Digital Systems and the Material of Legacy:
Supporting Meaningful Interactions with Multigenerational Data

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ABSTRACT

People generate vast quantities of digital information as a product of their interactions with digital systems and with other people. As this information grows in scale and becomes increasingly distributed through different accounts, identities, and services, researchers have studied how best to develop tools to help people manage and derive meaning from it. Looking forward, these issues acquire new complexity when considered in the context of the information that is generated across one's life or across generations. The long-term lens of a multigenerational timeframe elicits new questions about how future generations will manage and make sense of the information left behind by their ancestors.

My prior work has examined how people perceive the role that systems will play in the long-term management and stewardship of digital information. This work demonstrates that while people certainly ascribe meaning to pieces of digital information and believe that there is value held within their largely uncurated digital materials, it is not clear how or if that digital information will be transmitted, interpreted, or maintained by future generations. Furthermore, this work illustrates that there is a tension between the use of digital systems as ways of archiving content and sharing aspects of one's life and an uncertainty about the long term availability of the information shared through those services.

The work proposed here builds on this earlier to research to develop systems that will investigate how identity construction, the transmission of information across generations, the revisitation of digital records, the lifespan of digital materials, and the ways in which digital information reflects different aspects of one's desired legacy influence the use and value of legacy-oriented systems. The findings from this work will be analyzed to create patterns and guidelines for the creation of systems that allow people to manage, curate, transmit, and reflect on large personal collections of digital materials. In so doing, this work contributes a better understanding of how digital systems, and the digital information people create over the course of their lives, intersect with the processes of death, dying, and remembrance.

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CHAPTER 1: INTRODUCTION

As digital systems capture an increasingly large and significant portion of people's life experiences, it is important to consider how people navigate the processes of managing, curating, and reflecting on that information. These matters, complex in their own right, are further complicated the fragmentation of a person's digital information across identities and services, the scale and accessibility of a lifetime of digital materials and information, and variations in the perceived value of one's digital information. Despite these challenges, it is clear that people do place value on portions of their digital information and there is warrant to try and understand how systems might help them lift out meaningful components of their digital materials.

The field of personal information management has attempted to develop systems and practices to help people better manage and locate pieces of digital information. However, the idiosyncratic nature of each person's digital information, both online and offline, has made it difficult to develop solutions that truly address the need to make sense of what are essentially miscellanies of digital information, media, and data. Additionally, this work often neglects the role that systems themselves play in generating, shaping, and holding onto digital information, all of which influence the form and content of the information that is contributed by people. Interactions with digital systems also influence how people perceive the lifespan, ownership, and value of the information that is created.

Building on and extending earlier work in personal information management, there is a need to examine this issue within a broader temporal context - how people might manage, curate, and archive records that span lifetimes and generations. Though there has been some effort to highlight the potential societal and personal value of engaging in multigenerational information management and the potential challenges [45, 87, 88], there is much work to be done if we are to explore how digital information might impact existing practices around legacy and inheritance, and those of engaging with familial, cultural, and societal histories through the lens of digital systems and information.

In my prior work, I have investigated several key questions regarding how these practices have grown to reflect an increasing degree of interaction with digital systems and the ways in which digital systems are changing the nature of how people identify and express themselves. This work highlights several key considerations — (1) digital systems influence the types of content people chose to share, which thereby influences the materials and information that are left behind for future generations, (2) people believe that systems play a critical role in determining how long information remains available and to whom it is accessible, and (3) people value digital information and media but are unsure of how those things will be utilized or valued by future generations. In addition, these findings support the notion that there is value in sensitively negotiating the tension between the desire to craft a legacy and the inability to curate or manage the large amount of digital information that each person generates throughout their life.

In this proposal, I outline a study that seeks to understand how to build systems that address the processes of curating, transmitting, and making sense of digital information that spans the course of someone's life. This work is comprised of several components. The first is a small-scale study in which I will explore the nature of digital legacy with participants from different stages of life. The findings from this study will be used to create a collection of digital systems that reflect the potential for legacy-oriented systems to play a role in identity construction, the transmission of information across generations, the revisitation of digital records, the lifespan of digital materials, and a representation of aspects of one's legacy that extend beyond one's possessions. In the second part of

this proposed work, I will deploy those systems as technological probes to better understand the emerging issues surrounding the transmission, curation, and interpretation of a lifetime of digital materials.

The findings of this work will make a number of contributions to the design of legacy-oriented systems and to the understanding of how digital systems can shape rituals and practices surrounding inheritance and legacy. This work will contribute: (1) design recommendations and guidelines to aid in the development of legacy-oriented systems for both people who are curating their own information and people who will be exposed other people's legacies and (2) an analysis of how digital systems influence the process of legacy making and the interpretation of one's legacy.

CHAPTER 2: BACKGROUND AND RELATED WORK

The work proposed in this document draws from a number of disciplines. In the following chapter, I outline related work that describes how legacy, identity presentation, and the nature of one's possessions are impacted by the use of digital systems. I also draw from existing digital systems and services, such as Facebook, Gmail, and reddit, to ground this discussion.

Components of a Legacy

Establishing a legacy is a process by which a person highlights the aspects of their life for which they would like to be remembered [68, 119]. As illustrated in Figure 1, these aspects can include one's biological material or characteristics, representations of one's values, or possessions such as material and immaterial artifacts [68]. The creation of a legacy is motivated by a person's desire to shape how they are remembered, to ensure the continuation of their identity and values after death, and to highlight meaningful relationships from their life [119]. Legacy building is also a part of another related practice, developing a narrative about one's life and experiences [92]. Though there are formal practices associated with creating a legacy, such as establishing a trust or passing down one's belongings through a will, less formal practices such as storytelling and dispossession are often undertaken as a part of aging and grappling with one's own mortality. In addition to the practice of passing down a legacy, legacy is also influenced by how it is interpreted and understood by the recipients.

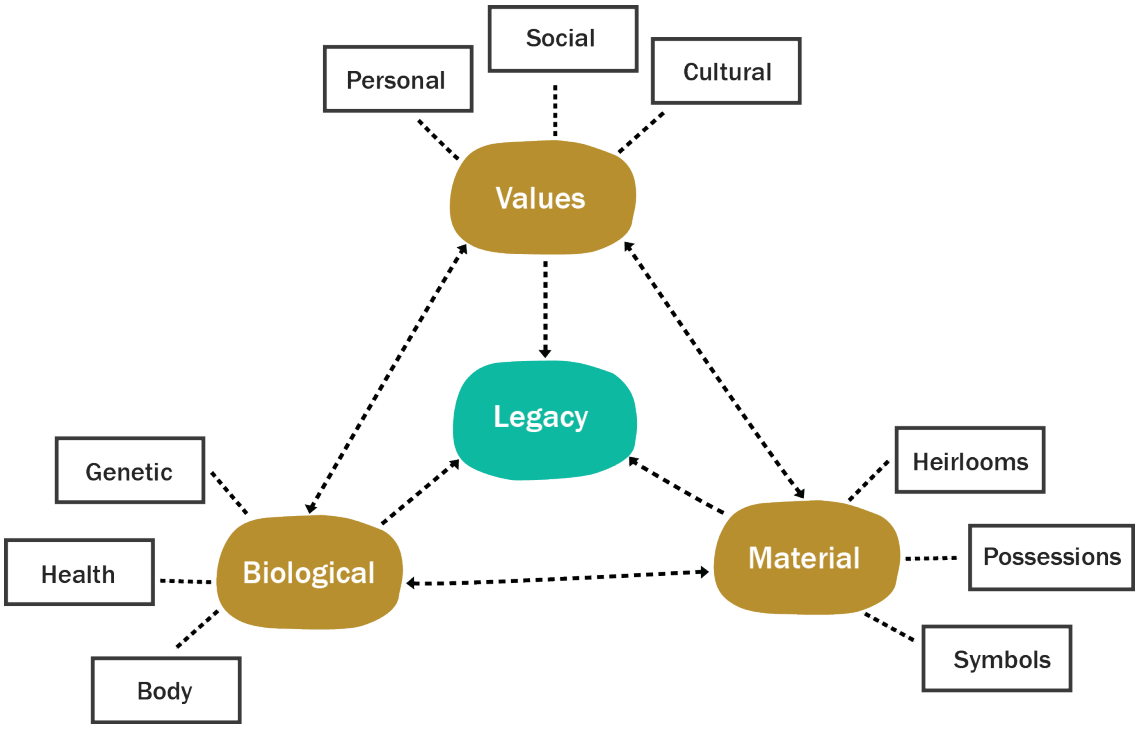


Figure 1: Legacy Framework by Hunter and Rowles [68]

In life, possessions are a powerful way in which people form, represent, and demonstrate aspects of their identity [12]. Material objects are one of the most prominent ways in which people pass things down to others as a part of establishing a legacy or leaving an inheritance. Though in some cases, people may choose to retain possessions after they've died, giving possessions away is often an integral

part of how people engage with thoughts about what their legacy might be [112]. When it occurs near the end of one's life, the process of dispossession is a way for people to try and ensure the continuation of their identity, memories, and values [84]. Beyond a single generation, possessions can represent a more enduring type of legacy by becoming a part of a family's shared history [33, 158].

Traditionally, immaterial possessions were most saliently represented in one's legacy through the passing down of wealth or representational symbols, such as documents that serve as a placeholder for money and other financial assets [68]. With the rise of digital systems and computers, there has been a reexamination of how another class of immaterial possessions and objects – digital data, systems, information, and media – might function as the material of a legacy, influence the process of organizing that material, and serve as a form of transmission for those materials. Work exploring the nature of digital objects demonstrates that people do indeed form attachments to digital possessions [13, 54, 35] but also illustrates the ways in which digital things are inherently different from, though not inferior to, physical objects [108]. Digital systems make it easier to access, acquire, and accumulate digital possessions [13], but also introduce challenges associated with managing and using them [103]. Moving beyond this fundamental investigation into the nature of digital possessions, it is clear that digital information, data, and media are being integrated into practices related to death, dying, and inheritance [87].

Technology Use in Mourning and Remembrance

Mourning the death of another person is a process that enables the bereaved to productively integrate that person's life into his or her own life story [153]. Grieving a person's death is often difficult for those who are left behind and can put the bereaved at risk for physical and mental illness [110]. Working through grief allows a person to move on with their life in a way that reflects the loss they have experienced [134].

As more of people's life is reflected by digital content and systems, the ways that people grieve and mourn has also shifted to reflect this trend. In some ways, digital systems have changed the process of memorialization and grieving into a public or collective act [17, 154]. In 2013, the Andy Warhol Museum launched a live webcam feed of Andy Warhol's gravesite (*fig. 2*). The goal of this project was to help people from around the world connect to the dead artist's work and legacy [43]. More commonly, social media accounts also provide space for people to mourn and share their recollections with other people [17, 21]. Online spaces like social networks make it possible for people to mourn the deceased in ways that are accessible for people who may be marginalized in the more formal process of grieving the deceased [22]. Though the development of social networks has provided a widely used platform on which to publicly memorialize a person who has passed away, this practice predates the rise of social networks [119]. Digital technologies, such as PowerPoint presentations containing images of the deceased, are also being directly integrated into public mourning practices such as funerals and visitations [154].

Digital systems and information also play a role in how people privately mourn, and subsequently navigate, a person's death. Communication platforms like mobile phones make it possible to 'send' messages to those who have passed away [87]. Other work has examined how technology might be integrated into private and familial rituals [144]. The rise in importance of digital information and systems has also contributed to the practice of inheriting digital information and digital hardware like laptops [154]. The breadth of what is contained in people's digital accounts and on digital devices like phones and computers exposes a number of difficulties faced by the bereaved, who must make decisions about if and how to make use of what has been left to them [87, 101]. This work suggests

that, given the difficulty of making sense of someone else's digital information and of negotiating the personal, private nature of that information, there may be reason to consider alternative means of managing that information, such as deep storage and safely letting go of digital materials [101].

Figure 2: A still image the live webcam feed of Andy Warhol's gravesite. Image retrieved from: http://www.warhol.org/figment/

The Nature of Digital and Virtual Data

Physical objects serve a valuable purpose as a way for a person to reflect how she sees herself and to shape how she wants to be seen by others [12, 152]. Virtual or digital objects can also serve this function but differ from physical objects in meaningful ways. Physical objects occupy space, typically have a static or limited number of forms, and often decay in a way that reflects the passage of time and use of the object. Attachment to physical objects is complex, emotional, and changes in dynamic ways over the course of one's life [74]. Digital things, have many characteristics not present in physical objects – primarily the ability to easy (or instantaneously) copy, send, delete, change the form of, and change access to digital information and data. These features enable a variety of new functions for digital materials and also shape people's relationships to those materials.

Though inherently different from physical possessions, it is clear that people do value their digital possessions and engage in meaningful interactions with them to some extent [13, 105]. In a study of the sentimental and meaningful objects in families' homes, Kirk and Sellen found that people included both digital and physical artifacts among their cherished possessions, though they selected more physical possessions than digital [73]. This work also highlighted the opportunity to digitize some cherished materials in a way that preserves their value or provides move value to those materials. Beyond sentimentality, digital possessions can find a meaningful role in a person's life through the capabilities afforded by a digital format. Digital information and media are capable of being shaped into a variety of forms. This mutability enables people to adapt digital objects to meet their needs and the changing circumstances of their life [108]. The ability to manipulate information stored in a

digital format also offers unique opportunities for interested parties who have access to this information to combine and sift through it in order to identify and extract meaningful patterns [78].

That being said, people's understanding and use of digital objects is influenced by a tension that exists between what they currently know about digital things and an uncertainty about what might happen to them in the future [154]. Digital information has the capacity to last forever, but is subject to a number of different forces that might make it inaccessible or destroy it altogether [61, 147]. Changes in the prevailing format or structure of digital information can render it inaccessible [26]. In addition, the lifespan of digital information is subject to the continued operation of the systems that hold that information. Digital systems, such as social networks and email providers, are subject to a number of vulnerabilities that could compromise the accessibility and privacy of one's information [29]. These vulnerabilities include a number of technological issues, such as having information stolen or compromised, but also include concerns about the long-term existence of the service itself.

Personal and Cultural Information Management

Personal information management refers to the collection of practices around managing and making sense of one's digital information. Research in this area has expanded as computers have become a part of people's everyday lives and as digital storage has become less expensive, both of which enable people to generate and accumulate more digital information and data [139]. Despite the multitude of systems and practices that have been developed to help people better manage their digital information, the heterogeneous nature of people's digital information and the relative and uneven importance of that information has made it difficult to develop solutions that reflect the diversity of people's practices [14, 71]. Furthermore, the fragmentation of information across different services and systems presents additional challenges to system designers and users [70].

Some work has examined personal information management over the course of a human lifetime. Early work in this area discusses how people might make use of information captured from systems, like the SenseCam, that document a person's life. In response to the problem of scale, the developers of the SenseCam emphasize the need for digital systems to take a role in drawing connections and meaning from the data they collect [51]. Other work points to the possibilities that result from having access to large amounts of data about a single person's life, such as developing better learning tools for that person or developing systems that tie together a narrative about that person's life using diverse sources of information [44]. Marshall discusses a number of challenges associated with the management of a lifetime of information, including predicting the value that information will have in the future and understanding digital information that has been removed from its original context [87, 88].

Digital information management is also a practice that is undertaken by groups, and studies of these practices offer some insight into how people manage, collaboratively or otherwise, other people's information. Collaborative information management occurs commonly at work, where members of a team will jointly manage documents and information. In these cases, the challenge is to understand how the rights of ownership are managed across the members of that group [40]. Families also often share the ownership of digital information. For example, as a child grows up, it is his or her parents who are likely responsible for documenting aspects of that child's life and managing that information until the child is old enough to take ownership of it [159]. Digital systems are also used as a part of information management because of their ability to support family-oriented practices like storytelling and reflecting on shared experiences [97, 112].

Cultural institutions such as museums and libraries are also involved in the management of information and artifacts that span generations and that now exist outside of their original context. One of the tasks of these institutions is to use their collections to create a narrative, but this process has sometimes downplayed the history of particular groups and perspectives in service of highlighting a different interpretation of the past [77, 22, 116]. Museums have frequently underrepresented the work of women and minority groups. In recent years, a greater concern for capturing the experiences of minority groups and experiences has led to a number of projects that allow people to engage in a collaborative and participatory documentation of their own culture [97]. This has been made possible, in part, by a greater ability for people to access and make use of technological resources. For example, in 2015 the non-profit group Story Corps released an app (*fig. 3*) that that allows people to record stories that are then available for other people to listen to through the app and that are archived in the Library of Congress [132]. Story Corps has traditionally focused on the experiences of everyday people, with an added emphasis on underrepresented topics like the experience of being a soldier, being incarcerated, and being Latino in America [133]. Story Corps makes many of these recording available to the public on their website, on public radio, and through the Library of Congress.

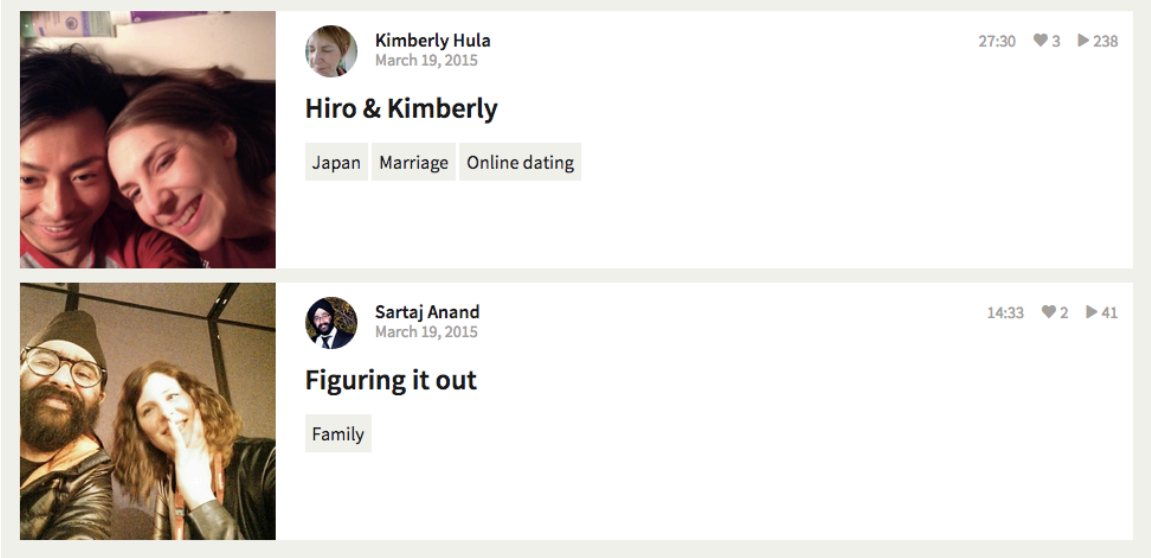


Figure 3: Two stories recorded using the StoryCorps mobile app. Retrieved from: storycorps.me.

