Experience Prototyping

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ABSTRACT
In this paper, we describe "Experience Prototyping" as a form of prototyping that enables design team members, users and clients to gain first-hand appreciation of existing or future conditions through active engagement with prototypes. We use examples from commercial design projects to illustrate the value of such prototypes in three critical design activities: understanding existing experiences, exploring design ideas and in communicating design concepts.

Keywords
Prototyping, experience, design, methods

INTRODUCTION
Increasingly, as designers of interactive systems (spaces, processes and products for people), we find ourselves stretching the limits of prototyping tools to explore and communicate what it will be like to interact with the things we design.

"Prototypes" are representations of a design made before final artifacts exist. They are created to inform both design process and design decisions. They range from sketches and different kind of models at various levels — "looks like," "behaves like," "works like" — to explore and communicate propositions about the design and its context.

As such, prototyping is a key activity within the design of interactive systems. Several groups of designers and researchers, perhaps most notably at Apple Computer, Xerox Parc, and Interval Research, have been active both in pushing the boundaries of prototyping beyond the range of traditional methods [1, 2] and in developing understanding of the value of different forms of prototype. For example, Houde and Hill [7], discuss various functions for prototypes as being essentially about the "role" an artifact will play, its "look and feel" and how it will be implemented. Other work has explored issues such as different levels of fidelity [17], prototypes for different audiences [5, 16] and models for use in the context of participatory design [4, 12]. Further, prototyping as a design practice is now promoted within the business community as a key element in innovation [10,13].

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Building from this foundation, designers at IDEO are working to expand internal prototyping practices to embody the concept of "Experience Prototyping" as an integrated part of the design process. In this paper we will discuss what we mean by Experience Prototyping, why we think it is important and then look at its application within three key design activities— understanding, exploring and communicating — through examples from design projects.

What is "Experience Prototyping"?
First, let's think for a moment about what we mean by "experience." Experience is a very dynamic, complex and subjective phenomenon. It depends upon the perception of multiple sensory qualities of a design, interpreted through filters relating to contextual factors. For example, what is the experience of a run down a mountain on a snowboard? It depends upon the weight and material qualities of the board, the bindings and your boots, the snow conditions, the weather, the terrain, the temperature of air in your hair, your skill level, your current state of mind, the mood and expression of your companions. The experience of even simple artifacts does not exist in a vacuum but, rather, in dynamic relationship with other people, places and objects. Additionally, the quality of people's experience changes over time as it is influenced by variations in these multiple contextual factors.

With respect to prototyping, our understanding of "experience" is close to what Houde and Hill call the "look and feel" of a product or system, that is "the concrete sensory experience of using an artifact — what the user looks at, feels and hears while using it." But experience goes beyond the "concrete sensory." Inevitably we find ourselves asking questions about the "role" which Houde and Hill define as "the functions that an artifact serves in a user's life — the way in which it is useful to them." And even more than this, when we consider experience we must be aware of the important influences of contextual factors, such as social circumstances, time pressures, environmental conditions, etc.

By the term "Experience Prototype" we mean to emphasize the experiential aspect of whatever representations are needed to successfully (re)live or convey an experience with a product, space or system. So, for an operational

definition we can say an Experience Prototype is any kind of representation, in any medium, that is designed to understand, explore or communicate what it might be like to engage with the product, space or system we are designing. Obviously this can include design prototyping techniques such as storyboards [15], scenarios [14], sketches [17], video, or step through Macromedia Director™ simulations, all of which certainly add value by communicating elements that make up an experience. But they do this to a mainly passive audience. For the sake of this paper we wish to focus on the methods and techniques which support active participation to provide a relevant subjective experience.

In discovery, there is a continuum that extends from being told about something, seeing for yourself, to doing it yourself. Quoting the Chinese philosopher Lao Tse: "What I hear I forget. What I see, I remember. What I do, I understand!" When we use the term "Experience Prototyping" we are talking about methods that allow designers, clients or users to "experience it themselves" rather than witnessing a demonstration or someone else's experience. One of the basic tenets of the concept is that experience is, by its nature, subjective and that the best way to understand the experiential qualities of an interaction is to experience it subjectively.

