Photobox: On the Design of a Slow Technology

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ABSTRACT
We describe the design and implementation of *Photobox*, a device intended to be used over many years, which occasionally prints a randomly selected photo from the owner's Flickr collection inside of a wooden chest. We describe and reflect on how engaging in the design of this *slow technology* [5] led to some unexpected challenges and provoked us to re-think approaches to making technologies that are intended to be used over long time scales and which might act infrequently. We also reflect on how living with the device during the implementation phase led to unexpected insights. We conclude with implications for research and practice in the slow technology design space.

Author Keywords
Slow Technology, Design-Oriented Research, Speculative Design, Technology Probes, Technology Heirlooms

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION
People's everyday lives and the environments they inhabit have become saturated with interactive technologies. The convergence of social, cloud and mobile computing has generated new opportunities for people to create, store and share archives of digital content at scales larger and rates faster than ever before. While people are clearly amassing diverse kinds of digital possessions, digital photos remain one of the most ubiquitous and enduring contemporary forms of personal content. It is estimated that Facebook will host roughly 210 billion photos by the end of 2011, making it the largest single photographic archive in the world [4].

These shifts raise many questions for researchers and designers of interactive systems. How will digital photo collections be meaningfully experienced over time as they grow to a size and scale that people have never previously encountered? How will these archives be passed down to other people or generations in the future, and how will they become meaningful? And, in contrast to accelerated rates of photo accumulation, what opportunities exist for designing technology aimed at supporting reflection on particular elements and experiences captured in an archive?

Figure 1. Clockwise from top left: The writing box before it was augmented; Upper panel (open) where printer components are hidden; Photobox can be opened to see if a photo has been printed; Bottom panel for photo organization and storage.

To explore these questions and ground our own thinking in this emerging space, we designed and implemented *Photobox*, an interactive technology intended to be used over many years, which occasionally prints a randomly selected photo from the owner's Flickr collection. A core aim of this prototype is to create a form that a user could 'live with', one that is aesthetically integrated into their home over time and, in doing so, engenders slower forms of consumption of photos in meaningful ways. However, engaging in the design of this *slow technology* [5] produced unexpected challenges, highlighting a lack of tools available to interaction designers on technical, methodological and conceptual levels for crafting technologies in and across long periods of time. These experiences provoked us to critically consider how designers interested in making technologies to be used over longer time scales could be better supported in the future.

While we are now deploying the prototype created as a result of this project, this was not our original intention. Through a design-oriented research approach [1], we aimed to better understand how designers approach and grapple with the slow technology design space specifically through building a fully functional system. It is these insights that

DIS 2012, June 11-15, 2012, Newcastle, UK.

emerged through the making of Photobox that we wish to reflect on in this paper. In what follows, we provide a brief background. We then describe the design process of Photobox. We conclude with a reflection on lessons learned from this process and implications they suggest for future slow technology research and design.

BACKGROUND AND RELATED WORK

In their seminal article on slow technology, Hallnäs and Redström argue that the increasing presence of technology in contexts outside of the workplace requires interaction design practice to move beyond creating tools to make people's lives more efficient to "*creating technology that surrounds us and therefore is part of our activities for long periods of time*" [5, p. 161]. They outline an agenda aimed at designing relationships with computational artifacts that will endure and develop over time, in part through supporting experiences of reflection on these things. Over a decade later, these issues remain critical in the HCI and design communities, and there has been a resurgence of work [e.g., 8, 13]. There is also a growing interest in how meaningful digital content might persist and be passed down across generations [e.g., 10] and, more generally, the need to consider designing across multiple lifespans [2].

More generally, within the DIS and HCI communities there has been increasing interest in the development of new knowledge through the construction of designed artifacts. Fallman [1] posits the fundamental activity of design-oriented research as giving form to previously nonexistent artifacts to uncover new knowledge that could not be arrived at otherwise. Researchers such as Gaver et al. [3], and Sengers et al. [13] (and others too numerous to mention here) have articulated design-oriented approaches that are united in their emphasis on the act of making as a means to critically investigate emerging research issues. Most recently, Obrenovic [9] has described how engaging in the design of an interactive system *itself* can play a pioneering role in developing underexplored research spaces. This work highlights the need for more examples of design-based interactive systems research to develop a foundation from which future theories and methods can be developed.

Our work modestly attempts to bring these different strands of research together. We want to investigate how technologies might be designed to slow the consumption of digital photos and support experiences of pause and reflection over the course of many years. We do this by grounding discussion around the design of a working prototype device that aims to make concrete new ideas for dealing with the rate at which people are acquiring personal digital content and its size and scale, as well as the growing legacies of data that may be left behind.