Reflecting on and Revisiting Digital Information

The process of reflecting on one's life is inextricably tied to the availability of one's memories. Human memory is, however, susceptible to a number of factors that influence the accuracy of those memories and one's ability to recall them [123]. For example, retelling a story of a memory can shape the memory itself, and, therefore, future efforts to recall it [86]. Though these features of human memory can have harmful effects, in some cases they serve a function by making it possible to recall other memories, allowing people to develop a narrative about their life, and helping people move on from difficult experiences [4].

Looking back on one's memories through reminiscence and reflection is an integral part of how people make sense of their experiences and can have a number of positive effects on their lives. Research from psychology has investigated the role and impact of engaging in self-reflection and has shown that while the topic of the reflection is influential, self-reflection can help people have a better

understanding of themselves [123, 66]. Reflecting on one's experiences also helps people make decisions about future behavior and form stronger social bonds with other people [15].

Within HCI, the topic of collecting information and reflecting on it has been explored by researchers from a number of communities, such as personal informatics, lifelogging, aging studies, and domestic life. From this large body of work, there are several systems that offer insight into how digital systems might support the processes of reflection and revisitation. van den Hoven and Eggen developed a system that allowed used to call up digital photographs using physical souvenirs in the home [67]. Another system, Pensieve [112], combined generic prompts with those that draw from the user's social media accounts. Studies of this system suggest that the prompts drawn from social media were effective at helping people reminisce, but that system-selected content can sometimes elicit negative emotions from users [33]. The media has also called attention to this issue as system-generated curations become more widely used — in 2014 Facebook gave users the option to view a system-curated review of their year. This "Year in Review" was negatively received by a large number of users whose negative or painful memories were captured and rebroadcast in the album. Based on this feedback, Facebook issued a statement that acknowledged and apologized for the negative impact the Year in Review had on some users [75].

In addition to supporting the reflection process, some HCI research focuses on the process of creating digital representations of people's artifacts and experiences. Focusing on the processes of creating, managing, and contextualizing one's memories and artifacts, Memory Lane was designed to address the challenge of getting people to actively take part in managing their digital materials [71]. Similarly, a project that studied how elderly people record their experience for future generations highlighted the ways in which people are already managing complex family-oriented archives and the importance of respecting the multifaceted nature of identity [80].

Identity Presentation, Privacy, and Disclosure

There are many theories about identity presentation, performance, and development, all of which are processes have the potential to shape what information people share with others, how they share it, and with whom. In the context of the work proposed for my thesis, there are several key concepts from this large body of work on identity and identity presentation that are significant. The first is the notion that identity is faceted across different social groups, settings, and interactions. Goffman famously described identity presentation in terms of a theatrical performance and used this metaphor to explain how people's understanding of themselves and the people with whom they communicate can influence their interactions [53]. Others have explored how the different aspects of the self (private, public, and collective) impact both behavior and one's self-concept [140]. The second key concept is that one's identity is dynamic and changes over the course of one's life [85].

Research in HCI has also investigated how both of these concepts relate to the ways in which people interact with digital systems. This work suggests that online accounts and networks provide people with an opportunity to highlight and present aspects of their life [136]. Anonymous and pseudonymous spaces online also provide users with a platform to experiment with presenting different aspects of their identity, which can aid in the development of one's identity [83, 145]. When one's content is tied to their real name identity, online networks represent an opportunity for people to present an improved version of their offline identity and to increase their social desirability [163].

Identity is also tied to the ways in which people make decisions about the privacy and disclosure of their information online. Understanding the privacy of digital information is a deceivingly complicated endeavor, as it is impossible to have a complete understanding of how content that is shared online will be used and who will have to it [56]. Palen and Dourish argue that managing the privacy of information shared online is a dynamic process in which people make decisions using an understanding of their own desire to communicate with others or express themselves combined with an understanding of the risks of sharing in particular settings [109]. On a more practical level, the day-to-day intricacies of the negotiation between privacy and disclosure pose a challenge for people who use these digital services and consider the implications of their actions.

Mechanics and Perceptions of Personalization

A major challenge when trying to understand how people will manage and make sense of legacy-oriented digital materials is the difficulty of making meaning from large collections of digital information and data. Work from personalization systems and recommendation systems shed light on how digital services might be able to help people lift up meaningful aspects of their digital records. Though not focused on the topic of legacy curation and management, existing personalization systems offer a way to better understand how people perceive systems that try and use their information to serve them with relevant content. For example, systems that power recommendations for websites like Netflix, Pandora, and Amazon are a prevalent part of people's experience using the web and offer a compelling way to understand how people might react to the use of digital systems that analyze their information in order to help them manage it. There is, however, great variety in what might be described as a personalization system and the nuances between those systems can impact how they are perceived. In their review of personalization literature from human-computer interaction and business, Sunikka and Bragge call attention to the different ways in which personalization has been defined in the context of technological systems [137].

Research focused on personalization systems used for advertising indicates that people feel uncomfortable with being tracked by systems geared towards serving them ad content [141], but that some understand that ads are part of the business model of many websites [120]. In addition, studies reveal that people understand why personalized advertising might provide better value to both them and the products of services being advertised [143]. For example, Google might be able to leverage its understanding of a person's interests to provide them with more relevant advertisements and media content. That being said, though personalized advertisements are often positioned as a way to link people to more relevant (and therefore less annoying) content, it is not clear that this is always the case [94]. Furthermore, the use of personalized advertisements opens up a number of other concerns for users, primarily fears about the privacy of their digital information [141].

Work from the HCI community has examined how people interpret how content is curated for them on social media sites and through information portals such as news sites [41, 76, 119, 129]. This work illustrates several key findings. The first is that many people do not understand what information is used to generate the personalized content or recommendations on social media sites, and, in response, generate their own explanations about how these systems work [41, 119]. The second is that that people sometimes feel reluctant to correct or disagree with a system's interpretation of their identity, instead deferring to abilities of the algorithms that generated the analysis [156].

For the proposed work, I am principally interested in distinctions between the different *types of information* that are used to generate personalized content. Though all of the data we are concerned

with in this work is the product of a user's action or behavior, there are important nuances regarding who authored a piece of digital information and what it describes. In Table 1 and Figure 4 below, I describe four types of information used by personalization systems: system-generated data, system-captured metadata, user-contributed data, and user-contributed metadata. Here, I use the terms *data* and *metadata,* respectively, to distinguish between a piece of information, such as a Facebook status update, and some additional piece of information that describes it, such as a timestamp. Similarly, the terms *contributed, captured,* and *generated* are used to reflect the extent to which the information with the product or by-product of a user's direct action. It is important to note that both of these sets of terms (*data / metadata* and *contributed / captured / generated*) represent spectra and that there is fluidity between how these concepts map to how personalization systems, like Facebook or AdChoices, operate. As such, the types outlined in Table 1 and Figure 4 are intended to be illustrative of four archetypes of data and do not represent the full spectrum of combinations of these concepts.

	User-Contributed Data	User-Contributed Metadata	System-Generated Data	System-Captured Metadata
Description	Data contributed directly by a user to a system.	Additional descriptive information contributed by a user.	Information that is generated by systems based on data collected from users.	Descriptive information that is captured by a system that describes user behavior.
Examples	A Facebook status update; an email message	Hashtags; location tags; an upvote on reddit.com	Analysis of a person's interests; a credit score	Information about credit card purchases; browsing history and behavior

Table 1: Four types of data used by personalization systems.

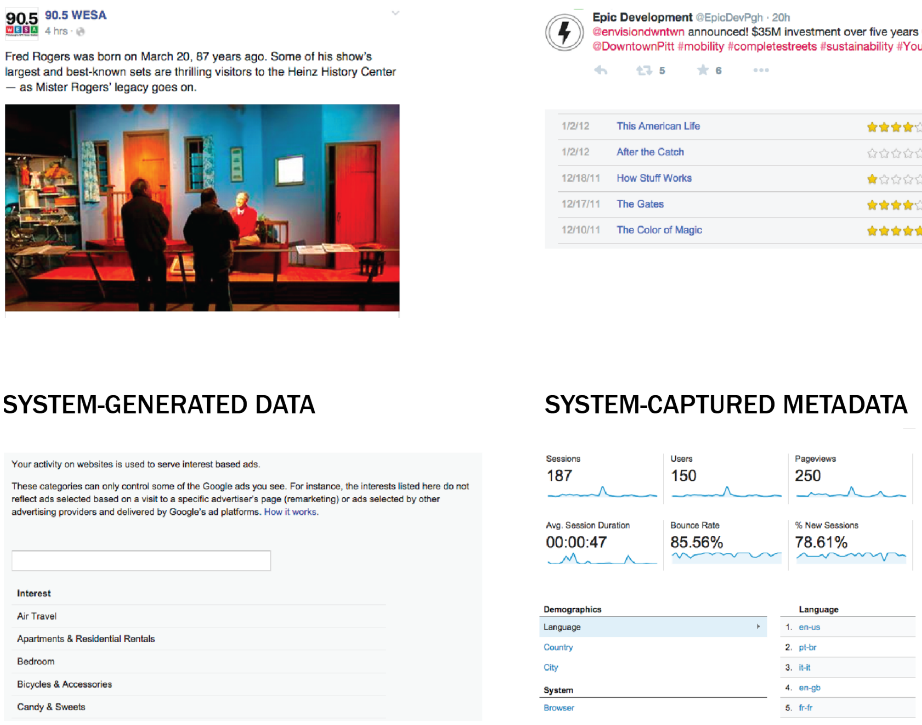


Figure 4: In situ examples user-contributed data, user-contributed metadata, system-generated data, and system-captured-metadata.

CHAPTER 3: RESEARCH METHODS

The work described and proposed in this document uses a number of qualitative methods drawn from the social sciences and from design research. In many cases, I have adapted existing methods to suit the needs of individual projects. In this chapter, I briefly outline the methods used in my work and provide information about how I draw from and build on existing methods. Table 2 describes the primary methods used in my work. My goal in doing so is to help articulate the different aspects of doing research through design and to provide insight into how these processes generate knowledge within my work. Each of these methods is described in more detail in its appropriate context in chapters 4-8.

Method	**Use in my work**	**Selected References**
Sketching and Concept Modeling	Exploring relevant concepts, articulating research goals, engaging stakeholders	Buxton [23], Fallman [42], Warr [155]
Design Probes (paper, technology, provocative)	Exploring research concepts, conveying ideas to participants, generating research data	Gaver [49, 50] Hutchinson [69], Boehner [17], Wallace[151]
User Enactments, Scenarios, and Personas	Helping participants engage with probes	Odom [104], Carroll [25], Pruitt [118]
Photo Elicitation	Supporting conversations with participants using their photographs, grounding	Clark-Ibanez [28], Harper [61], Heisley [64]
Directed Storytelling	Supporting conversations with participants, encouraging storytelling	Hanington [60]
Semi Structured Interviews	Engaging in open-ended investigations with participants	Corbin [31], Dickson-Swift [37]

Table 2: Methods used in my research work.

Artifact-Based Methods

The creation of artifacts plays a major role in the process of doing research through design, both as a way of exploring a problem space and as a way of communicating knowledge about how to address a problem [164]. Artifacts can also be used to generate knowledge through discourse that arises from people interacting with and reacting to those artifacts [10]. As design research frequently does not seek to produce knowledge that is falsifiable or verifiable [47], it is valuable to examine how the products of research through design contribute to our understanding of a problem and how we can move toward a desired future [165].

Sketching and Ideation

One of the methods I use in my work is sketching. These sketches take a variety of forms, such as potential system designs, models of information, and scenarios. Sketching offers many advantages as a part of the research process, such as providing a way to externalizing one's thought process [42, 155]. In addition to creating tangible output that can be used to convey one's ideas, sketching is associated with a number of well-documented advantages for designers and researchers, such as helping to shape the thought process and allowing people to iterate through ideas early in the design process [23].

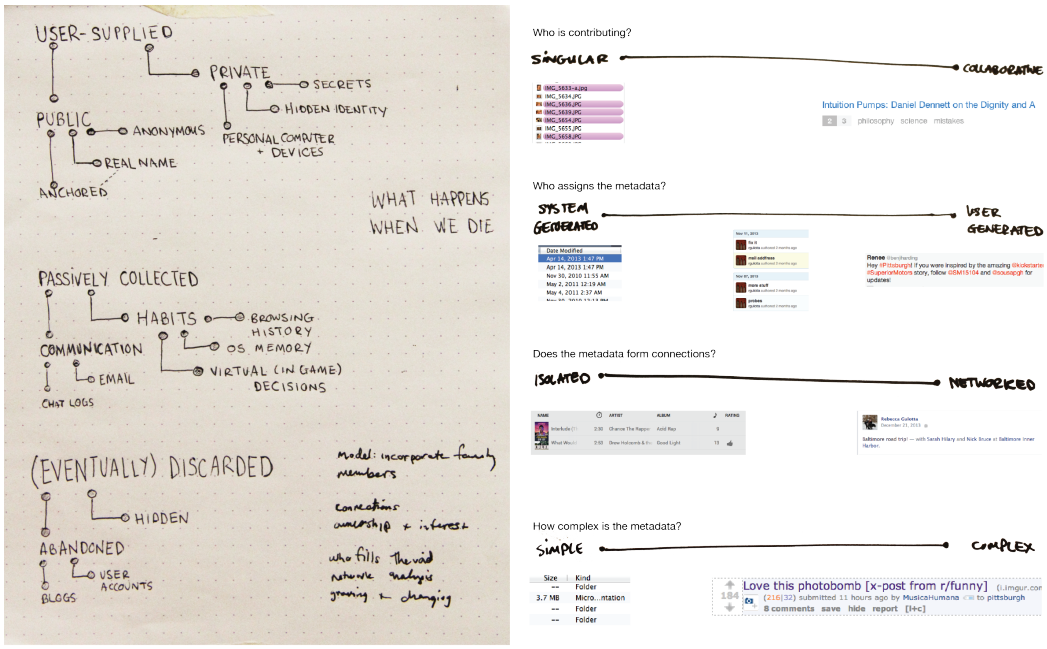


Figure 5: Sketches exploring the nature of digital information (left) and metadata (right).

In the early stages of a project, I often create sketches that illustrate a concept and help to expose nuances therein. For example, Figure 5 depicts two sketches I created to explore how different types of information were related to one another. Both of these sketches were a part of a larger series of explorations about these ideas. In the sketch on the left, I was interested in understanding the ways in which different types of digital information were connected to a person before and after their death. This work helped me better understand the distinctions between different types of content when viewed through the context of one's digital legacy. In the image featured in the right, I was focused on defining different characteristics of metadata such that I could better understand its use as a design material. In this sketch, I used real-world examples of metadata to represent these different characteristics.

I also use sketching do aid in the process of designing probes for my work. These sketches, such as those seen in Figure 6, are often used early in the development process to illustrate how I intend to use the probes to explore key areas of inquiry and to illustrate potential forms and designs for those systems. These sketches are used to discuss the project with collaborators and to solicit feedback about how the probes might relate to the goals of the study.

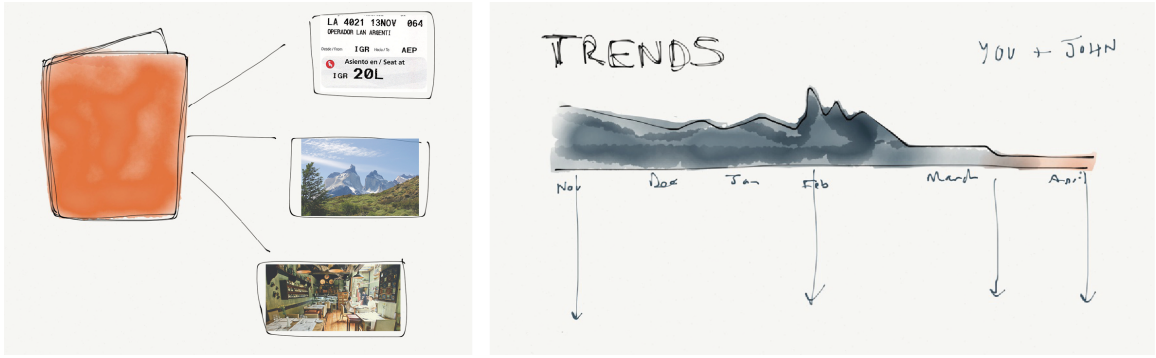


Figure 6: Sketches exploring how systems might utilize metadata to present people with meaningful digital content.

Design and Technology Probes

In addition to sketches and visual imagery, I create design probes and technology probes in my work [49, 69]. Probes, which were introduced to the field of HCI through the work of Gaver, Dunne, and Pacenti, who used physical cultural probes to establish a shared understanding with participants and talk to them about the city in which they lived [49]. Though the intention of this work was not to collect data, the probes technique has been adapted for a variety of purposes (data-drive and otherwise) in HCI [50]. One of the primary adaptations, technology probes, built on the ideas represented by cultural probes to explore how researchers could use early-stage representations of technology to engage people in experimental, playful, and participatory design sessions [69]. Probes have been used and adapted extensively in HCI for many different purposes, some of which have diverged a great deal from the original cultural probes work [17].

My research work draws from this broad spectrum of probes work in HCI and design to explore how provocative artifacts can be used to help both researchers and participants better understand potential futures for digital systems. All of the probes I have developed for my work were created to accomplish goals that reflect a blended perspective on what probes are and how they can be utilized by designers and researchers. One example of this work is shown in Figure 7, which shows index cards that I handed out to people who passed by my lab space. These index cards were printed with open-ended questions about one's digital information and encouraged people to draw and express their thoughts using a combination of text and visual imagery. I developed these probes to find out more about how people think about what information is available about them online. Inspired by the original cultural probes work, the information collected using these cards was not used for any research study but instead helped me gather a variety of perspectives about how people understand how much of their personal information is held by digital systems.