Experience Prototyping is less a set of techniques, than it is an attitude, allowing the designer to think of the design problem in terms of designing an integrated experience, rather than one or more specific artifacts.

Why is Experience Important? Why Now?

More and more we find ourselves designing complex and dynamic interactions with converging hardware and software, spaces and services — products such as mobile digital communication devices, or systems of connected interactions such as those which occur on a train journey or an Internet shopping spree. The resulting hybrid artifacts require new expressions of their original qualities, such as "sensitive product behaviors" based on true hard/soft integration. This unknown terrain demands new design approaches, specific considerations and, ultimately, the design of integrated and holistic experiences set in context, rather than of individual artifacts or components. For example, it demands that the designer think about the experience of light rather than think directly about the design of the physical lamps themselves. To meet this demand, the designer needs to focus on "exploring by doing" and actively experiencing the sometimes subtle differences between various design solutions.

Multiple disciplines are needed to solve the design problems of today — e.g. interaction design, industrial design, designers of environments, human factors specialists, mechanical and electrical engineers. Each discipline brings a unique understanding of the issues at hand and an individual approach to solving them [8]. To work effectively as a design team it is important to develop a common vision of what the team is trying to bring into being. Therefore, it is a powerful asset to have tools and techniques which create a shared experience, providing a foundation for a common point of view.

Information becomes more vivid and engaging when it resonates with personal experience. If designers and clients can have informative personal experiences, it is easier for them to grasp the issues and feel greater empathy with both the people who will be affected by their decisions, and the experiences users may face.

The tools we use to design, such as prototypes, influence the way we think. Solutions, and probably even imagination, are inspired and limited by the prototyping tools we have at our disposal. We have observed ourselves thinking in new ways about what is possible when new materials or design tools become available — such as computer based drafting (changing the development process to become more iterative), virtual 3D modeling (influencing the formal design towards more organic shapes), and new materials — such as Teflon™ or electro-luminescent fabrics (offering new product functions and opportunities for product design). Experience Prototyping allows us to engage with new problems in new ways.

EXPERIENCE PROTOTYPING IN PRACTICE

We have identified three different kinds of activities within the design and development process where Experience Prototyping is valuable:

- Understanding existing user experiences and context
- Exploring and evaluating design ideas
- Communicating ideas to an audience

In this section we will explore how Experience Prototyping contributes to the activity and give some examples from design practice.

Understanding Existing User Experiences

Experience Prototyping here is applied to demonstrate context and to identify issues and design opportunities. One way to explore this is through direct experience of systems — the prototyping goal is to achieve a high fidelity simulation of an existing experience which can't be experienced directly because it is unsafe, unavailable, too expensive, etc.

The questions to ask in this stage are: What are the contextual, physical, temporal, sensory, social and cognitive factors we must consider as we embark on design? What is the essence of the existing user experience? What are essential factors that our design should preserve?

The following three project examples will further explain and illustrate how Experience Prototyping can unveil the necessary insights to answer such questions.

The Patient Experience

This example builds upon people's own imaginations and the use of proxy devices to recreate the essential elements of a personal experience that would not otherwise be available.

The project was to design product and service related elements for an Internet enabled cardiac telemetry system. The system would involve both face-to-face and remote doctor-patient interactions as well as automated supervision for patients with chest-implanted automatic defibrillators. Before embarking upon design solutions for the future system, the team wanted to know what system characteristics would be needed to ensure as positive an experience for patients as possible. What is it like to be a defibrillating pacemaker patient? What is it like not knowing when and where defibrillating shock will occur? How does that affect people's everyday life? The design team set up circumstances to produce a similar experience for themselves to that currently endured by patients with such implants. As a real first-hand patient experience was obviously not feasible, one of the team set up circumstances to produce a similar experience. The aim was to provoke insights into important functional and emotional issues and inspire thoughts about how to deal with them.