DESIGN PROCESS AND IMPLEMENTATION

We designed the Photobox to critically explore potential future interactions surrounding domestic technologies aimed at slowing down consumption of digital photos, and supporting experiences of reflection. We wanted to create a technology that might contrast the always-on-and-available qualities of many contemporary domestic consumer devices. We also intended to create a design artifact, which had a form that did not demand attention from its owner(s) nor require active participation to enact its function. This design process provoked us to critically reflect on the making of the artifact, and the artifact itself encouraged a dialogue about (and beyond) the stance and potential future it embodied. Our methodology drew on several approaches including speculative design [3], reflective design [13], and design-oriented HCI [1].

Process and Rationale

The process leading to the development of the Photobox consisted of the following. We reviewed theoretical literature and empirical studies (a sample of which is noted previously). We then ideated many design concepts and progressively refined and clustered several conceptually related sets to construct an understanding of the overall design space. Comparable to Schön's notion of design as a reflective conversation with materials [12], we engaged in a reflective dialogue with theoretical and empirical materials, and iterative development and critique of the design concepts themselves, to arrive at the final Photobox design.

We intended the form and presentation of Photobox to be resolved to the extent that, at first glance, it might appear relatively familiar in comparison to other non-digital cherished things. We wanted its material aesthetics to evoke a sense of the warm qualities associated with older domestic artifacts. We settled on this design choice in the final design because it offered potential to distance the prototype from perceptions people might associate with a contemporary 'technology' (i.e. veneered oak compared to plastics encasing many domestic technologies today). Indeed, we hoped to leverage this material quality in the design in the service of provoking people to consider: "What ought a 'technology' I keep in my home look like? What do its materials and form *say about it?* And, what should it *do*?"

The two main components of Photobox are an oak chest we adapted from an antique writing box and a Bluetooth-enabled Polaroid Pogo printer. We decided on using a chest that had already gathered a healthy amount of patina as it seemed to symbolically project a sense of endurance and that precious things may be kept inside of it. This design choice was influenced by prior work illustrating how qualities of certain materials, such as wood, can inspire a perceived sense of durability [11]. Clearly, another approach would have been to design a completely unfamiliar or ambiguous form. This direction has much merit. However, we wanted build on existing socio-cultural associations about the qualities characterizing enduring material artifacts to open a critical dialogue about the nature of digital things. To this end, we wanted to use a printer to explore the value of making digital photos material,

particularly in terms of the potential durability a paper print might offer in contrast to digital files.

We augmented the writing box with an upper panel to hide the technology and a lower panel to create a space for photo storage. The printer was installed behind the upper panel (see Figure 1, upper-right) with a 3D-printed acrylic case securing it to a small opening in the panel (to allow a photo to drop onto the central platform of the box). This choice helped integrate all technology used to print photos into a form that enabled it to be fluidly opened up and put away. This choice was influenced by prior work describing how supporting the range of practices associated with use and *non-use* of sentimental objects appears central in supporting meaningful interactions with them over time [10]. For example, the occasional ritual use of an heirloom object, and subsequently putting it on display or putting it away.

The behavior Photobox enacts is to search its owner's Flickr collection, randomly select a single image, and then print this image within the box where it will wait to be discovered. We designed this process to occur automatically at random intervals once or twice per month without input from the Photobox's owner. We intentionally included this design choice to invert the 'always on, updating and available' qualities of many contemporary consumer electronics. This choice was also influenced by prior work describing how ceding autonomy to a system can open up new opportunities for people to actively create meaningful experiences with digital content [7]. We could have curated a special selection of photos from a person's collection to appear in their Photobox over time. However, we selected randomness to introduce an unfamiliar and potentially disruptive machine behavior. We wanted to explore how people might confront a technology delving into their personal archive and how their perceptions might change over time; a choice partly inspired by Alex Taylor's discussion of Machine Intelligence [14]. Furthermore, several related questions grounded these choices, including: How would people react to a device that did not attract nor require the owner's attention to carry out its function and, on that basis, acted very infrequently? To what extent would the Photobox actually be perceived to be an artifact that could be handed down, and how useful would it be in advancing the slow technology design program?

Implementation and Challenges

In order to fully implement Photobox as a robust working prototype, we designed and developed an application in the .NET development environment. The application runs on a laptop that communicates with the Photobox printer via Bluetooth to send commands. Despite Photobox's deliberately simple form and behavior, testing our implementation revealed several challenges. First, debugging the initial implementation required us to live with the device as a user would: over several months. Passing commands through the application at a more accelerated rate than it was designed for (e.g., printing seven photos in three days) could mask problems that might emerge over longer periods of time in the actual implementation. Thus, in early testing we had to program the application to, for example, send a command to the Photobox to randomly select and print a photo three weeks in advance. Interestingly, our .NET required us to pass the duration of time in milliseconds (e.g., 3 weeks being 1,814,400,000 milliseconds). This may seem trivial, however it was an issue that our design team continued to critically revisit and discuss. What we want to draw attention to is not the need to make an incremental change to development environments to accept larger time values (although the widespread scare over the Y2K bug is a perfect example of the need to do so). Rather, this instance reveals how few design tools are extensible enough to support the technical, conceptual and practical needs associated with designing over longer time periods.