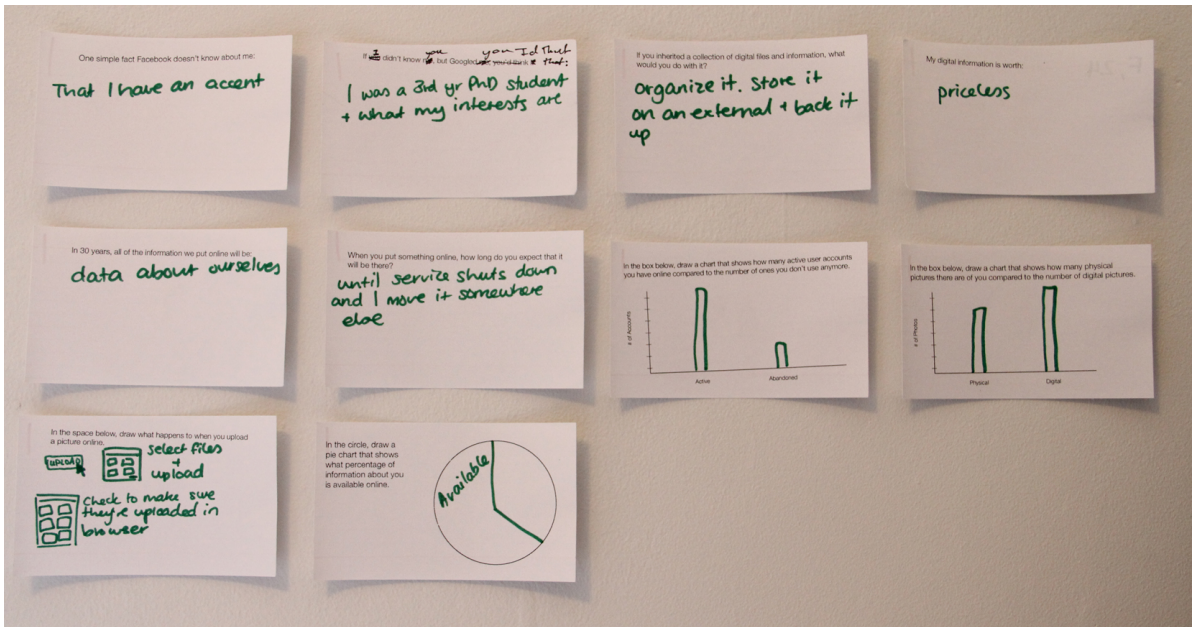


Figure 7: Paper probes used to informally gather information about how people think about their digital information.

Similarly, I created the probes pictured in Figure 8 to engage with the processes of making new memories and forgetting. These artifacts were made using found objects and were handcrafted to look like a treasured collection of mementos, like those that would be held in a memory box. The hand-crafted and personalized nature of these process was inspired by the probes work of Wallace, McCarthy, Wright, and Olivier [151]. In this example, the aesthetic and form of the probes was a deliberate choice that was made to support the process of helping people articulate what they find personally meaningful. Like the probes pictured in Figure 7, these artifacts were not used as a part of the data collection for any particular study but were instead used to start conversations with people about memory, family, and forgetting.

Figure 8: Handmade paper probes exploring memory and forgetting.

I have also created paper probes that were used during interview sessions with participants. One such probe, the Digital Account Inventory (DAI), was designed to help participants think about the breadth of different accounts they had created over the course of their life. The information they shared helped direct the discussions we had during the interviews and helped elicit stories from participants. In many cases, participants referred to the inventory when answering interview questions and made additions to the inventory as they remembered additional details. Though I did not use the information that participants wrote down on the DAI in my analysis, this paper probe did play a role in the larger process of collecting data by shaping the conversation I had with participants.

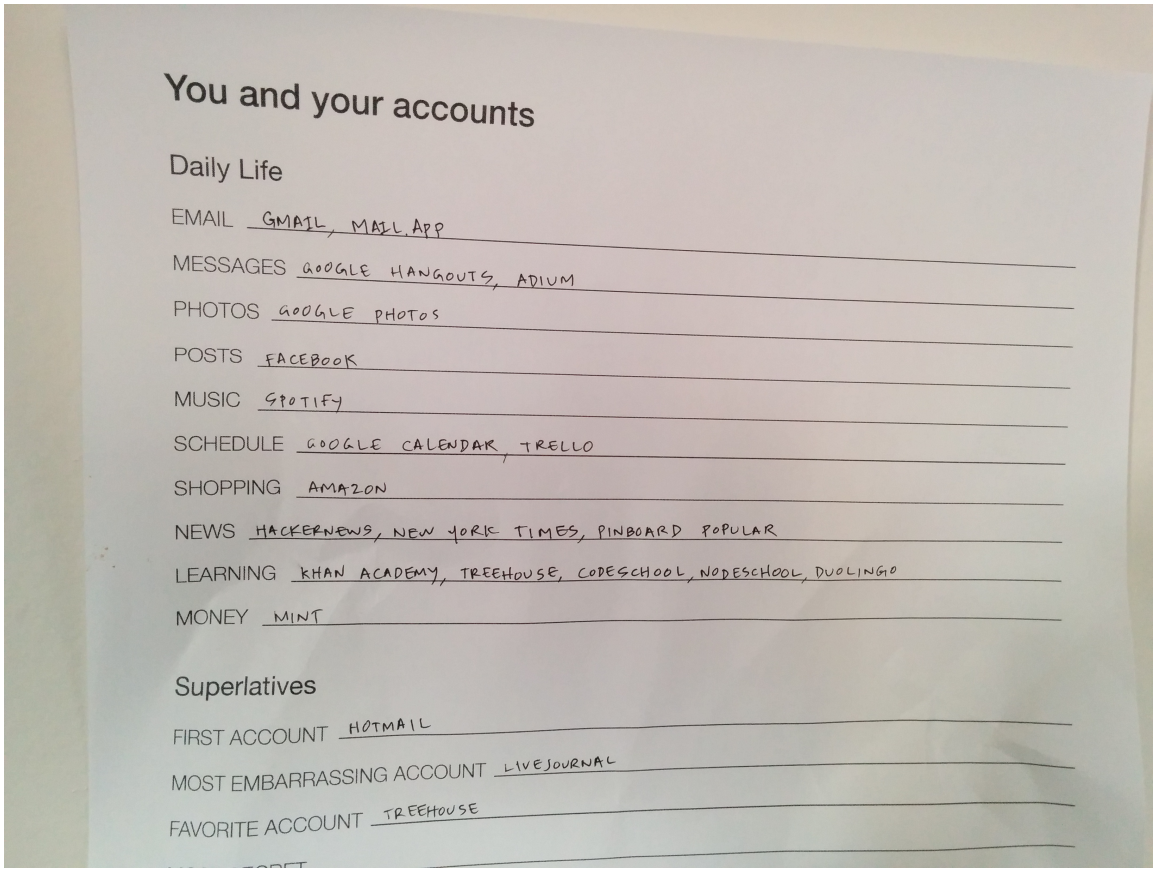


Figure 9: A Digital Account Inventory.

In addition to these paper probes, I have created and deployed two sets of interactive probes. The goal of these probes differs slightly from the paper probes I described in the preceding paragraphs. As interactive artifacts, these probes helped participants engage with potential options for how digital systems would handle and make sense of digital information in the future. It is here that I draw most strongly from the process of doing research through design. Though all of my work is oriented by the desire to tackle complex problems using design thinking, it is through the creation of these probes that I have the most significant opportunity to develop artifacts that are representative of potential futures and that help people engage in critical thinking about the future of their information and that of their families. This work draws strongly from the philosophy of technological probes [69] and extends this work by using the systems I develop as a way to engage with ideas that are not necessary connected to the development of technological systems.

These probes are valuable for my work because many of my research projects involve trying to understand a time that has not yet come to pass — one in the majority of people have access to a lifetimes and generations of digital information. The probes I create provide my participants with an opportunity to engage with what it might feel like to have inherited their grandparent's digital history, to pick what parts of their digital information they'd like to leave behind to future generations, or to dispossess one's digital artifacts. By combining the use of these probes with interviews, I am able to give people the tools to articulate their beliefs and feelings about complex and emerging phenomena. In addition, the process of creating the probes helps me investigate and express my understanding of how we might build systems that help people engage more meaningfully with the digital information they create or come to own over the course of their lives.

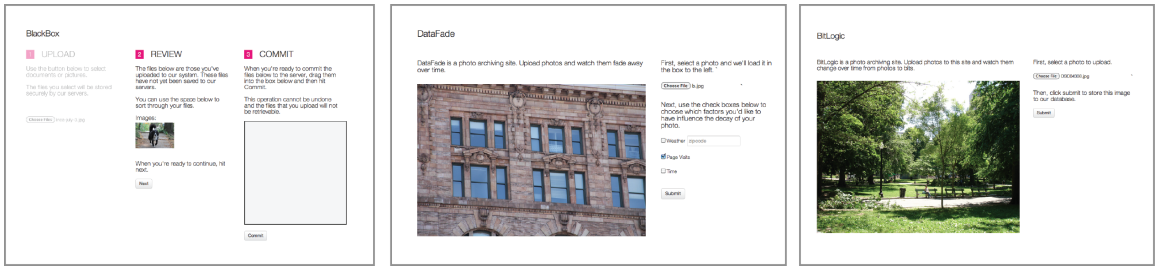


Figure 10: Three interactive probes exploring the decay of digital media and information.

One set of probes I created was designed to (Figure 10) slowly destroy or make inaccessible any digital media or information that a person chose to upload to them. All of the probes were created using JavaScript and PHP. The first system, DataFade, drew from how physical objects decay and used filters to slowly replicate the effects of sun damage, rain damage, and touch. The second system, BlackBox, was designed to be an exaggerated version of the practice of putting valued objects in storage. Photos and documents uploaded to BlackBox were kept secure in the systems archive but were not accessible or retrievable once uploaded. The third system, BitLogic explored what it might mean for something to decay digitally. Photos uploaded to this system would slowly acquire noise and eventually turn into a series of 1's and 0's. These systems evoked strong reactions from participants and encouraged them to think about their own practices of managing and deleting digital content.

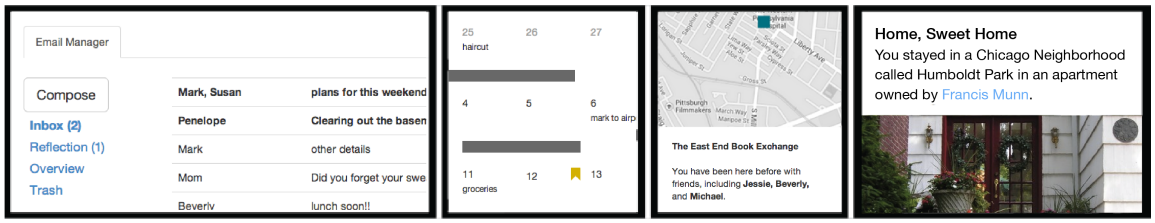


Figure 11: Four interactive systems exploring the use of systems to make sense of digital information.

Another set of interactive probes (Figure 11*)* were designed to explore the role that both users and systems play in the management, use, and representation of a person's digital information. These systems allowed me to ask questions about how these four key concepts – agency, generativity, time, and topic - influence how participants think about the future of systems making sense of, and judgments about, their digital information.

Conversational Methods

My work involves discussing sensitive topics with participants, such as preparing for one's death, the experience of losing a loved one, and one's relationship with their family members. Learning how to approach these topics and engage in productive discussions about them has been a central part of my development as a graduate student. I am guided here by work from the social and biological sciences [31, 37], which provides guidance about how to conduct interviews in a way that is empathetic to and respectful of participants, and that provides them with an opportunity to share meaningful or challenging aspects of their lives.

I commonly conduct semi-structured interviews with participants in their homes. Being in a person's home affords me the opportunity to learn more about a person's life and supports the interview process by providing them with the ability to use the artifacts in their home to provide context for

what they share with me. Conducting the interview in a person's home also helps me establish a shared understanding with that person. For example, in an interview for my *Digital Artifacts As Legacy* project, one participant invited me to look through the scrapbooks she had created to document the lives of her parents and siblings. In an interview for the *Legacy in the Age of the Internet* project, the participant invited me to conduct the interview in the parlor of a historic home she and her husband were working to restore. In both cases the setting of the interview provided valuable insight into a person's life, passions, and relationships with others.

Within the format of a semi-structured interview, I typically use qualitative methods that scaffold the process of telling stories about one's life. One technique I use is directed storytelling [60]. Using this technique, interview questions are phrased as a request to share a story about a specific event or experience. For example, in the *Legacy in the Age of the Internet* project, I asked participants "Can you tell a story about a time when you removed information that you had posted online?" Another method that I have used in my work is photo elicitation [28, 61]. The goal for this technique is similar to that of directed storytelling, but the process of telling stories is supported by visual images. Using photo-elicitation in combination with semi-structured interviews allows participants to drive the interview [64]. In the interviews I conducted, a participant's photographs (such as those uploaded to Facebook or Flickr) were used as a way to help them recall stories and to help me better understand their experiences and point of view.

I have also used an adapted form of user enactments [104] to help contextualize the probes I've used in my research work. The probes I created for the *Curatorial Agents* project were designed to reflect several of many potential futures for how systems might help make sense of, manage, and represent the digital information generated over the course of one's life. Examining these issues presented a major challenge, as it is not yet the case that many systems can gather or analyze information on this scale or for this purpose. As such, for each of the probes in that study I composed a scenario to provide a backstory for the information held in these systems, and to explain how the system would operate and the contexts under which it would be used. Asking participants to take part in these scenarios helped focus our investigation on the concepts represented by the systems.

Methods of Analysis

All of the interviews I conduct are recorded using a mobile phone or iPad. The recordings are transcribed, typically by me or other researchers involved in the project. In addition to transcribing the interviews, I also record my thoughts about each interview. The goal in writing these short summaries is to capture information that might not be conveyed through the transcript, such as the person's demeanor or a description of a possession they referenced during the interview. In addition, I have notes written during each interview session that highlight particularly significant or interesting aspects of that discussion.

Once I have produced and assembled all of these materials, I begin the process of analyzing the data. My work uses a purely qualitative form of analysis. For the projects discussed in this proposal, I used a technique adapted from grounded theory [32]. The grounded theory approach outlines a procedure whereby researchers first engage in a line-by-line or word-by-word coding of the data, produce categories from those codes, and then draw connections between categories in order to reflect on existing theory and literature. This is an interactive and collaborative process in which my co-investigators and I work to expose nuances regarding how our work builds on, or contradicts, existing prior knowledge about the role of curatorial and legacy-oriented systems. Though my work is not strictly focused on the generation of new theory, the findings from my work also contribute an

improved understanding of how to utilize this information to build systems that enable more meaningful interactions with users.

In addition, my work also contributes design implications that are intended to highlight opportunities to design systems in a way that allows for more meaningful engagement between systems and their users. In my work, these design implications result from an analysis of the findings from a particular study, the nature of existing systems and practices, and my understanding of what a desired future might be. As such, the contributions of my work (particularly those which results from studies using probes) are a mixture of field-informed design knowledge and practice-informed design knowledge [125].

CHAPTER 4: DIGITAL ARTIFACTS AS LEGACY

In this chapter, I describe work that explores how the vast collections of digital photographs and media generated over the course of one's life might influence how that person is remembered after they have passed away. This work drew heavily from existing literature from HCI, death and dying studies, and material studies.

To explore these ideas and ground my thinking in this emerging space, I designed and developed three fully functional systems to provoke participants to consider how their digital legacies might be treated in the future, and to envision ideas beyond the designs themselves. These systems were shown to participants as part of a qualitative interview where I explored behaviors and perceptions of digital legacy. This research work made two primary contributions, both of which are described in depth in this chapter. First, it detailed the design and implementations of three working interactive systems that were used to as provocative, reflective artifacts during sessions with participants. Second, it detailed three opportunity areas for moving forward in this space: creating family-oriented archives, developing systems that encourage purging of digital information, and changing perceptions about the nature and value of digital data.

Background and Motivation

The concept of a legacy is a complex cultural issue involving the creation and dissemination of identity across generations and time. When this concept is applied to individuals, it tends to be comprised of some combination of intangibles, such as life experiences and values, and physical artifacts, such as houses, books, vehicles, and furniture. Though a person's legacy is not exclusively at the discretion of the person to whom it refers, the curation of one's legacy is a way in which individuals can highlight meaningful aspects of their life [142]. Through the transmission of this legacy, a person is given the opportunity for these ideas, possessions, and values to be passed on and considered by future generations.

However, even in the context of this established practice, digital information systems are rapidly changing what comprises the meaningful possessions reflective of a person's life. The types of artifacts and collections that people own, the media through which information is transmitted, and the ways in which people experience relationships with others are increasingly becoming shaped by interactive technologies and systems [81]. As people share more information about themselves online, and from deep attachments to digital data and artifacts, these virtual objects are becoming more deeply integrated into our lives, and subsequently our legacies. Today's children are growing up in a context that places a high value on that which people capture and share digitally [80].

Given these changes, it is critical to examine how digital artifacts and information are being integrated into existing practices related to death, family, and inheritance. Prior related work has explored how people construct value with their virtual possessions [106, 52], the roles technology can play in both death and bereavement [89, 154], and differences in in qualities of virtual and material possessions [103, 87]. This work built on these collective areas through an in-depth examination of how people perceive and prospectively consider digital artifacts in the context of their personal legacy, against the backdrop of their other material practices and physical heirlooms.

Exploring the Decay of Physical and Digital Artifacts

In order to aid in the development of the technological probes used in this study, I undertook a study of how decay affects physical objects and what values or feelings were represented by that process. Prior work in HCI [101] had suggested that decay, destruction, and the putting away of digital information might be a way for people to manage and make sense of the large amounts of digital data they accumulate over the course of their lives. However, translating that idea into a set of technological probes required me to engage in a more thoughtful exploration of the visual aesthetic of decay, the emotions it conveys, and the processes it reflects. This work played an instrumental role in the development of the technological probes, which are described later in this chapter.