The designer distributed pagers to all other team members. The pager signal was to represent a defibrillating shock that would be of sufficient impact to knock a person off their feet. Participants were paged at random times during a weekend and asked to capture their immediate circumstances for each occasion — where they were, with whom, what they were doing and what they thought and felt knowing that this represented a shock? After this exercise, team discussion about personal experiences ranged from anxiety around everyday activities like holding an infant son or working with power tools, to social issues about how to communicate to onlookers what was happening and how to get proper medical help.

Figure 1: The patient's experience kit.

When participants were paged this indicated that they had received a defibrillating shock; they recorded their surroundings with the camera, and noted their impressions.

The participants, including engineers, bio-technologists, and representatives from marketing and product planning on the client side, quickly translated their own experiences into patients' needs. For example they appreciated the importance of warning information to help patients anticipate and prepare for a shock. They also saw the need to provide information to indicate the patient's condition to bystanders, and a broader base of remote support for this next generation of products and services.

Clearly, the form of prototype devised by this designer was based upon some initial assumptions about the fact that surprise, social and contextual factors would be important elements of the experience. This type of insight, sometimes informed by research of a more conventional kind, is necessary to guide the design of a specific Experience Prototype so that it can simulate important aspects of the real user experience, unveiling the previously not-fully-appreciated design issues.

The ROV Pilot Experience

This example too, used a proxy device to provide the team with specific insight into an experience that was not readily available to them.

The project involved the design of a pilot's interface for an underwater remotely operated vehicle (ROV) and its cameras. It was important that designers grasp and deal with some of the cognitive confusion that would arise for the operator. There would be problems for operators steering a tethered vehicle with six degrees of freedom, as well as multiple cameras — which can be positioned independently from the ROV itself — while trying to find a target in a vast undifferentiated space with limited visibility.

In the initial project phase, the design team created a task analysis, based on interviews with pilots and literature research which was useful to them, but did not communicate the realities of ROV operation very effectively. For the first experience prototyping exercise one of the designers used a rolled-up sheet of paper to limit her peripheral view while searching for a target — a Post-it note in her work space.

To get to the more problematic cognitive and functional issues, the team developed a game in which one player, A, stood in a room which was empty except for multiple chairs (portraying underwater obstacles), and one of them held a chocolate bar, the target. Player A held a video camera connected by a long cable to a remote TV screen where the live picture was viewed by player B. Player B gave verbal instructions to player A to move right/left, forward/back, and up/down and gave separate verbal commands to direct the camera.

After a few yards of cables wrapped round A's legs and the chairs as well as B's frustration at making mistakes — "Aargh! I meant camera right not move right," the design team and the client had personal insight about many important issues. For example, it was obvious that a critical need was clear feedback to support a mental picture of the vehicle's path through space, feedback about the tether

condition, and the need for a clear distinction between controls for the vehicle and for the camera.

As a follow-up, the team asked a participating retired ROV pilot about the validity of the simulated experience which, to his surprise, portrayed a quite accurate picture. He provided additional information, mainly about contextual factors (e.g. different levels of experience, underwater conditions, support tools like maps) which might change or influence the portrayed experience. The ability to share this Experience Prototype provided verification and enrichment of the simulated experience with a real life event. This further enhanced the participants' understanding of the pilot's problems, and created a shared reference point between all members of the design team as the work moved forward.

Role Playing a Train Journey Experience

It can be very informative, as well as fun, for designers to explore what experiences would be like for a particular person in a particular context through dramatic improvisation. This might be with or without props representing designed artifacts. In this example, an investigation into passenger needs for a new rail service, a group of designers used acting techniques such as role playing, bodystorming and improvisation to gain deeper insights. These methods are inspired by work at Interval Research [1,2] where the terms "informance" (for informative performance) and "bodystorming" (for physically situated brainstorming) were invented to describe these contextually rich explorations.

