort before going into user research. The pushback was quite strong. Since the next step was an $80,000 design project with a big-name agency, the client didn't want to spend that money without knowing more about what people wanted.

A good point, but we didn't recommend this company spend $80,000. How about spending five percent of that amount to solve some of the obvious problems up front? That idea did not resonate; it seemed that doing "design" meant the full-meal deal, rather than a skill set that could be applied at many points along the development process.

In other situations like this, when we're brought in to help refine an existing design, our clients frequently expect that we'll peel away an artifact from their development process and show that same artifact to people in order to see what they do or don't like about it. The classic paper about this issue is Stephanie Houde and Charles Hill's "What Do Prototypes Prototype?" (http://www.viktoria.se/fal/kurser/winograd-2004/Prototypes.pdf). The authors explain there are three key testable aspects of a prototype: the role this thing could play in people's lives; how usable this thing is; and the appeal of the visual, aesthetic, tactile, and so on. Houde and Hill's major point is that any prototype can embody two of those three aspects at most. Trying to test all three with one artifact is not effective.

Lately, we've found that some clients we work with expect to ask research participants complete feature specification questions. Rather than our normal approach, which is to help people engage with a concept broadly on their own terms, identify desired features, and then prioritize those features, we're being asked to essentially interrogate people to directly answer the engineering question that the client's team faces. We're big advocates for understanding the difference between the question you want to answer and the question you choose to ask. "What is the minimum wireless range for which you'd still consider buying this product at your preferred price point?" is not very navigable by someone who is seeing a new idea for the first time. While we don't ask questions like that, the misguided belief that we should can impact how our findings are accepted.

In a recent project, we showed a number of alternative designs for a future product. One was high-end enough to be almost sci-fi; another was familiar to people using mobile devices; and another was a kludgey workaround. When we showed the third alternative, some people said nothing at all, while others changed the topic. Both responses seemed like a pretty clear value assessment, but when we met with our client, he challenged us to identify all the individuals who explicitly rejected this solution, as if that would be the proof the idea was not viable. We pointed to the passion that other features evoked and suggested this was the best indicator of what people

wanted, but we had clearly different ideas about how the insights from the research were going to inform the design and development efforts. We'd hope to see a design effort translate the insights from the research into useful and buildable solutions, rather than take technically achievable solutions and use research to design a feature specification.

In each of these examples, the absence of design from the research process hampered the impact of the research. When we're using research to understand whether or not a concept is going to address people's needs, we need design to create the best representation of that concept, and we need design to translate the output from that research into the next iteration of that concept. We can conclude that research needs design, before and after. Rather than treat research and design as separate activities (sometimes performed by siloed departments or vendors), I would encourage all the stakeholders in the product development process to advocate for an integrated approach in which design activities and research activities are tightly coordinated and aligned.

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When we're using research to understand whether or not a concept is going to address people's needs, we need design to create the best representation of that concept, and we need design to translate the output from that research into the next iteration of that concept.

On Hopelessness and Hope

In culture, and particularly in the creative professions, a profound dichotomy of hope and hopelessness has permeated discussions of project engagement and project work. At conferences, in client meetings, and over a beer or two, designers frequently and increasingly describe the rich potential to effect massive change and empower humanity in our work and in our jobs. This potential lies both in the nature of the work itself and also in the scope and scale of our influence. Designers have a large degree of control over the world around them. While this control may have a sense of delayed return—as products take months to land in the market—we can often trace both cultural and individual changes back to particular product introductions, feature changes, or even brand philosophies.

Still, I see designers bemoan their ability to actually follow through on visionary promises; deliver products that work and act as intentioned; or even conceive of artifacts that will evoke a sense of desire, mystique, or intrigue. They may find themselves designing things they deem insignificant, or they may be working on significant problems but feel unable to effect enough change, or they may simply not have the appropriate skills to execute on the challenges of behavior and the larger issues of cultural change.

Yet a number of individuals—a group that is small in number but significant in its contributions—have managed to deliver on projects broad and deep. They do act as renaissance individuals, and they do manage to tackle problems that are complex and whose solutions result in important contributions. In working with and observing these types of people, I see several commonalities.

These designers are not focused on innovation. Their work may be described as innovative, but these individuals approach their work with a focused pragmatism that emphasizes appropriateness, not newness. They don't strive to be as unique as possible. Instead, they observe their constraints and attempt to fulfill these constraints directly.

These designers have a passion for details. All design work has both concept and detailed stages of development. Often, designers gravitate toward preliminary concept work because they find it gives them more freedom to explore. Yet design that seems to resonate on a behavioral level is detailed, nuanced, and crafted. This comes through relentless iteration, refinement, and patience.

These designers are constantly reflective. Design is an intellectual activity, and while few of the designers I refer to here would actually call themselves intellectuals, they exhibit the sense of thought and reflection described by Donald Schön in *The Reflective Practitioner*. In a situation of complexity that requires order, Schön explains designers will constantly "engage in a conversation with the situation they are shaping… and if they are good designers, they will reflect-in-action on the situation's back-talk"

Above all, I see these designers expect to have a dramatically deep impact, rather than a broad one. Their expectation is to affect only the small, detailed, and critical aspects of the artifacts they design. They don't speak of "designing experiences," in some grandiose fashion, and they don't describe their work as "end-to-end design" or "system thinking" or "affecting the experience of the end-to-end customer journey." These designers are able to quickly prioritize problems, select those of most importance, and then, through a reflective, detailed, and extremely rigorous design process, create appropriate design solutions.

I wonder if designers should refocus their efforts on the more mundane and detailed. Rather than emphasizing the "strategic, game changing" nature of their work, and rather than considering their role as "innovators" or those engaged in "delivering the brand promise," designers might better focus on more humble, appropriate, and refined goals.

Accept—quietly and implicitly—that your work will affect millions. Focus on the nuances and details of the craft itself, and on your capacity to engage in a conversation with your work. Through this will come humble and beautiful design solutions that will live on, affect culture, and change behavior. And through this will come a sense of subdued pleasure in your creative work.

—*Jon Kolko*