I begin this study by looking at images tagged in Flickr with the word decay and other words that were related to that idea, such as the words worn out, used, abandoned, forgotten, damaged, patina, and wabi sabi. As I looked through these images, I selected images that represented particularly striking concepts. These included photos of abandoned buildings, well-used clothing and cherished objects, and the natural processes that often accompany decay. I then used affinity diagraming to organize those images and developed a set of eight statements about the different visual, emotional, and procedural qualities of physical decay. These statements do not represent some larger framework for how we might understand decay, but instead function as a set of statements designed to help me think about the different ways that decay is expressed and interpreted.

These eight statements were:

Decay is texture.
Decay is organic.
Decay is slow.
Decay is abandonment.
Decay is ruin.
Decay is opportunity.
Decay is patina.
Decay is the memory of use.

I composed eight collages using these statements and the images I'd collected; these collages are pictured in Figure 12. There were several takeaways from this process. The first was that the patina that an object acquires over time was a strong signal about its value and how it was used. The patina an object acquires over the years has a distinctive aesthetic, one that is often mimicked when people producing new goods want to make that object look like it is a valued or treasured keepsake. The second was that while decay is a destructive process, it could also represent an opportunity to rebuild, re-author, or discard things from one's past. In addition to being a signal about the age of an object, the decay of a valued object can provide an opportunity for a person to reflect on what makes that object valuable to them (or not). Finally, it was clear that while people expect that physical objects will decay over time, there was less certainty about what it might mean for a piece of digital information to decay.

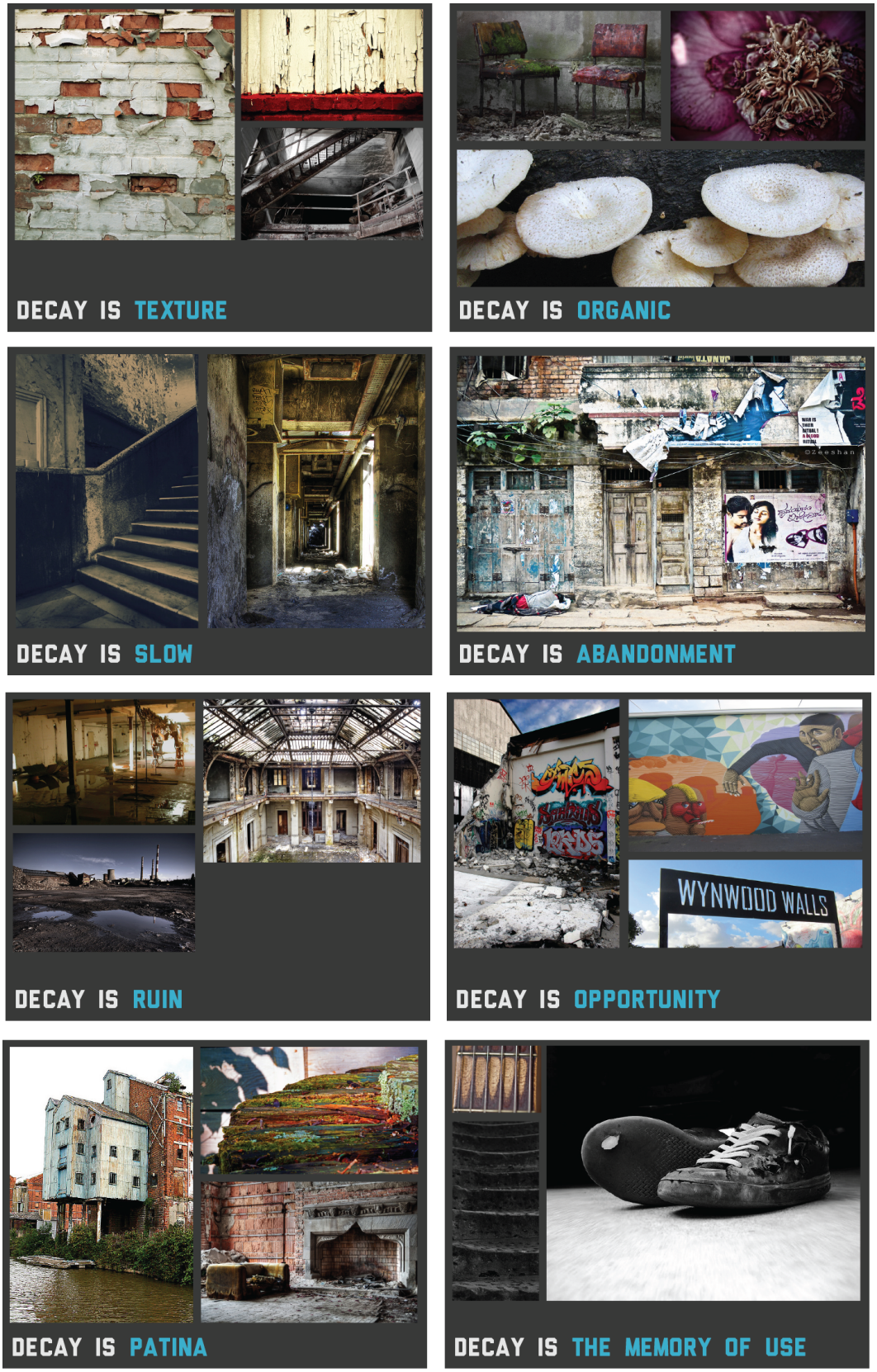


Figure 12: Collages exploring the qualities of physical decay.

Having completed this study of physical decay, I was also interested in exploring how the decay of physical objects differs from that of digital or virtual objects. To learn more about this, I read literature from the library and archival sciences both of which have long discussed the implications of the distinctions between how digital and physical materials decay over time [47, 62, 63]. This reading demonstrated that though the processes unfold in different ways, there are a number of signals and practices that allow digital files and information to reflect their age and importance. Based on these readings, I created the graphic in Figure 13, which illustrates the changes and forces that lead to the decay or destruction of both physical and digital materials. The findings from this exercise directly inspired the creation of all three of the probes used in this study.

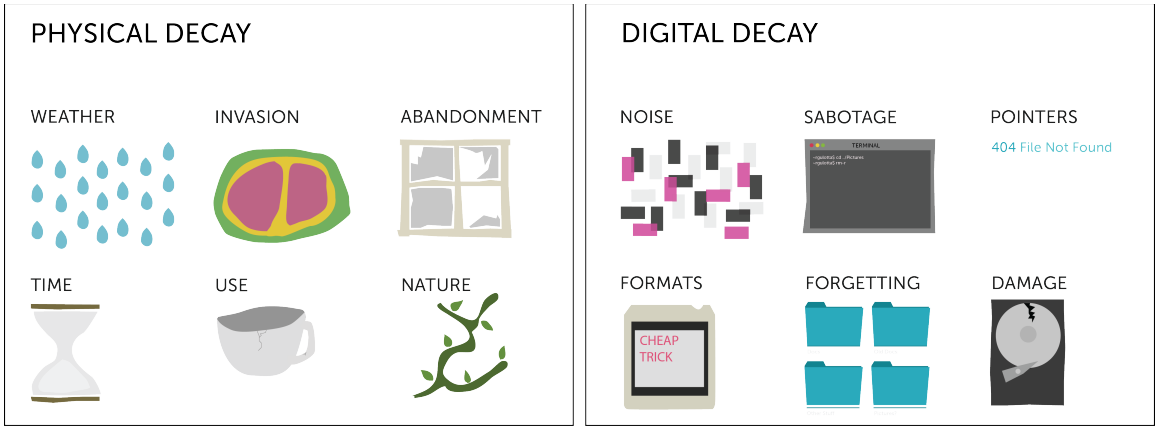


Figure 13: An illustration comparing the different forms of physical and digital decay.

System Descriptions

It was my goal to design systems that could be used as speculative, provocative artifacts as a part of interactions with participants to explore their feelings about digital legacy (i.e., *probes* [69]). Importantly, the goal of this work is not to assess the functional feasibility of applying concepts like decay to digital things. Instead, aging and decay were chosen because they provide a provocative counterpoint to established thinking about digital things. Decay is in contradiction with the permanence and safety that people often associate with digital data [157] and have been highlighted as potential ways in which digital systems could help people cope with the large collections of digital information they generate [101]. However, little research in the HCI community has moved beyond studies of current practice to embed decay and aging into working systems.

To explore these ideas and ground my thinking in this emerging space, I designed and developed three fully functional systems to provoke participants to consider how their digital legacies might be treated in the future, and to envision ideas beyond the designs themselves. They include: (1) *BlackBox*, a file archiving website; (2) *DataFade*, a website that causes photos to decay based on physical phenomena; and (3) *BitLogic*, a website through which images decay along a digital spectrum, from photographs to bits. All three systems were programmed for the web using JavaScript, PHP, and MySQL. Each system was designed to explore a specific aspect of what aging might mean for a digital file. In some cases, this was a literal appropriation of concepts from the physical world, such as weather and touch, and in others, I attempted to push the boundaries of what it might mean for there to be digital processes that deliberately lose digital information (but not necessarily meaning or value) over time. The development of these systems drew most heavily from the practice of reflective design, which emphasizes the value of reflection for both users and designers as a way to reexamine perceptions, beliefs, and experiences [127]. Development was also influenced by recent work with speculative design [49], critical design [9] and technological probes [69].

DataFade

The first system, *DataFade (fig. 14)*, was a photo archiving site that allows users to upload a picture and watch it decay over time. Upon visiting the site, users were invited to upload a photo, and to select from a number of agents of decay. These agents were chosen based my exploration of the visual, emotional, and aesthetic characteristics of decay. These agents were: the weather at a zipcode of the users choosing, the number of online visits to the photo, and time. If a user chose to have a photo decay in accordance with the weather, the system tracked the number of sunny and rainy days in the zip code provided. This was designed to mimic how a photo will be damaged over time if not protected from the elements. If the user chose page visits, the system kept track of how many times the web page was loaded. This agent was chosen to reflect how a photograph would acquire a patina that reflects its having been touched or used. Finally, if the user chose time, the photo was programmed to decay at a steady rate over time, as it would in the physical world.

This probe was directly informed by the visual and emotional characteristics of decay that I identified when making the eight collages. It was my goal to use filters and effects to elicit discussion about different behaviors that result in an artifact being abandoned, discarded, or destroyed. As a result, each of these agents was chosen as a digital approximation of a physical process. In the physical world, for example, a photo will decay due to exposure to the elements, through handling, and through chemical changes over time. In this system, visual effects were used to represent each of these processes. As demonstrated in Figure 15, the passage of time changed the colors of the photo to a more sepia tone, sunshine increased the brightness of a photo, rain decreased the saturation, and visits decreased the opacity.

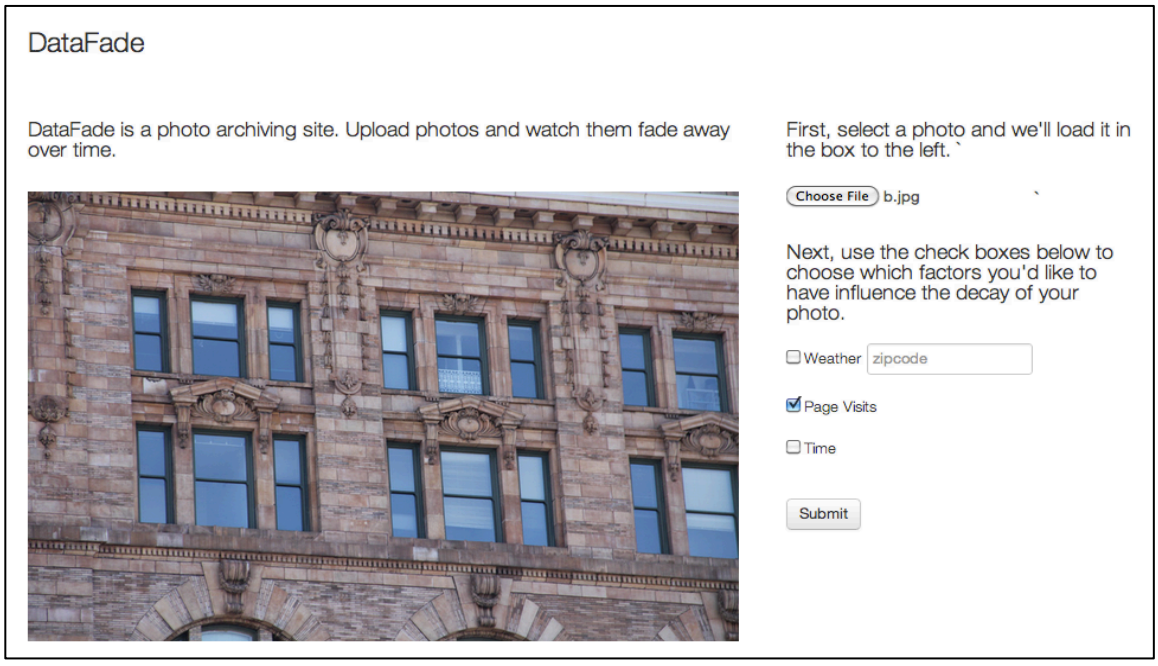


Figure 14: The main page for *DataFade,* programmed using Javascript, PHP, and mySQL.

Figure 15: The different effects of the *DataFade* system. From left to right: 1) the original photo, 2) the effects of time, 3) the effects of different weather conditions, and 4) the effect of visits.

BlackBox

The second system, *BlackBox* (*fig. 16*) was a file and photo archiving site. Users were prompted to upload documents and photographs, which were organized by the system. The user selected which of these files they would like to upload, and dragged visual representations of those files into a large box on the right hand side of the screen. Upon hitting submit, any files that have been dragged into the box are then processed by the system, and the user is given a link they can use to "re-visit" their files.

Unlike a traditional archiving service, however, users who visited the link provided to them when they uploaded their files did not have the ability to access the files. Instead, they were greeted by a message describing the uploaded files and providing information about how long the files have been there. In presenting only data *about* the files — and not the files themselves — this system played on the idea of "purging" through storage. People often place objects in a box, and store that box out of sight, as a way of reducing clutter, keeping things safe, and fulfilling obligations to hold on to mementos [73]. *BlackBox* intentionally pushed this idea to an extreme, provoking users to contemplate how they view the ownership, lifespan, and safekeeping of their digital files.

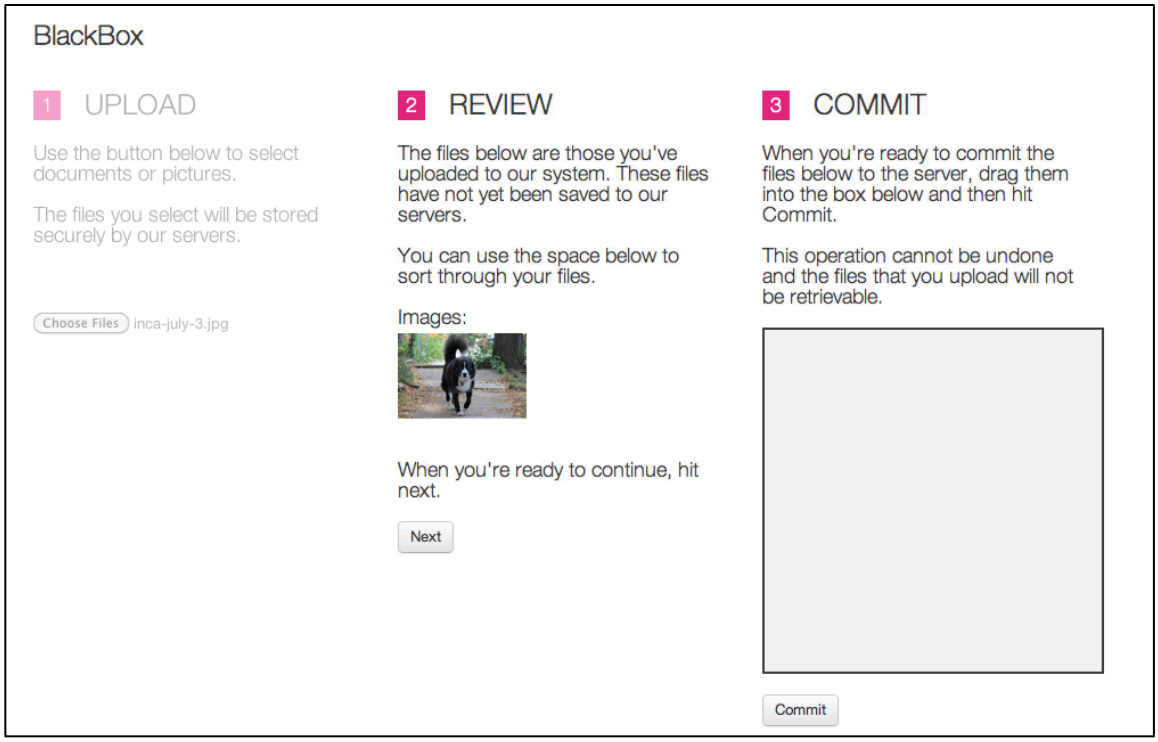


Figure 16: The main page for *BlackBox*. On this page, the user is in the process of uploading a photograph to the systems.

BitLogic

The third system, *BitLogic* (*fig. 17*), was photo archiving site that allowed users to upload a single photo at a time. The photo that was uploaded to the site would, over the course of 30 days, decay along a digital spectrum that I devised. In contrast to the process of physical decay, which generally occurs in a familiar manner through exposure to various agents, digital decay is a less familiar process. Digital files typically exist in one of two states: either they are accessible or not. With *BitLogic*, however, I wanted to explore what it might mean for digital things, like physical objects, to decay over time and to exhibit signs of decay without relying on affordances from the physical world.

Figure 17: The BitLogic system.

Photos uploaded to this system decay from their original state, in which they have evocative and personal meaning to the user, to digital data, which can be interpreted by a human but is far more meaningful to a digital system. This process is shown in Figure 18. In this system, the process of digital decay consists of two stages. In the first stage, the photo is increasingly distorted by noise and loses opacity. In the second stage, as the noisy photo nears transparency, the photo is slowly replaced by a field of binary 0s and 1s, representing bits.

Figure 18: A photo decaying digitally in *BitLogic*. From left to right: 1) the original photo, 2) noise applied to the original photo over time, and 3) that photo transformed to bits.

Participants

Participants

10 adults (7 women and 3 men), ranging in age from 25 to 55 (average= 39.8, sd = 9.635) participated in the study. All of the participants were parents, and their children ranged in age from 8 months old to 21 years old. I chose to study parents because they are typically old enough to have experienced inheriting or being given physical artifacts from family members. Furthermore, people with children are in a position that often necessitates a consideration of their own legacy. Additionally, the process of documenting family life is a major way in which people generate media (e.g. photographs, videos, etc.) and possessions that might be passed down as a part of a legacy.