Improvisation seems to be most useful when acted out in a sequence of focussed scenes to ensure that appropriate activities and contextual situations are covered. In this train journey example, the design team explored different types of travelers, their needs, and various unexpected situations during specific stages of a train journey (e.g. entering the station, ticketing, waiting, riding the train, connecting to other means of transportation). Each scene was introduced with a card containing the scene's rules, explaining the goal, and the roles of players and audience. A professional actor familiar with improvisational theatre techniques acted as the supervising moderator. He gave one player instructions such as "Buy a return ticket for yourself and a child", while another designer played the role of a ticketing machine. Other instructions involved different conditions: "Now do it with gloves on." "It's dark and windy." "The machine only takes coins, no notes." "The ticket machine is very helpful and friendly."

Taking breaks for discussion after each scene enabled the learning to be captured immediately following each improvisational scene. Such breaks are a time for group reflection and idea generation stimulated by actually participating in or witnessing the scene. The breaks provide an opportunity to go beyond appreciating the issues involved to generating initial design ideas. In bodystorming — brainstorming that occurs either during or between scenes in response to problems that are uncovered — many ideas are expressed verbally but some are expressed physically and come spontaneously through interaction with proposed design elements, or quickly improvised stand-ins. In our example, the improvisation of the ticket machine interaction might cause someone to provide a shelf for a purse or luggage, or a radical change of appearance such as indicating that the machine is out of order (e.g. turning away from the intending purchaser). The dynamic physical nature of the event stimulates an appropriate response in situ.

In a second piece of research for the same design task, the team took a train journey themselves. To facilitate the exploration of unusual situations and to open the designers' minds to other customer experiences, they found it helpful to devise and assign specific tasks to each other. They gave each other cards that read, for example: "Pretend that you can't speak English." "Be hungry, find something to eat." "Be friendly and chat to the train staff."

Figure 2: Experiencing a train journey.

The team combined objective passenger research with subjective discovery as they played out roles they assigned each other.

This exercise bridges the gap between real and prototyped experiences. It was a "real setting with real people," but the designers' feelings and behavior were mixed with performance and acting. The designers found that role-playing in the real setting gave them permission to observe. It also provided a useful additional lens through which to observe and live passengers' experiences in the context of their own train journeys.

However, the key idea in both these role-playing experiments, as with the simulations described in the first two examples, is to have the designers make discoveries themselves. These discoveries have a level of personal significance that makes them easy to understand and discuss among designers and users. The vividness of this owned experience creates subjective, lasting memories which influence and guide the designers' choices and decisions throughout all stages of the design and development process.

Exploring and Evaluating Design Ideas

The main purpose of Experience Prototyping in this activity is in facilitating the exploration of possible solutions and directing the design team towards a more informed development of the user experience and the tangible components which create it. At this point, the experience is already focused around specific artifacts, elements, or functions. Through Experience Prototypes of these artifacts and their interactive behavior we are able to evaluate a variety of ideas — by ourselves, with design colleagues, users or clients — and through successive iterations mold the user experience.

Controller for an immersive environment

In the early stages of developing a user experience, multiple design directions need to be efficiently prototyped and compared. Ad hoc use of analogous objects as props can quickly guide decisions about which kind of experience is most appropriate. In this example, of designing a control device with six-degrees of freedom for a video game, the team identified three radically different potential directions and looked for props to help them understand the kind of experience each would afford:

A tactile immersive experience — represented by a palm-sized pebble

A shared experience, where the control functions could be split between two hands or two players — represented by two different-sized joysticks mounted on suction pads

A full-body physical experience— represented by the surface of a customized skateboard.

Simply "playing" with these relatively crude props was a powerful method, enabling the designers to unveil the nuances and implications of each particular direction.

Figure 3: Control in an immersive video environment.

Early in the project, the team played with a range of everyday objects to explore what different levels of physical involvement might feel like.