Testing also revealed that the proprietary paper pack only included enough material for ten photos before the printer could no longer enact its function and had to be manually reloaded. The printer's design made it impossible to augment to expand the number of photos it could print. In a minor re-design, we subtly embedded an LED in the front of Photobox that would indicate to the user when it was out of paper and needed servicing. However, this had clear implications for our desire to create a technology in which the user did not have to regularly intervene.

Finally, creating a robust slow technology required our design team, composed of interaction designers and UI programmers, to confront different engineering-level issues than we normally do. For example, to ensure Photobox would effectively receive commands over time, we needed to augment the Bluetooth printer to surpass its power switch (without overloading it), as well as to re-sync with the laptop if either were to lose power or transition into sleep mode. This required us to consult engineers outside of our team. Collectively, these instances helped make clear some of the very real challenges interaction designers face when transitioning conceptual slow technology ideas into functioning material realities.

DISCUSSION AND CONCLUSIONS

The slow technology design space presents rich opportunities and issues for interaction designers. Through a critical reflection on our design team's experience, we aimed to highlight some of the inherent challenges in transitioning a slow technology concept into a robust working prototype. This highlighted a clear need for new computational tools to support designers interested in slow technology. For example, the values grounding the design decision in .NET to only allow the passage of milliseconds in command threads owes to the practice of designing applications with rapid Input/Output cycles. While clearly there is value in creating such applications, this design decision imposed a constraint on our aim to create a technology that acts infrequently with slow I/O cycles in

the service of slowing consumption and supporting reflection. While very recent work has begun to explore how values underlying efficient life/task management might be inverted to support moments of slowness in end-user devices [e.g., 8], tools to support interaction designers in creating such slow technology applications remain conspicuously absent. There are clear opportunities for creating new applications that embrace larger notions of time as an imposed constraint with the aim of provoking designers to explore what kind of artifacts—and futures—might be produced with such tools.

Our implementation also highlighted how making robust slow technologies require addressing engineering-level issues that interaction designers and UI programmers may not normally face. This suggests an opportunity for expanding physical computing platforms to help reduce the initial complexity of augmenting electronics to operate less frequently over longer time periods. For example, the Arduino platform could combine advances in solid-state storage and low power consumption within new hardware components to help designers more rapidly transition their conceptual ideas into working material forms.

Finally, the underlying choices grounding the limited amount of photos that could be printed at one time highlight the manufacturers' assumed model of to-hand use and, more generally, the lack of openness in many off-the-shelf domestic technologies. This inability to personalize for long term use had direct implications for our implementation. It also marks a larger open question of how modularity might be achieved in mass manufactured consumer items. We imagine this may imply changing both manufacturing processes and, importantly, how we conceptualize off-the-shelf technologies themselves.

On a broader level, our experience of implementing (and living with) Photobox highlighted deeper challenges bound to designing and investigating slow technologies—the long time periods implicated in this design space raise complex practical, technical, and methodological issues that are arguably atypical in HCI research when taken as a whole. What new knowledge can we uncover about slow technologies used over longer time periods when we cannot test for or anticipate critical challenges that could, for example, complicate a field deployment study? How much could we learn about people's perceptions of technologies intended to be used over many years, if not generations, if they are only deployed for a glimpse of that time? Indeed these are intriguing issues that seem fundamental to future innovations in this space.

Interestingly, while research introducing technology probes to users is now redolent in the DIS and HCI literature [e.g., 6], relatively little work has explored how the *creation* of design artifacts can productively work as a probe for the design research team itself. In this paper, we unpacked how the making of Photobox highlighted key challenges and raised new questions implicated in productively investigating slow technologies over longer time periods. Throughout this process, the evolving prototype and attendant design materials worked as a boundary object provoking and mediating critical discussions in our team (and at times with people outside it) about the very issues discussed here. This paper clearly builds on the growing corpus of approaches to design-oriented HCI research [e.g., 1, 2, 3, 5, 6, 9, 13]. As the field matures, one productive way forward may be additional works documenting the practical, technical, and methodological struggles, commitments, and decisions design teams themselves are forced to grapple with as the community moves forward in making slow technologies.

ACKNOWLEDGEMENTS

We are grateful for the critical feedback and encouragement from the reviewers. It was crucial to improving this paper.

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