The decision to focus exclusively on parents was influenced by research that illustrates how people's relationships with objects change over the course of their lives. Whereas young adults put the most value on objects that do things, adults in middle age are more likely to identify artifacts that remind themselves of their accomplishments as the significant objects in their lives [11]. A third group, older adults, typically place value on evocative objects that provide them with the ability to reminisce [11]. As such, speaking with parents would allow us to explore how this understanding of material possession would relate to the possession of digital artifacts. In addition, parents are often in a position to reflect on the legacy of their aging family members and to think about how their children will look back on their lives.

To recruit participants, I submitted advertisements and messages to a number of sources, most notably craigslist, local listservs, and local groups on *reddit.com*. Respondents were screened to confirm that they were parents in the Pittsburgh area, that they used the Internet at home, and that they had digital photos on their home computer. Beyond those selection criteria, I deliberately worked to ensure that the participant group represented parents with children at different ages, and both single and married parents.

Methods

For each session, one or two investigators met with the participant in their home. This setting provided an opportunity to observe and ask questions about topics such as digital file management, the selection of cherished inherited objects (and objects desired to be passed down), and the integration of physical and digital media in the home.

The sessions lasted between one to two hours and were comprised of (1) a semi-structured discussion, in which I asked participants questions about their use, creation, and management of digital things and physical artifacts, and (2) exploration of the three technological systems, used by the participants on their home computers. Prior to my arrival, participants had been asked to select 10 to 20 digital photos from those available to them online or on their computers. Participants were free to choose any photos they liked, though it was suggested that they choose photos that were meaningful to them. For the remainder of each session, participants uploaded the selected photos to the systems and were asked to reflect out-loud on their feelings and thoughts as they explored each system. The entire study session was captured via audio recording, with the participant's permission.

Nine of the ten participants chose to upload photos to the systems; P1 opted out of using the systems but instead reflected on explanations and a demonstration of how the systems worked. All of the participants were shocked by, entertained by, or skeptical of the systems I presented. I encouraged them to avoid making usability or visual critiques of the systems and to instead focus on the service

being provided. In this way, I gathered participants' reflections on the characteristics of digital data and their nuanced feelings about the value of digital media.

Findings

Prior work has indicated that participants might value the opportunity to discard their digital content in a controlled manner [101]. Work from personal information management also suggested that participants would not have developed formal or particularly effective practices for managing the digital content they'd captured about their own lives and the lives of their family members [160]. Given this work, the goals of our study were to investigate how the framing of legacy, death, and inheritance influences how people understand the impact of their digital content and media.

To investigate these ideas, I transcribed the recordings from the study sessions. I then read through the transcripts in order to get a sense of the large, over-arching themes that were present in the data and that offered some reflection on prior work and our areas of inquiry. I then clustered those themes into a set of five key findings, each of which discusses a different aspect of how participants use of, and perceptions of, digital media intersect with concerns regarding the long-term implications of that content. As such, these findings expose a number of design opportunities for existing systems that collect and manage people's digital information.

The findings presented below representative of the information contributed by the participants in response to the three technological systems and to the interview questions. I present findings that are directly related to the systems first, and then point to some general findings supported by participants reactions to the systems and the interviews. In each case, I note how many participants contributed to that finding. In the sections below, participants are referred to by their participant number, from P1 to P10.

Importance of Authenticity

Participants were critical of the idea that a person would have any reason to get rid of any digital media that had made it into their archives. When describing the systems, P9 said "*I guess it's just a, like a bad road map or something, Or is it trying to fix something that's not broken*." The prevailing belief was that the act of deleting a digital file went against the nature of digital devices and systems: "*I wouldn't want to use it because it goes counter to every reason I use digital*" (P6). That is, with cheap or unlimited storage available both online and offline, why get rid of anything at all? Given this belief, participants questioned the role that such systems would play: "*It just seems like there is no utility like that's kind of the value of [digital files], so it loses its value. It's interesting to me that you can even to do that. Would I choose to do that? No"* (P5). These quotes are demonstrative of the ways in which participants pushed back against a set of processes that contradicted their understanding of what it meant for something to be digital.

Participants were also skeptical of the appropriation of physical concepts for digital media. This included the application of physical practices (i.e. *BlackBox* and *DataFade*) and processes (i.e. *DataFade*), but extended to the very idea that digital media would decay in the first place. This is an astute observation, since digital media is often venerated by consumers for its ability to resist decay. Regarding such digital decay, P2 said: "*But it's possible to not have that happen. And so like, in terms of practicality, this is something that's more fun to watch and see what happens over time, but not the ideal because I would think that if you want to save your pictures for a long period of time, you want them to be as pristine as possible*." Correspondingly, one participant commented that BitLogic more appropriately reflected the way in digital information should decay because it expresses that decay in terms of a digital transformation.

Whereas patina and wear often contribute to the value of physical objects and heirlooms, participants were not interested in a digital patina, as seen in the DataFade system, that they felt detracted from the artifact. Four participants suggested that the real value of systems like these were as thought exercises or art, which offer an opportunity for reflection: "*I could see using it as an evocative art project and throwing away the original. As a, more as a thought experiment than anything else*" (P7). During interviews, I used this strong set of opinions as an opportunity to discuss other ways in which digital media could reflect use, ownership, and relationships. Two participants responded more enthusiastically to the idea of a digital system that added information as a form of patina or aging: "*Yeah, I like data. Data being added to it is great*" (P6). However, this process of adding data to a digital artifact is tied to its own set of complications: How do we choose what information is meaningful? How do we balance the addition of information with the desire to sort and curate? And how do we incorporate this information into different types of digital data and media?

Contradictions Regarding Value

At many points during the sessions, participants questioned whether their personal digital data might be worth anything to their children. This line of inquiry spanned all of the digital data discussed with participants, including email accounts, social network accounts, and digital files. P6, responding to a question about the value of all of her digital data said "*I can't think of how it would be that valuable to my descendants or whatever anymore than it is to a random stranger right now*." In many cases, this opinion seemed to be in opposition to their personal experiences, in which they expressed fondness and attachment to artifacts, in particular photos, that had been passed down to them by their parents, friends, or older relatives. During the course of the interviews, four of the participants shared family albums and scrapbooks that were an established part of their family history and legacy. Additionally, participants talked about the desire to have more information about their family members: "*If my mother had an external hard drive with photographs of her entire life I would absolutely want to have a copy of these files*" (P2).

Uploading photographs to the provocative systems also highlighted a contrasting set of opinions regarding the value of digital photographs. When choosing photographs to upload, users were wary of selecting photos of their loved ones or that represented precious memories. It seemed difficult for them to subject the photo to a process that would cause it to disappear: "*I guess it's a little heartbreaking to see this deteriorate over time. Part of that is just that emotional attachment you have, particularly with your kids*" (P9). Similarly, participants highlighted their reluctance to delete digital media in the absence of an accessible backup. P7, when asked if he would upload content to one of these systems asked "*Can it be retrieved?*" Finally, P2 talked about how he'd feel if he found out that his son had used one of these systems to get rid of digital photos he had taken: "*If that was the only places where those files existed anymore, I might be a little disappointed*."

This attachment to and concern for the safety of digital files is interesting when put in the context of the suggestion that these files wouldn't have value to their children. Clearly, participants struggled with the idea of discarding digital files despite their questions about to whom they would have value.

A Generation in Transition

All of the participants described having inherited or coming to own possessions given to them by other members of their family. These possessions included jewelry, large pieces of furniture (e.g. an organ, a piano, a grandfather clock, etc.), and photographs. Few of these objects were in use by the participants, though some were present in the main areas of the house. In many cases, the

participants felt as though the objects were too fragile or outdated to be regularly used. That being said, these objects were given elevated status as objects that represented relationships and experiences. Participants were uncomfortable with the idea of throwing away or getting rid of these heirlooms, despite their low financial value, and their plans were to pass them on to their children. In contrast, not a single participant had ever experienced inheriting any form of digital media or information.

Despite not being personally familiar with the process of inheriting the digital, nine of the participants were open to the idea that their children might some day come to inherit or own digital things as a part of their legacy. With seven of the participants, this awareness was accompanied by the absence of direct preparation. For example, P8 described positive feelings about passing down digital photographs to her kids, but had not yet considered how that process might occur. When asked if she would pass down a hard drive to her children, she responded "*I don't know, maybe we'll all have computers in our brains by then. I haven't really thought about that, no, to pass down a digital form*." On several occasions, participants disused how, in contrast to the systems used in this study, there might be value in creating online services that guarantee the safe-keeping of digital media.

In a similar vein, it was a common practice for participants to have digital media stored in physical media such as external hard drives, CDs, and DVDs. In these cases, participants talked about leaving those objects to their kids. Though the CDs and DVDs had been created as a way of creating backups, the act of passing down these objects had been integrated into traditional practices regarding the transmission of physical objects. P9, who had burned many of her images to CDs and DVDs described her hope that her children would be able to access information stored on these discs: "*…I'm assuming we'll have jpegs and gif files for eternity and all that is created today can be translated 25 or 50 years from now. So even if it's on the CD, they can still access it*."

A small number of the participants were directly engaged with the process of establishing their digital legacy in addition to their children's digital legacy. In all three cases, these participants were tech-savvy individuals whose jobs involved working with technology. P3 was heavily invested in making a concerted effort to manage both the quantity of his digital photographs and to make the information accessible to his children: "*… as part of my will, I will have an envelope with passwords so my kids can get into my passwords and into those files*." Two other participants described having created websites for both themselves and their children, on which their digital information could be stored and managed. This acceptance of the place for the digital as a part of an inheritance or legacy is evidence of a major shift in how people's family lives are being changed by new technology.

The Burden of Inheritance

Across all of the sessions, there was an awareness regarding the scale of participants' digital collections. When asked to describe the number of digital photos or emails they had, participants often responded with numbers in the thousands ("*Several tens of thousands*" (P2), and "*There's over 2000 photos on this memory stick*" (P8)) or were unable to put an exact number on their collection ("*I don't know, I wouldn't hazard a guess and there's many duplicates because they're just all in folders on my external hard drive*" (P3)). Similarly, when asked if there would be value to a person who wanted to look through the collection of his digital information, P7 responded by saying "*As an archeological dig, sure*," indicating his perceptions about the difficulty of extracting significant information from his email, files, and other digital accounts.

The size of their digital collections is partially attributable to a striking similarity between the ways in which people manage physical and digital photographs with regards to purging and curation. In both

cases, eight participants were reluctant to discard photographs, regardless of media. When pictures were deleted, it was typically because they were blurry or because they had been taken by their children. When describing her practices regarding getting rid of digital photographs, P4 said "*I mean, if they are blurry or her face is like weird, because she was half way blinking… I will go through and delete the ones that didn't turn out all that great*." Additionally, the ease with which people can take and store digital photos contributed to this behavior. P7 explained that "*Disc is cheap*", and there was therefore no reason to delete digital data. This finding was reinforced by the ways in which participants challenged the value of the systems developed for this study.

This type of digital accumulation is a well-documented phenomenon, but is cast in a different light when it is put into the context of a legacy. Five participants expressed the belief that it was up to their children to manage their collection of digital photographs and information: "*I feel like, well, I put some organization into it. I feel like they'd be able to. It would take time, but the kids can figure it out*" (P8). Nine of the ten participants described using organization systems no more sophisticated than sorting events by season and year, with named folders for special events. Without more detailed information about the content and people that appear in the photographs, it may be difficult for their children to derive significance from the photos. This is especially a concern when the scale of the collections is considered. Even for people who don't intend to leave digital information for their children, they will often have a digital legacy that exists as a result of their interactions with technology. As a result, participants are creating a digital footprint that might make it difficult for their children to manage this inheritance and extract things of value.

Content, Intention, and Disclosure

Participants expressed different comfort levels with regard to sharing aspects of their digital information with future generations. This was influenced by both the content of the information and the reasons it was created.

On the most acceptable side of the spectrum, participants expected that their kids might see digital photographs featuring family members or events. In some cases, these photographs were taken with the intention of being passed down to the children. Similarly, two participants maintained blogs on which they posted updates about their family life and pictures of their children growing up. P10 described the ways in which she was documenting her child's life using *Tiny Beans*, a blog service geared towards parents, in combination with physical books to document her son's life: "*We have these books, and we have the Tiny Beans. I think [those] are the main records that we keep. So one electronic and then these two in written format… So yes, I will want him to have access*." In both these examples, there is an expectation that children would someday have access to the information and media that documented participants' lives.

Other types of accounts elicited entirely different responses. Email was a common topic of discussion during the sessions with participants, and was offered in comparison to the practice of saving old letters. Seven participants thought that their email accounts might contain individual conversations or threads of conversations that their children would value, such ones with their family, friends, or partners: "*I think that some of the emails I've kept were from when B and I were dating, those were kind of sweet. A couple from my mom, I think. I might print them I don't know what I'd do with them. Maybe worth passing down*" (P8). However, participants were also wary of the idea that their children might someday have access to their email accounts. P3, when discussing his email account, said "*If I were to do that I would go through my email account and delete a lot of things. There are probably some things in there that would be embarrassing to me… I wouldn't be leaving my password in a will to somebody, I don't think, because those things are particularly more personal."*

People were least comfortable with the idea of passing on passwords to their accounts, such as Facebook or blog accounts, which would provide unrestricted access to their children: "*If I knew for a fact that, you know, on my deathbed my Facebook was going to become the property of someone else, I may want to go back through and curate it a little bit more to make sure I had control over the kind of images of myself that I was leaving behind*" (P3). Certainly, in terms of existing practices regarding the passing on of physical objects, people often make choices about what to share and what to leave behind. Even with careful consideration, it can be difficult to manage and sort through the contents of one's physical possessions. This problem is exaggerated in the digital realm because of both the depth of people's digital identities and the ways in which people separate facets of that identity using different accounts and networks. Like many internet users, P6 maintained digital identities that she intentionally separated from her anchored, offline relationships: "*I had a journal that was almost totally anonymous and I had I guess friends and followers on there who, the vast majority of them who did not know me in real life. It was true and it was all me, just a side, that okay, people on that account didn't know any of the normal me. And all of my daily friends didn't know about that account*."

This example, and the contrasts between participant's interest in sharing different types of information, highlight a significant challenge regarding the transmission of the contents and character of a person's digital identities. People intentionally curate digital accounts and files in order to represent different aspects of their identities [135]. Taking a long term view, this opens up two oppositional potential hazards: (1) the loss of digital information that could have been valuable to future generations despite the personal or private nature of the information, and (2) the chance that future generations may find or be exposed to information that the creator intended to remain separate and hidden from their curated collections of information.

Design Opportunities

I developed three design opportunities from these findings: family oriented archives, file management through selective archiving, and comfort with long lasting digital legacies. These design opportunities are a direct response to the insights generated from participants and point to a number of ways in which technology can be used to help participants establish, curate, and derive meaning from their digital information.

Family-oriented Archives

Participants found it difficult to conceptualize how their digital information would be valuable to future generations. This problem was partially attributable to the abundance of data they had generated across networks and identities, but was primarily tied to their uncertainty regarding who might be interested in the wholesale contents of even a single facet of their digital identity. As such, participants thought their data might have value, but struggled to answer the question of *to whom* it might be valuable.

This information points to the opportunity to create systems that allow people to sort their digital information in terms of who will receive it after a they have passed on. This practice is similar to established traditions related to the passing on of physical mementos; selecting individual artifacts to pass on to particular people conveys a sense of importance surrounding that person and their relationship with both the artifact and the deceased. In a digital system, designers could develop add-ons, plugins, and data scrapers that pull from the different places in which people generate or collect digital data and allow them to assign that data to people or groups in the context of their personal legacy. In doing so, this would provide users with the ability to elevate the importance of pieces of

digital information and share them with particular individuals. However, this practice would need to be [].

File Management through Selective Archiving

Another obstacle faced by participants was the sheer quantity and diversity of their digital data. Participants discussed having thousands of photos, multiple digital identities, and a large quantity of emails that were saved online in social networks and digital accounts, and offline in folders on a collection of hard drives. In many cases, there were duplicates or redundant information captured across networks.

One way of addressing this issue is to expose people to the idea that they should be more selective about their personal archives and, furthermore, to provide them with the tools to do so. An example of this could be a system that recognizes when a file is blurry, a duplicate, or one of a large collection from the same short period of time. For digital documents, email systems could identify the source of correspondences and make inferences from that information about the value of the data. Based on these analyses, a system could suggest to a user that they delete those files. Ultimately, the choice lies with the user, who would decide whether to keep a piece of digital data. However, such a system could change the expectations that users have around saving digital information, helping them transition from the practice of saving everything to a more nuanced curation of the digital. As such, this system could help participants generate more manageable digital archives for future generations.

Comfort with Long-Lasting Digital Legacies

Finally, participants' creation of meaningful digital legacies was hampered by mixed feelings regarding the potential longevity of their digital data. Several participants discussed how, if faced with leaving a digital legacy, they would like to go through their digital data and get rid of sensitive or private information. This is understandable, when confronted with the idea that your Facebook profile or Twitter account might be the way in which generations of family members reflect on your life, it is reasonable to be concerned with the impact of those sources. However, is it precisely this provocative and uncensored information that might offer the most compelling insights into your life and identity.

Given the potential value of this information, designers have an opportunity to develop systems that encourage the archiving and safe keeping of digital data, particularly when it is focused on experiences that fall outside of daily activities. Though potentially embarrassing or revealing, this is a meaningful collection of data in that it represents a perspective that might not have been available or understandable by children as they were growing up. As such, it is important to push people to think deeply about the sacrifices they make by excluding pivotal aspects of their lives and identities from their digital legacy.

Conclusion

In this chapter, I presented a study that examined how people think about passing down digital information as a part of the legacy they leave behind, and how that information might influence how future generations look back on a person's life. I collected data using semi-structured interviews and a collection of interactive probes. The findings from this work illustrate that people are: (1) critical of systems that seemingly defied their perceptions of digital things, (2) grappling with the issue of assessing the value of digital media and information, (3) aware of their status as harbingers of new traditions and practices regarding digital media, (4) responsible for generating a vast digital archive their children will be responsible for managing, and (5) sensitive about the exposure of different

aspects of their online identities. These findings demonstrated that there are a number of challenges associated with building systems that can support the process of reflecting on one's digital materials. That being said, the findings also expose a number of questions regarding how digital systems influence the ways in which users think about these issues. Given that this problem space is tied to a number of complex challenges such as managing one's own digital information, making sense of records that have been left behind by others, and understanding the nuanced feelings people have about their different accounts and services, it is worthwhile to examine how systems can play a role (if any) in addressing these issues.