Experiencing an Airplane Interior

The same concepts apply in exploring ideas at a completely different scale, when designing a user experience set in a public and/or constrained environment. This example involves early exploration of ideas for the interior layout and components of an airplane. The design team together conducted a variety of bodystorming explorations within a full-scale foam-core environment simulating the inside of an airplane. Using props, such as chairs, readily available in the studio, the team enacted various social situations and activities such as sitting and reading, sleeping, and talking to a travel companion, receiving and eating meals, to evaluate ergonomic and psychological comfort with different arrangements.

Again, many ideas for physical configurations could be tested in a time and money efficient manner. Additionally, the involvement of the whole design team created a common focus and a shared ownership of the design directions chosen for further development.

Figure 4: Bodystorming layouts for an airplane interior.

Ideas were generated and evaluated rapidly by the team as they directly experienced physical and social issues in this full-scale environment.

TV Channel Changing Experience

Sometimes it is important to engage clients and other team members in radical design ideas before they are fully resolved. In this example, for an exploration of television remote controls, the designer wanted to explore the specific experience of switching channels, while ignoring other aspects of functionality or look and feel. He was especially interested in exploring the implications of a more intuitive and multi-sensory design solution. He created what he called "behavioral sketches" which were simple electronic circuits containing a few lines of code (Basic Stamps™), encased in off-the-shelf soap dishes. The two experience prototypes were controlled by a tilting gesture, switching channels up or down. The two prototypes differed however, in their feedback, one being visual — through moving light

bands, the other being tactile using vibrations. By tinkering with the simple software program, he was able to efficiently develop and test many subtle iterations of product behaviors and user experiences. The low resolution and fidelity of the prototypes proved to be vital for successfully sharing the insights of this conceptual approach with other designers and the client. They were expressive enough to convey a very sensual and compelling control experience, without constraining the imagination for further fine-tuning of the user experience, or the transfer to product applications beyond remote controls for televisions.

Children's picture communicator

Part of the process of design exploration involves checking out ideas with potential users. For example, in the EEC funded "Maypole" project's exploration of community communications [11] the goal was to create prototypes which would give children an experience as close as possible to that invoked by the intended design solution. Usually, user tests focus on fairly specific functional performance issues. Such tests also generally involve conditions that are not typical of the ultimate use situation, for example they frequently involve outsiders (e.g. as observers or "Wizards of Oz" when some functions need to be simulated by a person). This makes it difficult to answer questions about experience such as: How will people feel about the system we are designing? Will it change the way people behave or think about an activity? Is it compelling to them in their own context? A true Experience Prototype for users — providing a really relevant experience — seems to require a level of resolution and functionality such that it can be "let loose" into an everyday context and more fully integrated into people's lives.

For the Maypole project, Nokia built working sets of picture communicators that the design team was able to distribute to children who could take them away and play with them unsupervised for days at a time [6].

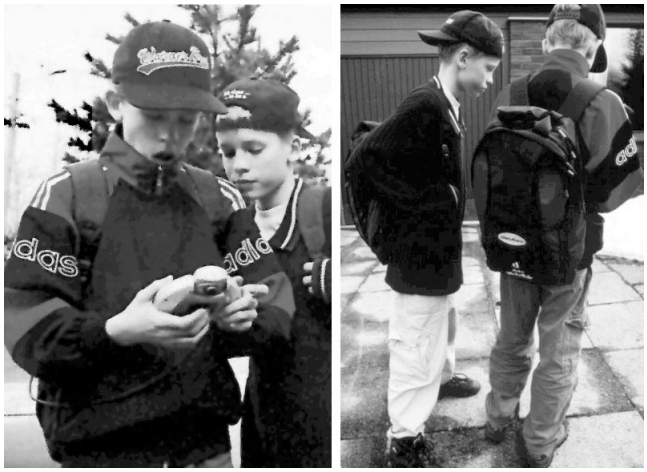

Figure 5: Picture-communicating prototype.

Despite heavy backpacks containing batteries and drivers for the prototypes, the children were happy to integrate picture-sending and receiving into their daily activity.