CHAPTER 5: LEGACY IN THE AGE OF THE INTERNET

The work described in the preceding chapter highlighted a number of complexities regarding how digital information influences what people leave behind. Throughout the interviews for that project, participants discussed how the systems they use, such as Facebook, Gmail, and Yahoo Mail, influenced their understanding of what they share, the value of that content, and the long-term availability of that content. This trend inspired me to take a closer look at how the systems themselves play a role in the legacy-making process.

With that goal in mind, I started the project described in this chapter. Through 14 directed storytelling sessions with adults from Pittsburgh, I explored how people perceive the lifespan and impact of the digital information tied to their real name, and that which is held in their private, hidden, and abandoned accounts. I discovered how digital systems shape the accessibility, use, and abandonment of one's information, the ways in which people manage and assess non-active digital information, and people's perceptions of how that information might change or be valued in the future. This work contributed a novel, in-depth explorations of how a person's collection of digital information, including that which falls outside of one's active, real-name identity, might be seen through the lens of a personal digital legacy. These findings have broad-ranging implications with regards to how systems, societies, and individuals will grapple with the long-term implications of digital information.

Background and Motivation

The creation of a legacy is a dynamic and subjective process through which information, values, and memories are passed down to future generations [68]. As a purposeful curation of the components of one's life, a legacy is influenced by how its creator would like to be remembered. Typically, in constructing a legacy, people emphasize the artifacts and memories that highlight meaningful aspects of their life [142]. After a person's death, that legacy is then subject to the interpretations of those to whom it is left [142]. A legacy is also colored by existing notions held by the receivers of that legacy and by the uncurated artifacts that are left behind. As a result, long after a person has passed away, a legacy can continue to evolve to reflect a changing understanding of the deceased's life and values.

As people increasingly utilize interactive systems to share, record, and reflect on their lives and experiences, it is important to consider how digital information might influence both how people curate their legacies and how they are remembered. Prior work has focused on tools and perceptions related to the deliberate curation of digital media and information. Several related strands of research have emphasized developing systems that enable people to archive and manage aspects of their digital life [45, 87] better engage in meaning-making with digital information [114, 127] and reflect on their family's digital history [57, 100]. Building on this emerging body of work, I explored the topic of personal legacy with a broad focus regarding ways in which people share digital information. In this work, I was specifically interested in engaging with the ideas of personal or familial legacy, but touched on how these concepts might relate to broader concepts like cultural legacy.

In the service of capturing a more holistic notion of one's digital self, this inquiry explored both accounts and information that are tied to one's real name identity and those that are in some way held apart from one's real name identity. This latter category includes digital identities and accounts that are private, that people separate from their anchored networks [163], and those that they have abandoned over time. Though these accounts may not comprise the primary identities users put forth

online, they are increasingly becoming an indelible part of a person's digital history [122]. However, there is uncertainty regarding how these types of accounts might be accessed and interpreted in the future; the unintended discovery of information held in them has the potential to influence, and perhaps complicate, the legacy a person intended to leave behind. Furthermore, the ease with which people archive and distribute digital information makes it difficult to control (or even understand) the context and lifespan of information shared online [56].

Participants

I recruited 14 participants (eight men and six women) from Pittsburgh through online advertisements, neighborhood list-servs, and flyers. Four of the 14 participants were recruited because they self-identified as people who had accounts that were abandoned, secret, private, or separated from their real-name identity and networks. Though all participants engaged in these practices to some extent, I recruited these four participants explore a more diverse collection of the ways in which people utilize online systems to construct their identity and share information online [111]. This approach has some limitations, as targeted recruiting of extreme user groups (such as people who only communicate online using anonymous accounts, or who are deeply invested in the process of managing their own digital records) might have yielded further insights. However, I wanted to begin with a diverse group to gain a rich, descriptive understanding of the space to inform what might be salient issues for future research.

Potential participants were screened to ensure the sample was diverse in terms of age, occupation, marital status, educational background and technical proficiency. The youngest participant was aged 20 and the oldest was 50 (the median age was 29). Seven participants were single, one was divorced, and the remaining six were married. Participants had a variety of occupations, including waitress, teacher, and health care worker; two participants were unemployed. Three of the participants had jobs related to information technology. Several participants were tech savvy, and described utilizing a host of online tools to share information with friends and create digital media. Nearly an equal number were skeptical about the role of technology in their lives and took a measured approach by attempting to limit the types of information that they shared and that was available about them online.

Methods

For privacy considerations, interviews were conducted in participants' homes when other residents of the home were not around. Because interviews dealt with potentially sensitive topics, I adopted an approach combining directed storytelling and open-ended interviews. Directed storytelling is a method that employs prompts to encourage people to share stories about their experiences [60]. For example, participants were asked: "Can you tell a story about a time when you removed information that you had posted online?" When integrated into an open-ended interview, this technique can help participants productively engage with and reflect on their past experiences. Furthermore, asking participants to tell stories about their experiences helped establish rapport and lessen their hesitancy to answer personal questions.

The interviews covered a series of topics about the participants' use of digital accounts and networks over time, perceptions of how they present themselves online, experiences managing digital information, and assessments of the lifespan and potential impact of their digital information. Interview sessions lasted between one and two hours and followed an open-ended discussion guide, including questions that covered topics related to how participants identify themselves online, their experiences managing their digital information, and their perceptions about what factors will

influence the longevity of their digital information. Additionally, I created a digital accounts inventory for participants to fill out at the beginning of the sessions. This inventory (*fig. 19*) had three sections: (1) an elicitation of a list of the websites and accounts participants used for everyday activities (e.g., messaging, banking, and listening to music), (2) questions prompting participants to assign superlatives to valuable, private, or significant accounts, and (3) an elicitation of what accounts and services were connected to their social networks. This inventory was not intended to be comprehensive, nor was it used directly in the analysis. Instead, it was designed to provoke participants to consider and reflect on the breadth of digital services they have used over many years. This activity served as a starting point for discussions about the ways in which participants construct and perceive of the boundaries surrounding and among their online identities.

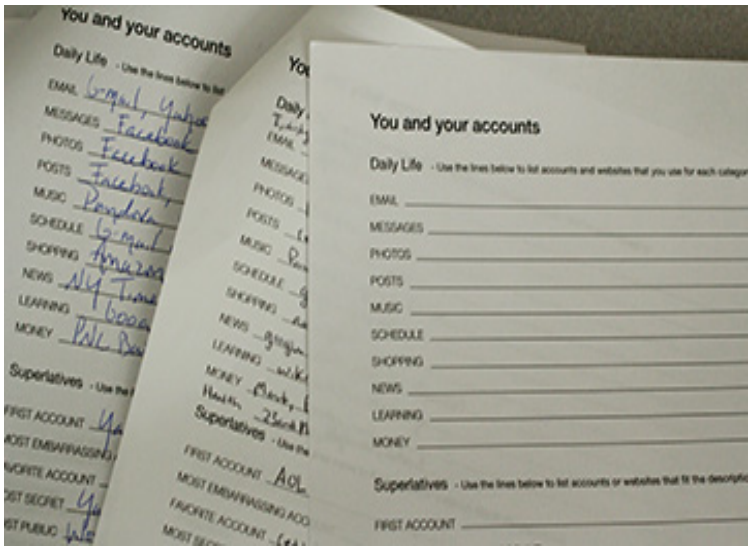


Figure 19: The digital accounts inventories used in the study.

Findings

All of the study sessions were audio recorded. I transcribed the recordings from the study sessions and then began a process of open coding by reading through each transcript and developing codes to reflect the information participants had shared. After coding all of the transcripts, I developed a set of higher-level categories for these codes that clustered them across different topic areas. Connections between these higher-level categories were used to generate the findings presented in this chapter.

The interviews and digital accounts inventories revealed a range of online accounts utilized by participants to manage different aspects of their lives online. All participants used computers on a daily or weekly basis and all had a web history of some kind. All participants had used websites in which personal information was collected, such as Facebook or Yahoo Mail. Some, particularly the four youngest participants, were web savvy, though an approximately equal number of participants used their computers in less sophisticated ways — primarily as a portal for sending and receiving email. Several websites — such as Facebook, YouTube, Gmail, Yahoo, and reddit — were well represented across participants. I also asked participants to describe two types of accounts: those that they were embarrassed by and those that they kept secret. This category was largely comprised of accounts on dating websites, email, forum, and chat accounts that were deliberately created as secret accounts, and accounts on blogging websites.

Outside of these major services, there were a number of individual differences between the accounts that each participant reported using, which help illustrate the diversity of the participants' online lives. For example, while one participant described a number of meaningful accounts that were linked to his interest in music and his performances, another participant used online services primarily as a means to find employment.

These findings, which are presented in depth in the following paragraphs, revealed nuances regarding how shifting notions about technological systems and the long-term accessibility of digital information impact the ways in which we share and subsequently manage information online.

Identity Management in the Context of Digital Legacy

Engagement with Real Name and Active Identities

While identity construction and information sharing online [39, 137] are well documented in prior literature, these findings examine and reflect upon how these phenomena might shape one's personal digital legacy. All of the participants described ways in which meaningful aspects of their life were not captured or shared online. Additionally, because of the trend towards connecting with people using real-name identities, there was apprehension about sharing information that might have broad-reaching or long-term impacts. I was interested in this topic as it may have significant influence on how a person's life is interpreted by future generations. As people increasingly use digital platforms to share, record, and archive information, it is imperative that we reflect on how gaps in one's digital information may influence how that person is remembered.

Participants described diverse and individually significant aspects of their lives that were not readily knowable or recordable by digital systems, making them underrepresented on digital platforms. Examples provided by participants included key components of one's personality, communication between family, close friends, partners, and spouses, and the day-to-day reality of one's life. P2, explaining his assessment that his digital accounts represented only a small portion of the information about his everyday life, said: *"Like, I'm not trying to say that you'd only get a 3% picture of who I am, but like, probably much less than that, probably less than half a percent, less than a tenth of a percent. It's kind of hard to, someone's inner monologue only occasionally escapes and ends up as a comment somewhere...."*

These participants confirmed that, to a large extent, information that was not being captured through digital services was not being recorded elsewhere such as in a journal. Of course, some of this uncaptured information is represented by means other than formal physical records or readily accessible digital records. For example, a couple might not have a strong digital footprint for the details of their relationship but might have accumulated many physical mementos that reflect their life together. Similarly, a deeper analysis of aspects of one's digital life, such as a person's connections on social networks, could also help future generations develop a better picture of one's close relationships. Clearly, the tools and mechanisms that are developed to curate people's digital lives for long-term archiving would benefit from the ability to better understand and harness the potential of their digital records.

Beyond the incidental gaps that result from the nature of one's relationship with their friends and family, there were also many examples of people who purposefully withheld information because of concerns about self-presentation. Ten of fourteen participants expressed concerns about the risks of using digital systems to share provocative or potentially harmful opinions. Talking about how his role as a semi-public political figure had influenced what he shares online, P4 remarked: *"I mean I, now that I'm involved with city council, ...I try to be careful about how I present myself publicly. Which is very hard for me, because I kind of like, I can't remember what it was but I came up with a joke earlier today that was*

hilarious but completely inappropriate. I wanted to badly to publish it but I was like 'I can't let that reflect on the [people] I work for and stuff like that.'" Consequently, these provocative, personal, and often-revealing aspects of a person's life were shared in accounts and spaces that are more difficult to connect back to that person. In so doing, they were effectively removed from the publicly available or easily accessed information about that person.

Clearly, these gaps and omissions could have a major impact on how a person is remembered. The sharing of content online has created a series of practices that make it difficult for people to express and record viewpoints that they are afraid will reflect poorly on themselves, and which may lead them to be ostracized by others in their social networks. Despite the risks of sharing this type of information, viewpoints, interactions, and information contradicting commonly held beliefs about what is 'acceptable' or 'right' might be a telling and valuable piece of information as future generations look back on one's life, especially as viewpoints on issues change over time.

Abandoned, Private, and Deleted Identities

All of the participants described having accounts that were once prominent but had since been abandoned or fallen into disuse. Though some of these abandoned accounts were later deleted or deactivated, in all cases, the abandonment and the loss of digital information had an impact on the types of information available in one's digital records as it can negatively impact the accessibility and availability of some part of those records.

Identity presentation online is complicated by the ways in which both a person's pre-existing digital records and the systems through which they share digital information influence how they are perceived. In some cases, a person's digital records play a meaningful role in their ability to participate and contribute to an online network. That is, when available to other users, these records can impact both how a person will behave and how others perceive him. As expected, many participants had taken steps to distance themselves from accounts that might cast an unfavorable light over their present-day interactions online and offline. Though offline interactions are subject to the same influences of older interactions, this is of particular concern with digital systems because of the uncertainty regarding the accessibility and context of digital records and information.

Eight of fourteen participants described the abandonment or deletion of an established online account, which was typically because the account no longer reflected how they wanted to represent themselves either online or offline. P7 described having developed a blogging persona through which she wrote about a difficult year she experienced both personally and professionally. She continued to use this blog until she felt that it was no longer representative of her: "*things are starting to go better with like job and love life and things. I don't feel like I need it anymore."* In a similar vein, P14 described his embarrassment about an account he used as a teenager: *"Which I think is exactly what I'd see if I looked at my old chat logs, [that] I was dumb or I was vulgar, or something"* but noted that he was not alone in having felt embarrassed by accounts created when he was young. In both of these cases, participants chose not to delete these accounts. Instead, they distanced themselves from the information, while the accounts continued to persist online. In both cases, the participants were still able to access the information but were not sure about how long they would allow that information to stay online nor how possible it would be to completely distance themselves from it.

Similarly, five participants described having created accounts in response to major life events — such as moving to a new city, looking for a new job, or a health crisis — which eventually fell into disuse. P6, reflecting on the chat account she created after a vocal chord surgery said: "*I had a really big surgery in 2009 and I was laid up and my vocal chords after the surgery were paralyzed and I couldn't*

speak to anybody. … someone said, 'You should just go in a chat room and type away.' And that was how it started." During this period in her life, the account provided an outlet for her to connect with others. However, once her speech was restored, it was subsequently abandoned and was later lost completely when Yahoo shut down their chat service.

These types of accounts are idiosyncratic, but highlight how abandoned identities can be valuable resources as a snapshot of a particular time in one's life. However, almost none of the participants retained the ability to access these types of accounts, either because they have forgotten their login information or usernames, or because they deleted the accounts when they no longer served a purpose. For the accounts that were not deleted, the abandonment of those identities makes it uncertain whether the information held therein might be accessible in the future and whether it will be possible to connect that information back to a person's more prominent accounts and identities.

Systems and the Accessibility of Digital Information

Systems as Unseen Partners

When asked to reflect on the lifespan of their digital information, participants described how the systems and service providers that hold their digital information have a large influence over whether that information remains accessible over time. One result of this perception was that nearly all participants found it difficult to assess how long their digital information would be available online. In some cases, this ambiguity was a result of past experiences using services that had faded from popularity or had been shut down: *"Like how long is Facebook really going to be popular? …Or is it going to be like MySpace, where these are just sitting out there and no one uses them. Or even the blog, how long will it be sitting there. Forever? I don't know."* – P7. In another example, P6 described her expectations about the lifespan of her digital information: *"I'm assuming [my information will be available] forever unless Facebook shuts down. I wrote a letter to the editor in the 80s and its still on there... [I think] that it'll be on there forever and when I'm long gone dead buried and ashes there will be some reminder that I was here."* Uncertainty related to the lifespan of digital information is a critical issue in two regards: how people weigh the potential consequences of sharing personal information online and whether the information they have shared will be available to future generations.

It was clear from these conversations that many participants did not feel as though they were the primary agent in deciding how long their digital information would be available online. Participants questioned the motivations for services like Facebook and Gmail to archive a person's digital information: *"Yeah, um, I would think that people [should] have more control over the quality of the archival on their personal archives and formats and the like public stuff you know, how long is Facebook gonna give two shits about somebody's pictures from 2 years ago?"* – P8. Even when discussing options for the safe-keeping and archiving of one's digital information, there was an emphasis on looking for systems that could fulfill the desire to ensure the long term safety of one's records: *"If there was like a digital will, last will and testament or something I would try to make use of it."* – P2. This feeling of disempowerment and dependence on digital systems also pervaded conversations about the difficulty of managing undesirable information that was available online: *"[I didn't] like finding things about me on Google, but it's not removable."* – P1. Conversely, several participants described having had accounts that were shut down by a third party, such as college and work email accounts. These are immensely important considerations regarding how people conceptualize the role that systems play in the maintenance of digital records.

Systems as Generators of Digital Debris

The internet also exerts a strong influence on one's digital records through the proliferation of services and contexts that necessitate the creation of new user accounts. There are extensive amounts

of both (1) systems that, for reasons related to identity presentation, drive people to create additional accounts to express potentially damaging information, and (2) systems that require users to create a new account to access their service. On reddit, for example, it is common to create an anonymous "throwaway account" in order to share private or potentially damaging information. As P12 observed, *"There's things sometimes you're signing up for, [and think] this should be a throwaway account. This is the browser game for command and conquer, this is only going to be interesting for 24 hours."* This was emphasized when, during the interviews, almost every participant asked to make additions to their digital accounts inventory after remembering an account they had forgotten to include. Systems that encourage the creation of throwaway or temporary accounts represent a significant challenge for users as they try to conceptualize where their digital information is located and who has access to that information.

Systems as Mediators of Digital Identities

Norms about sharing and identity online have shifted over time. Previously, it was common for people to employ a pseudonym as their primary identity online. P13, describing a long-held username: *"It's nice, it could probably easily get traced back to me but it's nice to have some degree of anonymity and removal from [my real name], I find it, it's kind of intriguing."* Today, many services like Gmail and Facebook require users to provide their real name and share information under that name. Though these policies are difficult to enforce, they have shaped norms about how people identify themselves. In this way, these policies are part of a larger trend I observed in which people tended to move away from utilizing primarily anonymous accounts online towards establishing a real-name online presence.