These prototypes required a power pack and transceiver unit that the children had to carry around in a backpack, yet the experience of being able to take pictures and send and receive them to and from friends proved so compelling that the users almost forget about that inconvenience.

As an observer of user evaluations, one knows very quickly if the designed experience is a good one. If it is, people get so involved in the experience that they forget about the limitations of the prototype (e.g. a tether to the computer running the software, or an extreme weight or size hindrance because of limiting prototyping components).

Communicating Ideas

The role of Experience Prototyping here is to let a client, a design colleague or a user understand the subjective value of a design idea by directly experiencing it. This is usually done with the intention of persuading the audience — for example, that an idea is compelling or that a chosen design direction is incorrect.

Digital Camera Interaction Experience

In an early project on digital photography the goal was to help a client envision what digital photography might be and how to design both the camera and the user experience as a complete system (including picture storage, retrieval, manipulation, etc.). In the initial phases of the project the team used traditional communication techniques such as scenarios, still and dynamic visualizations, and interactive on-screen simulations. After going through a series of presentations, the design team realized that the client did not completely understand the intended user experience and camera behavior. The breakthrough came when the designers built a hardware and software integrated "look and feel" prototype based on the design specifications as they stood at that time. The prototype bore little resemblance to a desirable product in shape, form, size or weight. For example, there was a sizeable cable running from the camera to a desktop computer where all the processing occurred.

This Experience Prototype contained a small video camera attached to a small LCD panel, encased in a box. The size of the LCD panel was determined by the desired resolution, rather than by the desired physical size, in order to maintain the key aspects of the proposed user experience. The working prototype was accompanied by an appearance model to communicate the appropriate size and detailed formal aspects of the design solution.

Figure 6: Digital camera interaction architecture prototype.

The prototype used a desk-top computer's processing power to manipulate the dynamic qualities of the control system and screen behavior.

The prototype had a live video feed and captured still photos with audio annotations in real time, as response time was a critical component of the user experience. Since the processing was done by the desktop computer running regular software with a simple programming environment, it was easy to fine-tune the response time of the camera to enable the design team and the client to feel the impact on the user experience.

It was the clients' developers who asked for multiple copies of the prototype which were then used as a "living specification" throughout the clients' internal design process to maintain a perspective and verify new design concepts. The client reported that there were many pressures to change the resolution, or the speed of response, but that the prototype enabled them to see, feel and resist the negative impact of such changes.

Figure 7: Kodak Digital Science DC 210.

This was the first in a series of Kodak digital cameras which embodied the interaction architecture and response qualities illustrated by the Experience Prototype.

This example perfectly demonstrates the importance of motivating and exciting a decision-making audience by providing them with a stimulating, hands-on experience. Knowing the audience and their expectations helps determine the resolution and fidelity of a prototype. Also care needs to be taken to explain its specific intent when an audience is not familiar with this particular form of prototyping. In this digital camera example, the design team built the Experience Prototype with enough flexibility for it to endure many iterations of refinement on the way towards the desired user experience. The designers were creating a prototyping platform where the hardware components were carefully chosen and built to last. The software environment was established in a modular architecture, so that simple code changes would not affect the artifact's behavior in other modes. The client however, was so impressed by the hands-on experience, that some of the design details which were compromised by time pressure, were ignored and the design phase was announced as completed directly following the presentation!

The Kiss Communicator

In this last example, "getting into the mood" became a significant set-up task for successfully communicating the proposed experience.

The "Kiss Communicator" was a concept prototype built to explore ways of using technology to communicate with another person in a subtle, sensual way. The intention was to keep the nature of the physical object as simple as possible, so the interaction was more about the experience of the message.