While thirteen participants reported utilizing pseudonymity or anonymity to share some information online, all of them described having their real names associated with accounts such as Facebook and email. These accounts were the primary ways in which they shared information online. Seven participants talked about the professional importance of maintaining a curated, real-name identity online. As there are significant differences in the types of content people are comfortable sharing with anchored, pseudonymous, and anonymous networks, this shift significantly shaped how participants create, utilize, and manage their digital identities.

Technological shifts also play a major role in the abandonment or deletion of digital accounts. In some cases, this is due to identity presentation – people did not want to be associated with an old or unfashionable technology. P7 described this feeling: *"I used to use Yahoo as my main account, but now everyone uses Gmail."* In other cases, shifting from one system to another was a response to new technologies providing a better service to users. Four participants explicitly described having switched to a new digital account because it offered better features or a better experience. Though users expressed feeling a strong connection to particular user names or accounts, the experience of interacting with a digital service can have a strong influence on a person's decision to maintain or abandon that service.

Legacy Making with Digital Information

In the final portion of the interview sessions, participants were asked to prospectively reflect on their long-term plans for the management of their digital records. These discussions surfaced their impressions about what, of their large quantities of digital information, might be worth saving, archiving, or passing on to future generations. It also touched on how participants perceived the differences between the lifespans of their public and private information.

Building on Existing Practices

When asked to think about what digital information might be worth saving, it was common for participants to frame their answers in terms of current practices regarding the bequeathing of one's physical things. Participants spoke often of the desire to save correspondences, such as through email and forums, drawing analogies to physical records and media. P2, describing whether he'd like to save his digital information, said: *"I mean, people read their parents letters to each other, to other people and know who they were. I'd say it's important to me." P4 used similar language when describing posts he'd made to a forum: "A lot of people kept their correspondence in the [time] previous to this time, when people actually wrote letters to each other. I mean those [posts] were essentially like, some of those were like short letters."* Given uncertainty regarding how digital information might play into one's legacy, it follows that participants might look at established practices to make predictions about what might be valuable. In addition, this focus on personal correspondences points to areas of one's digital life that might merit additional consideration with regards to archiving.

Information Accessibility

Thinking more broadly about the implication of one's digital records, participants described what information they would like people to have access to and how their digital records might play into that desire. On one extreme, P6 was strongly opposed to the idea that anyone might have access to her records after she'd passed away*: "I don't want anyone in my digital stuff. Not in my underwear drawers, nothing. It's a weird thing."* She felt that enabling others to access her digital records would be a violation of her privacy. Though she was the only participant who was wholly opposed to this concept, numerous participants described the ways in which they hoped their digital records provide a curated or filtered view of their life. P5, describing his hope for the lifespan of his digital information, said: *"…if I regret something, I don't want to keep it as long."* However, as described in a prior section, participants were quick to note that they might not have control over the lifespan of their digital information.

Speculation about the future

As many participants described having abandoned, deleted, or edited older online identities, I was interested in their perception of how the ways in which they present themselves online might change in the future. Participants were asked to speculate about the types of changes they might make to their digital records as they got older. This inquiry yielded a diverse collection of responses that generally fell into one of two categories: (1) the belief that one's digital records would evolve over time in response to changes in one's life, changes to the technology that they use, and a desire to organize one's digital information; and (2) the belief that the highly curated nature of one's digital records lessens the need to deliberately make major adjustments to those records. However, in both cases, there was clear uncertainty, particularly when discussions were framed in the larger set of curatorial behaviors and actions that had already been undertaken by participants with regards to their digital records and accounts. In short, it was difficult for participants to pinpoint any particular predictions about their future interactions through and with their current digital identities.

Design Implications and Opportunities

The creation of a legacy is a complex process, and the rapid growth of technology is increasingly intersecting with it in profound ways. A key contribution of this study is to provide insights into how the range of digital information about people's identities that proliferates on the internet might influence how their lives are interpreted and reflected upon by their families and future generations.

It is clear that users struggle to manage their digital information, that one's digital information can provide a distorted representation of that person's life and values, that systems themselves play a large

role in the lifespan of the information they contain, and that users are uncertain about how to conceptualize the role that digital information might play in how they are remembered. Based on these findings, I describe a number of systems, interventions, and augmentations of existing practices that begin to address the need for more thoughtful engagement with how people's digital records will serve as a part of a meaningful legacy left for future generations.

In the section that follows, I identify opportunity areas related to legacy making and digital systems. Inspired by the work of Sas and Whittaker [124], the ideas put forth there are not intended to be prescriptive. Instead, they are written to highlight and reflect upon the complexity of how both users and systems are engaged in the long-term management of one's digital information. The first – *cross service identity curation* – focuses on the opportunities and challenges associated with developing services that can help users manage disparate pieces of digital information. The next – *capturing, revealing, and cleaning digital debris* – discusses the creation of systems and practices that help people engage with the dispossession of digital things. Finally, the third opportunity area – *supporting cultural legacy making* – examines the potential societal value of maintaining and analyzing large collections of digital records.

Cross Service Identity Curation

Within the larger collection of information a person has shared online, there are identities, spaces, and networks that can serve as valuable representations of notable periods in their life. Currently, the information held in these kinds of digital identities is lost when a person's use of that identity ceases. After an account is no longer in use, there is currently no widely established cross-service mechanism for users to archive the information held within or to maintain access to that information over time. As a result, a substantial amount of a person's digital history is lost, either because she or he can no longer find or access the information, or because the system itself has been shut down by a service provider.

There is, however, clear value associated with holding on to some of a person's digital information as a way of gathering pieces of information that tell a story about a person's life. Similar to emerging critiques of the life logging perspective [127] I am not arguing for all-encompassing life-archiving systems that mystically pull together all of the aspects of a person's online life. It is difficult to anticipate what exact accounts and digital representations of a person will be meaningful for future generations. However, there is clear exigence for the development of systems, both digital and physical, that enable users to curate, elevate, and archive digital systems that played a meaningful role in how they interacted with others online, how they shaped their identity, and that are imbued with the experiences of particular life stages. These types of systems could also have value as a tool that exposes users to the idea that their digital information may have an impact on how they are remembered.

In addition to providing a space that supports this curatorial process, new systems could be designed that implicitly advocate for the value of the information and virtual possessions kept in one's digital accounts. In comparison with the physical practices and artifacts surrounding the representation and curation of one's legacy, people have not fully integrated digital information into their conceptualization of what they will leave behind to future generations. These findings illustrate that it is not yet common for people to think about the long term, legacy-oriented implications of their digital information (except for limited cases related to financial digital information). We are at the outset of these practices, which suggests a clear opportunity for designing new interactive systems that are aimed at better fostering the creation of expressive and meaningful digital legacies.

However, it is essential to critically consider potential unintended consequences bound to this emerging design space. New systems and tools could enable the creation of more valued and interwoven digital legacies, but they would necessarily make connections among previously disjointed areas of digital information. This could expose users to identity theft and cause breaches between established online networks and identities. In addition, this may threaten the use of truly anonymous accounts.

Capturing, Revealing, and Cleaning Digital Debris

Correspondingly, there is a need for further mechanisms that enable people to divest themselves of digital debris. I refer here to information and identities that are the by-product of contemporary internet use. As described by participants, these include accounts that users were forced to create in order to access a website (but that were abandoned almost immediately thereafter), information collected about a user without their knowledge, and accounts that are made to share some limited or relatively meaningless piece of information.

In this case, I propose two complementary strategies. First, there is an opportunity to support practices that reduce the amount of digital debris that is created. As an example, a potential avenue for this is to advocate for the utilization of generic, empty accounts that a person can use in lieu of creating new, meaningless accounts. In practice, savvy internet users can already find websites to which people have submitted account names and passwords that they can use for themselves, most commonly when accessing content held behind a pay wall. However, these practices are not widely known and numerous legal and ethical issues are tied to their use. Increasing numbers of websites now also allow users login access by virtue of their Facebook or Google account. While these authorized logins prevent the need to create new accounts, they may also expose a user's data to third parties. As a result, there is an opportunity to create systems that enable people to have greater agency in deciding where and when they share personal information online. Additionally, there may be value in systems that advocate for the use of pseudonyms to limit the exposure of personal information. Such systems could productively aid in reducing the scattering and fragmentation of a person's digital information [107].

There is also the opportunity to capture and address digital debris after it has been generated, an initiative that could take many forms. One such example would be to create a database of instructions to help users navigate the process of shutting down unwanted accounts. Another is to create a system that could automate the process of revealing one's unused or abandoned accounts, and providing both technical and emotional support for deleting or deactivating those accounts. Nonetheless, the development of such systems is complicated by the idea that users may not be able to predict what digital accounts might be valuable in the future and what they might lose by deleting particular pieces of digital information.

Supporting Cultural Legacy Making

Finally, in addition to the meaningful domain of personal and familial legacy, there is an opportunity to reflect on how digital information might be integrated into broader concepts like the heritage or legacy of an entire culture. The promise of enduring and widespread accessibility of digital platforms makes the digital realm an attractive option for the preservation of both physical and digital cultural artifacts and information [1, 62]. However, as noted by Friedman and Nathan, the preservation of digital information is a complex issue fraught with challenges that stem from uncertainty regarding the long-term ownership and management of digital information [45].

Beyond structured preservation projects being undertaken by cultural institutions like museums and libraries, I argue that digital information and systems could also contribute to a body of cultural knowledge by: (a) allowing individuals, rather than institutions, to construct and share their own interpretations of things of cultural value, and (b) providing a way to retroactively capture and organize information about people, events, or artifacts of cultural importance. Building on growing digital literacy and access, digital systems provide a powerful medium for individuals to advocate for their perspective on what matters in their culture and what should ultimately become that culture's legacy. These efforts are, of course, subject to similar concerns regarding the role of systems and users in the preservation of that information. But, nonetheless, they highlight the opportunity to create systems that grapple with questions of ownership while also enabling individuals to be actively engaged in the process of identifying and sharing information of cultural significance.

Conclusion

In this chapter, I investigated how the increasing proliferation of online accounts and personal content are shaping people's identity practices online and how those practices might shape the digital legacies left behind. I identified findings and design opportunities about online information, including digital records outside of one's active, real-name identities and examined how those might be seen through the lens of digital legacy. I considered the potential benefits and dangers of designing new technologies intended to better enable people to reflect on their digital identities during various life stages and to play a more central role in constructing their digital legacies. Fieldwork presented complications participants faced when coming to terms with their online digital records, practices developed to navigate these tensions, and issues that remain unresolved.

These findings highlight the ways in which people's use of digital systems influences the types of records they generate. It also brings to light questions about how the ability for systems to analyze and interpret people's digital information might impact how people look back on their lives and what materials will be available for future generations. Additionally, related work in this area suggests that users think of their digital information in terms of five different categories: high value collections, things that are curated online, collections that emerge through use, content that is intended to be consumed in the moment, and dynamic content [81]. This raises a number of questions about how each of these types of content might play a different role in the process of curating a legacy.

CHAPTER 6: CURATORIAL AGENTS

In the previous chapter, I examined how systems influence the availability of different types of digital media and content and extended those findings to speculate about how that might influence how a person is remembered by future generations. Building on that work, I started the study described in this chapter, which focuses on the capacity for systems to analyze, make judgments about, and create representations of one's digital information. If systems are to play a role in the management of lifetimes or generations worth of digital information, it is important to consider how those systems might shape how people see, interpret, and contextualize that information.

I explored these issues and focused on the implications of the developing capabilities for digital systems to analyze and make judgments about the information that they capture. This work placed special emphasis on how these types of systems, and the questions they elicit about user and system agency, intersect with concerns about the management of long-term collections of heterogeneous digital data. Drawing methodologically from technology probes [69] and reflective design [127] I developed four interactive systems to provoke discussions with participants about the role that both systems and people play in the process of curating and deriving meaning from digital records that are diverse with regards to their source, temporal context, and meaning.

Through sessions with 12 adults from Pittsburgh, PA, I utilized these systems to investigate how digital systems might make sense of unwieldy, diverse collections of digital information. In addition, this work explored the complex nature of how people feel about digital systems interpreting and making judgments using their digital information. The findings from this work exposed nuances regarding the discrepancies between system and human memory, the ability for systems to act as mediators for personal digital content passed down to future generations, the ways in which people sometimes use personalization systems to reflect on their own identities, and the opportunity to use metadata as a way to engage people in thinking deeply about what information is captured by digital systems. Based on these findings, this work put forth a collection of design recommendations for the creation of systems that enable more meaningful interactions with heterogeneous digital records.

Background and Motivation

Managing digital information is a well-documented problem; it is far easier to generate information than it is to make sense of it or to derive meaning from it. Though it is clear that people value some of the digital information and media they create through their interactions with digital systems [13, 88], it is less clear how to identify significant pieces of that information and how to make sense of vast, heterogeneous archives. Prior research has studied relationships with physical objects, and existing practices with digital content, to better understand how users and systems might work together to identify that which is meaningful [105, 115]. However, the idiosyncratic, fragmented nature of people's digital records and their management strategies makes it difficult to develop prescriptive solutions [70, 72].

Looking forward, managing digital archives may be further complicated by the integration of records that span years, generations, and owners. The prevalence of digital media and information has already begun to uncover questions about how they might be integrated into existing practices related to death and dying [90] and whether they will hold value to future generations [57]. More broadly, there may be cultural and societal value in building systems that can archive and derive meaning from multigenerational records [45]. As such, it is worthwhile to explore how records that span generations might be integrated into the experiences of those left behind, even many years into the future. If

people's digital records are to endure past their lifetimes, considering how people will make use of or contribute to those records in their own lives becomes significant.

Defining the Design Space

In order to explore these research questions, I set out to develop a set of provocative, interactive systems to use as probes during the study sessions. It was my intention that the probes would serve as a way to provoke and inspire discussion with participants about issues that might otherwise be hard to imagine or articulate. Methodologically, the approach for the development, orientation, and use of these systems draws from reflective design [127], technology probes [69], and user enactments [104]. That is, building the probes for this study provided me with an opportunity to examine my own understanding of these concepts and also provided participants with a way to experience systems operating in a way that represented potential options for how systems might operate in the future.

The starting point for this work was to explore how metadata could be used as a design material. Metadata is the information that describes, annotates, or adds onto digital data [55] and plays a central role in how systems capture, analyze, and represent user behavior. Though there is a fluid relationship between what is referred to as 'data' and that which is described as 'metadata', in this work I was centrally interested in metadata as a way to examine the relationship between digital systems and the people that use them. As such, I was concerned with two categories of metadata: (1) person-generated metadata, such as comments on a Facebook post, and (2) system-generated metadata, such as the number of times a song has been played. Metadata is one of the main sources of information that systems capture about users and leverage to make decisions about what information to share with those users. However, the degree to which users are aware of having contributed this data greatly influences how they perceive system actions.

Building from this focus on metadata, I set out to select design dimensions that would offer a perspective on different ideas related to systems making use of one's data. The dimensions I selected were topic , or the nature of the content captured and represented by the system, generativity, or the extent to which the system generates novel representations of a user's content, agency, or the extent to which the user and system have input in the operation of the system and time, described both how the information was presented to users and the timespan of the records used by the system. These dimensions were chosen based on the goals for the study and on prior work in this area [57, 58, 161] which highlighted issues and opportunities for meaningful reflection with digital information. These dimensions were also drawn from related work in personalization [6], legacy making [142], and slow technology [102] and are described in depth below.

Topic

The first dimension was the topic of the information held by the system. Existing systems created to help people reflect on their digital information are often not designed in a way that expresses or embraces individual variations in the meaning of that information. I selected topics that reflect aspects of a person's life that are often represented by digital data, such as familial relationships, exploring both new and familiar places, and shared experiences.

Generativity

The second dimension was generativity, or the extent to which the system generated novel presentations using existing data and metadata. Though each of the probes generates new representations of content to some degree, I was interested in exploring how users perceive the

differences between systems that generate new ways of looking at existing digital information and those that more faithfully represent a user's digital content.

Agency

The third dimension was agency, or how the user and the system each influence the selection and representation of information. This dimension was, in some cases, built into the ways that the participant could interact with the system. In addition, for each system, participants were presented with a number of scenarios about how it would work, varying the degree to which the people could exercise agency about capturing and sharing the information held therein.

Time

The fourth dimension was time. This dimension is represented in the systems through several variations, most saliently through a decision about when the content is presented to users and the time periods represented by that content. In addition, the systems were designed to elicit conversations about how the information embodied therein might impact the remembrance of someone's life and how that information might evolve in meaning over time.

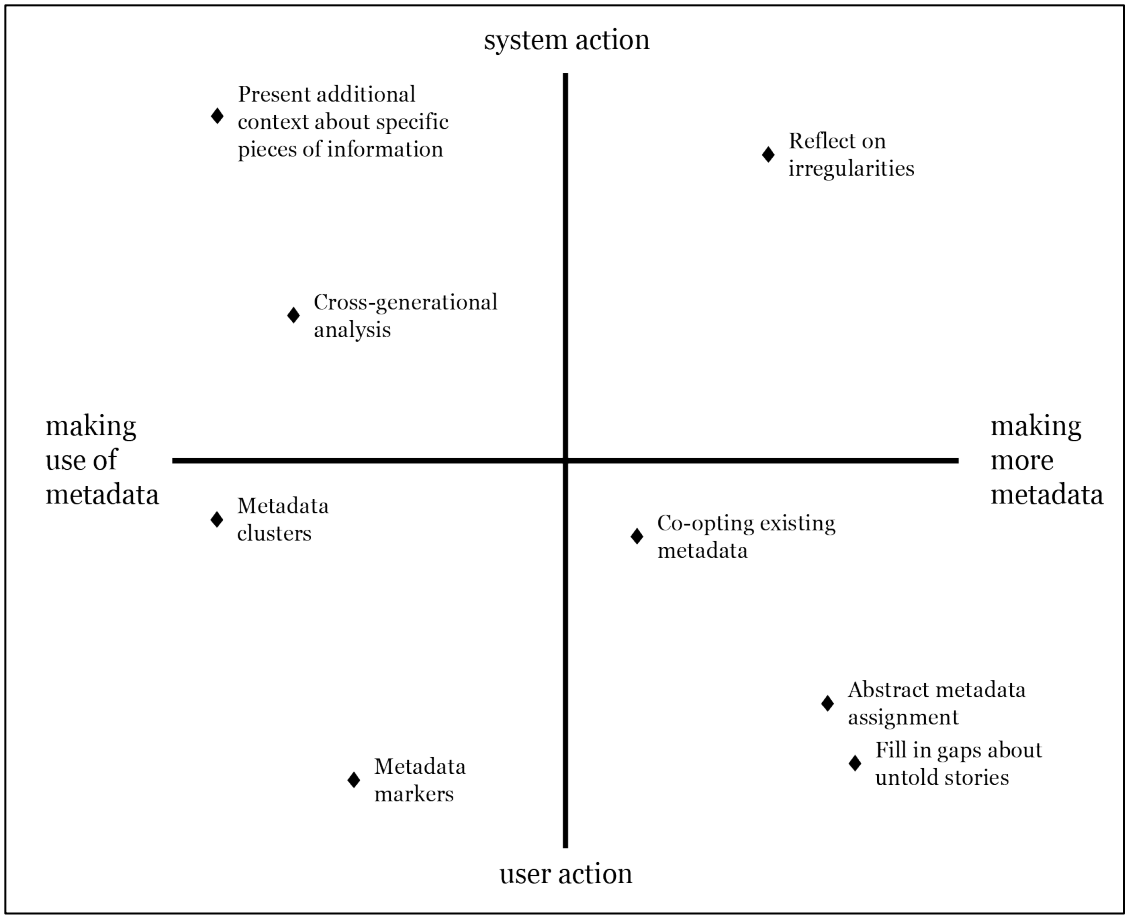


Figure 20: Plotting agency and generativity for metadata-based systems.