Designed to facilitate the exchange of emotional content between people separated by physical distance, the "Kiss Communicator" used wireless technology to transmit the digital equivalent of a personal gesture, such as a wave, wink or a kiss. Each Communicator connects only with a specific corresponding module, resulting in a secure and intimate one-on-one exchange. To let a partner know that you are thinking of her or him, you squeeze the Communicator gently. It responds with a slight glow to invite you to blow into it and create your "message" in the form of an animated light sequence as the device responds to your breath. The "message" shows while you blow and if you are happy with it, you simply relax your grip and it is sent to the corresponding Communicator. On the other end, the partner Kiss Communicator indicates that there is a message but waits until its owner squeezes it to play back the light sequence.

There are some important conditions necessary to really appreciate the experiencing of this prototype: an intimate relationship, two distant people, sending a gesture, etc. Now imagine sharing this concept with clients in their business suits in a conference room. To help set the scene for the experience in this formal context the designers now usually

preface the hands-on experience of the prototype with a short video sequence which shows a pair of the devices being used by a dreamy couple who are working apart. Using conventional devices like soft focus and a romantic soundtrack, the video creates, at least temporarily, an atmosphere that is more appropriate. This situation exemplifies how traditional and more passive communication techniques (like video) and Experience Prototypes can work hand-in-hand, with the goal of sharing a new user experience with an audience.

Figure 8: The Kiss Communicator.

This pair of prototypes let people have the hands-on experience of creating, sending and receiving subtle sensual messages. Video helped to create an appropriate context.

CONCLUSIONS AND NEXT STEPS

Our current analysis and examples have shown how experience prototyping has contributed to real design projects in three key ways:

By helping to develop understanding about the essence or essential factors of an existing experience: Experience Prototyping simulates important aspects of the whole or parts of the relationships between people, places and objects as they unfold over time.

In exploration and evaluation of ideas: Experience Prototyping can provide inspiration, confirmation or rejection of ideas based upon the quality of experience they engender. It produces answers and feedback to designers' questions about proposed solutions in terms of "what would it feel like if...?"

In communication of issues and ideas: by enabling others to engage directly in a proposed new experience it provides common ground for establishing a shared point of view.

Experience Prototyping is not a new phenomenon within the design community; designers have always been ready to adopt and adapt technology and processes of many kinds to create early representations of their ideas and understandings. But the concept of Experience Prototyping specifically, we believe, deserves a conscious focus. It should become an established and well-supported tradition within design practice. This belief is founded upon observation of our own practices that shows that we can be more sensitive, can design better experiences for people, and can be more convincing about the value of our design decisions, by intentionally adopting such an approach.

From this perspective, it is obvious that Experience Prototyping is not about the creation of a formalized toolkit or set of techniques, but is about developing an attitude and language to solve design problems.

Establishing an Attitude

Traditional prototyping techniques and tools are embedded in traditionally distinct design disciplines. Experience Prototyping, as a tool in designing complex systems, asks for a blending of the multiple design disciplines and beyond. One great advantage of Experience Prototyping is that it requires hybrid and overlapping skill-sets such that it is not exclusive to any single design discipline. As such, it offers an opportunity for all types of designers to supplement their traditional discipline skills in an effective and broadening way.

Initially at least, it seems important to promote a low-fidelity mindset for Experience Prototyping. High-fidelity prototypes certainly have their place but our examples show that, especially in the understanding, exploring and evaluating design phases, there is great value in low-tech methods and improvisation with basic materials — rolled paper, pagers etc. Low-tech solutions seem to promote the attitude that it is the design question that is important, not the tools and techniques that can be brought to bear. Based on what we have learned so far, we plan to further develop a range of skills among our designers including tools and techniques such as Basic Stamps™, PIC chips (supported by traditional tools such as Macromedia Director™ and simple electronics to integrate hardware and software), improvisational theater and role-playing, basic video/audio recording and editing as well as the more traditional physical modeling such as foam models and foam core environments.

Different activities need different kinds of spaces and resources. We are currently in the process of supplementing our traditional model shop and electrical engineering lab with a large flexible space — a "theater" — to function as a stage for spontaneous role playing, as a place to build "scenes" and full-scale environments, and provide audio/video recording, editing, and projection facilities, as well as blue screening capabilities. In addition to the functional value these spaces and facilities have in supporting Experience Prototyping, they also provide important value in physically representing the attitude they intend to promote. They are a daily reminder to push their specific design projects and their specific disciplines to a limit, and to sustain and evolve the language of Experience Prototyping.

What We Don't Know

As we move into a more conscious frame of mind about Experience Prototyping, we are aware of much we do not yet understand about how to best utilize the principles for the most innovative and successful results.

What is the appropriate representation for different audiences? Experience Prototypes might be designed primarily for ourselves, other members of the design team, users, and internal or external clients. The audience influences both the type of prototype we create and the degree of context and explanation we provide to frame the experience for them. For users it may be difficult to provide an early, low-fidelity improvisation prototype of sufficiently robust nature that they can have an experience in a naturalistic context without supervision. Higher levels of fidelity have their problems, too. As in our example of the prototyping platform for the digital camera, clients may become unshakably attached to early ideas when they experience a single convincing manifestation of many different possibilities and perceive it as the final solution. Clearly it is important for designers to share their understanding of the intent behind an Experience Prototype, but perhaps there are also lessons to learn about communicating these intentions more effectively by carefully choosing the prototype or prototyping technique.

A second question concerns the relationship between active and passive prototyping methods. Intentionally, this paper focuses upon prototypes that create an active/first-hand rather than passive/vicarious way of appreciating experience. Hence we discuss the value of role-playing and improvisational theater, rather than of watching someone else's experience. Is there any danger that active involvement, especially when an audience is present, tends to direct energy away from understanding the experience to acting as if you were having the experience? Perhaps sometimes there is at least additional learning to be gained by observation and reflection of someone else having an experience as opposed to being fully immersed in it yourself and then transferring or generalizing your own personal and subjective experience without cross-checking with real users. The example of the ROV operator's feedback following the prototyping experience, the use of supporting materials for the digital camera experience prototype (the designers provided an appearance model as a "looks like" reference) and the video scenarios explaining context for the Kiss Communicator, shows that there is a balance to be found in effectively combining active and passive ways of realizing experience.

Indeed, it is essential to think of Experience Prototyping as complementary to other design methods. First, no matter how good Experience Prototyping is at promoting empathy, (e.g. as in the patient experience) we cannot actually *be* other people. There will always be a place for other design and research methods to help us understand other people's points of view. Second, as in all forms of prototyping, we inevitably make choices about what elements of the ultimate experience to represent and what to omit. This means recognizing that a single prototype is never enough. Multiple prototypes, and other methods such as contextual observation, user testing and participatory design all bring important perspectives to complete the picture.

Additionally, these other methods help us in identifying the relevant factors of an experience that we plan to represent. For example, in a specific prototype, just what mix of emphasis do we want to give to specific aspects of the experience, such as sensory, physical/spatial, cognitive, social and temporal/dynamic qualities? To create an appropriate prototype we need to determine, for example, whether we are interested primarily in the sensory and temporal/dynamic aspects of an experience (such as in the TV remote), the physical/spatial and social aspects (as in the airplane), or the cognitive and temporal/dynamic aspects (ROV; digital camera). And, since we are developing only partially integrated prototypes, "setting the stage" for the experience becomes crucial. We need to be explicit about what needs to be ignored (e.g., because it "does not look like" or "would not be tethered") and about what context surrounds the user experience ("a high pressure emergency situation" or "a very intimate and private moment").

Finally, we come back to the point that people's experiences with products and systems are a complex integration of personal and circumstantial factors. People will have experiences with the things we design, whether we intend them or not, and in ways that we cannot hope entirely to predict. Nevertheless, understanding, exploring and communicating the experiential aspects of design ideas are central activities in design. Experience Prototyping, while it creates only approximate and partial simulations of the real experiences others will have, brings a subjective richness to bear on design problems. It is an approach that, we believe, will benefit from more conscious attention and deliberate experimentation.

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