Given these constraints, I brainstormed a number of concepts. In order to decide what ideas to build into systems, I analyzed the concepts and their potential to stimulate meaningful discourse about how curatorial systems influence the legacy a person might leave behind. This process was documented in

a number of ways, as seen in Figures 20 and 21. Figure 20 is a matrix in which I plotted the concepts according to (1) the degree to which they are driven by users or systems and (2) the extent to which a system would interpret the information before showing it to a user. I used this process to ensure that the systems would allow me to explore how each of these key ideas – topic, generativity, agency, and time, influence the larger questions about how people perceive the role and implications of personalization systems in the context of one's legacy.

After considering how each of my concepts mapped to the goals of this work and to existing literature, I chose to move forward with four ideas – a system that looks for patterns in one's email to highlight potentially meaningful threads, a system that integrates multigenerational information into one's daily life, a system that integrates private and public information to supplements one's knowledge about their own activities and interests, and a system that attempts to collate diverse threads of data into a single record. Figure 21 depicts how each of these ideas was connected to the four design dimensions.

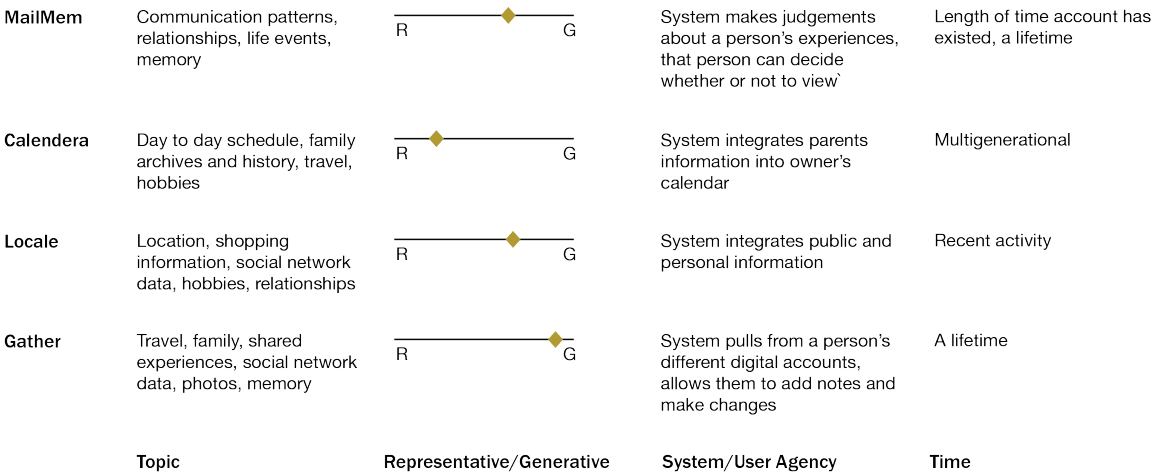


Figure 21: A table depicting how each of the probes (*MailMem, Calendera, Locale, and Gather)* is connected to the four dimensions (topic, generativity, agency, and time).

System Design

The four systems developed for this project were called *MailMem, Calendera, Locale*, and *Gather*. They were websites, a format that reflects how these services might be used if they were real, working systems. Each was pre-populated with specific information that related to a scenario developed for that system. Though all of the data presented to participants, including emails, familial records, and location data, was fabricated for the study, participants were asked to imagine that the information presented was their own, a technique drawn from design research methods such as user enactments [104].

MailMem

MailMem was an email system that identifies meaningful email threads and then presents them to users in their inbox. This process included an analysis of metadata collected by the system, such as the number of times an email had been viewed, the presence or absence of media, and the number of replies, in addition to a rudimentary, simulated semantic analysis of the content itself. This system was designed to explore people's feelings about the capability for systems to analyze large amounts of data about a person's life and generate it's own assessment of the meaningful aspects of that

information. Figure 22 is an early sketch of this illustration, demonstrating how it might be integrated into one's email service.

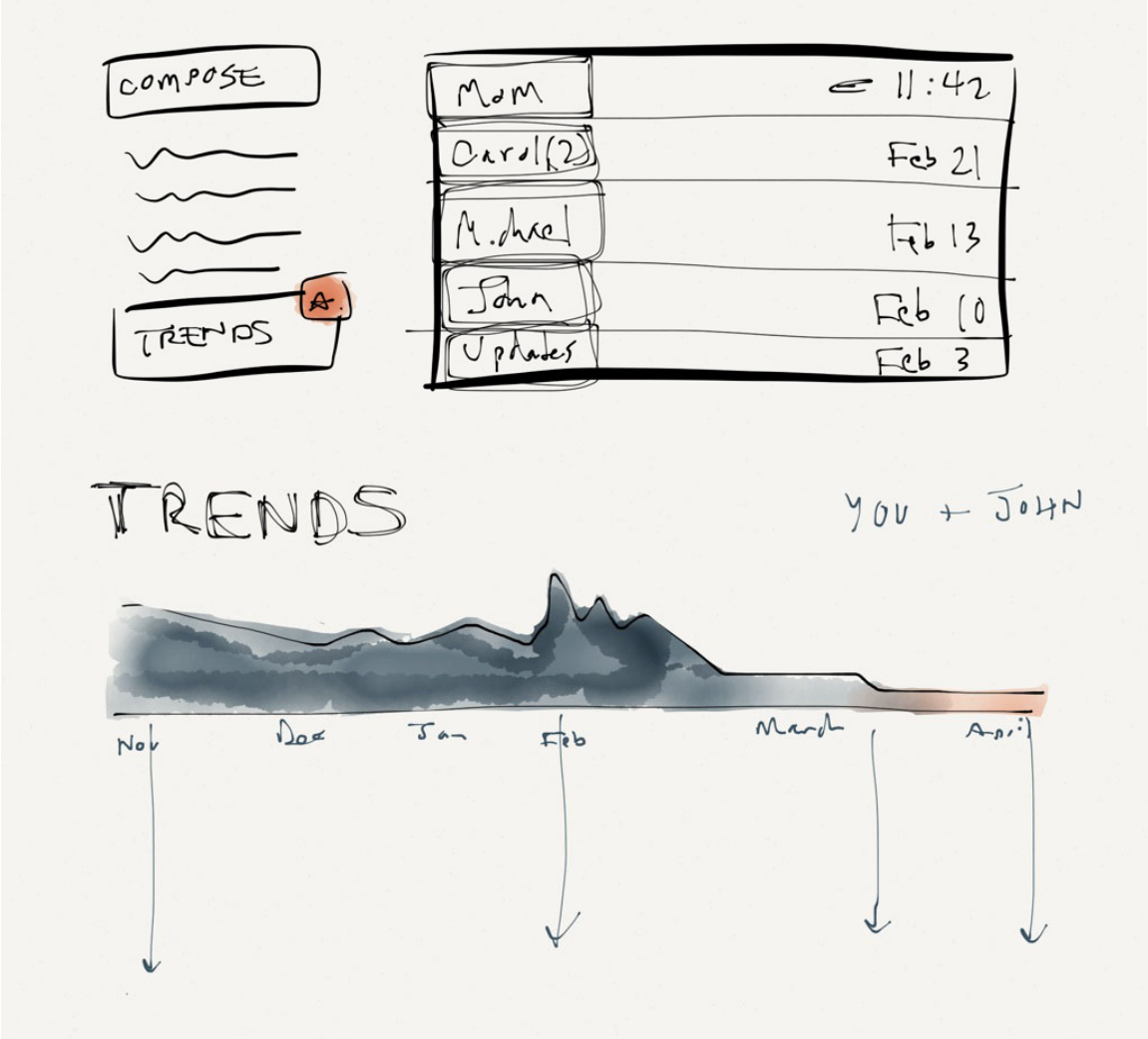


Figure 22: Early, pre-production sketches depicting the analytical abilities of *MailMem*.

For the study sessions, participants were asked to imagine that the system was capable of selecting conversations that it had assessed as being meaningful or unusual. I described how *MailMem* would unpredictably and periodically unearth these conversations and present them to the owner of the inbox, which allowed me to experiment with both time and agency. For the study, participants were presented with a set of conversations marking the end of a relationship. The graph was scaled to reflect the volume of communication between two people and the red lines indicate particular emails being highlighted by the system.

Figure 23: The inbox for the *MailMem* probe.

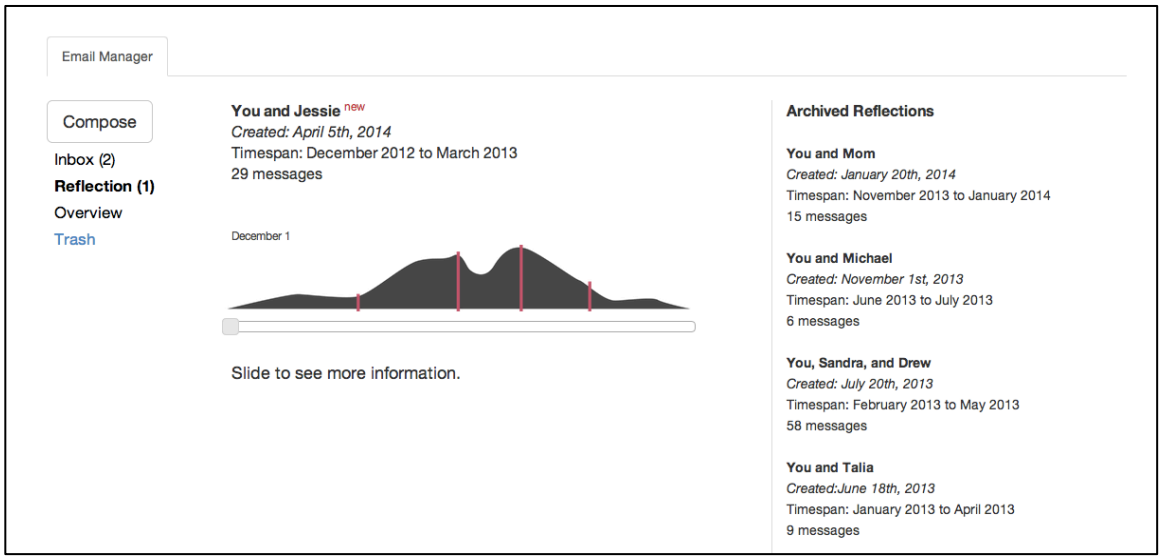


Figure 24: A thread selected by *MailMem* as being meaningful or interesting.

MailMem was positioned to explore how the differences between one's memory of an occurrence and the system's interpretation of that occurrence influence the process by which a person composes a life story or narrative [92]. In addition, this work was partly inspired by prior research exploring how to use email archives as a way to illustrate social connections and to identify interesting content held within [59, 150]. In contrast to these systems, however, the primary goal of MailMem was not to expose participants to information about their social networks or to help them gain a broader understanding of their communication patterns. Instead, this system was designed to provoke conversations about systems using and interpreting information captured through their use. I chose to frame this system around an emotionally charged topic in order to talk with participants about how predictive and adaptive systems might operate given the deeply personal information sometimes held in digital systems.

Calendera

Calendera was a calendar that integrated records from one's forbearers into the user's monthly view of their schedule and was developed to explore how systems might be involved in deriving meaning from multigenerational records. These multigenerational micro-remembrances were signaled using a golden bookmark, pictured in Figure 25. *Calendera* contained three bookmarks, revealing content that was a mixture of public information (such as immigration records) and information that systems could capture but that is likely not publicly available (family photographs, music listening habits).

While these micro-remembrances were integrated into a calendar, this format was used primarily as a tool to introduce the idea of routinely reflecting on digital records from past generations.

Figure 25: *Calendera* with a bookmark showing that there is information available about the owner's family.

During study sessions, participants were asked to imagine that *Calendera* had access to generations of digital records from which it could pull out pieces of information that it identified as interesting or meaningful. For the study, I created three micro-remembrances (*fig. 26*): photographs from a parent's first trip to New York City, publicly available immigration records documenting the user's grandparents' arrival in America, and information about the user's dad's favorite music album.

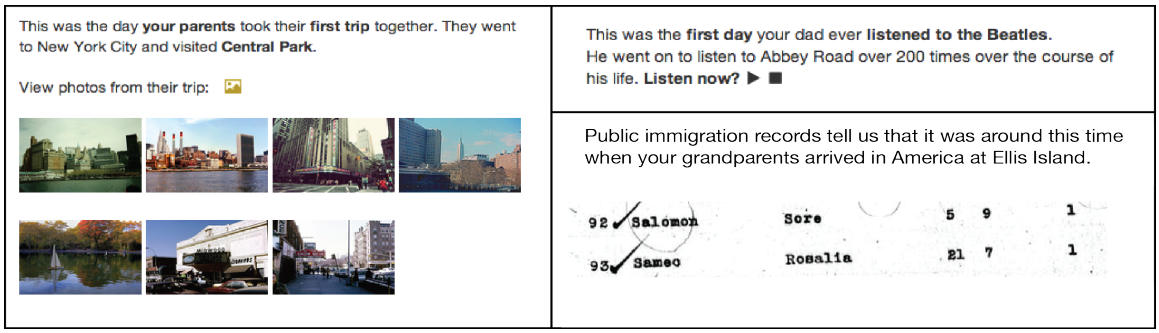


Figure 26: Three micro-remembrances for *Calendera*.

The sketch in Figure 27 illustrates how this system might integrate someone else's content into your everyday life, such as showing a user a set of pictures from their father's birthday across many years. Extending work on everyday reminiscence [33], the goal was to explore how the personal remembrance of a loved one can evolve over time and how being exposed to their digital records might influence the process of reflecting on their life. *Calendera* also provoked speculation about how a system would make judgments about what was meaningful and how the original owner of the content would be involved in the process of passing it on. Additionally, as a variation on the time

dimension, *Calendera* explored how, in the future, digital systems might make use of extant digital content from one's family members.

Figure 27: A sketch depicting the different types of information that Calendera could show to users.

Locale

Locale explored how systems might incorporate contextual information into a person's digital records. It is a map-based system that combined information about where a person has been with information captured from his or her own records and from external, publicly available sources such as Twitter and Facebook. *Locale* (*fig. 28*) displayed a map on which a small number of locations have been highlighted. If a location is clicked, it displayed information about that location, the user's history at that location and, in some cases, external information about that place.

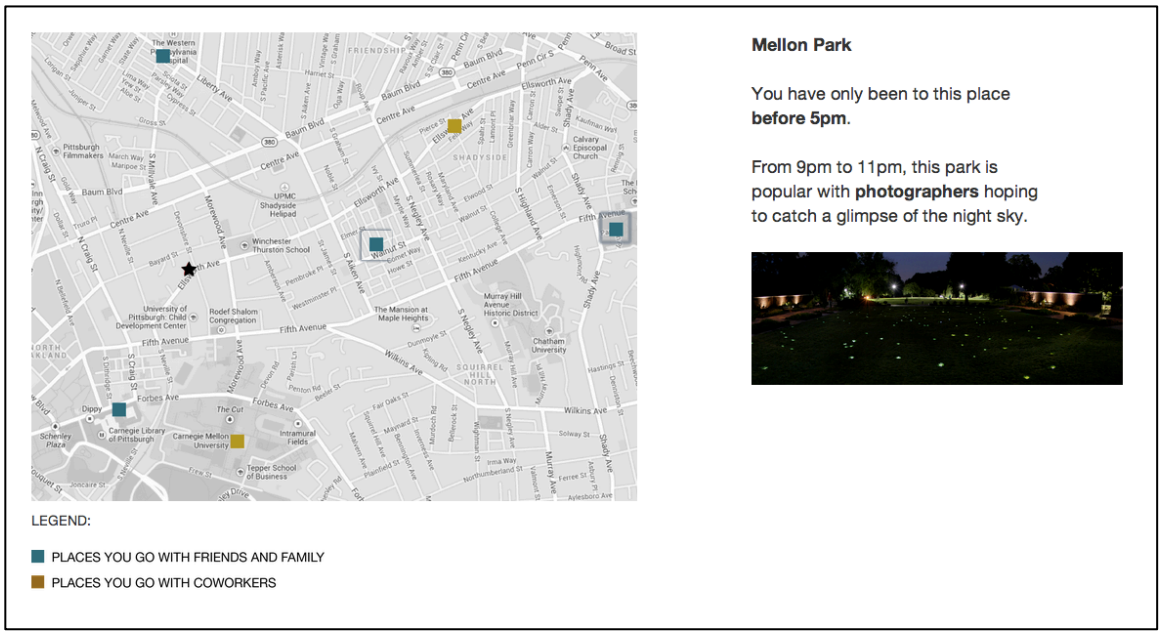


Figure 18: Location information and context in *Locale*.

Participants were asked to imagine that this map, the locations on it, and the information presented to accompany those locations, reflected their own experiences. Given that scenario, I provided them with time to explore the map and each of the pieces of information embedded therein.

Though *Locale* displayed location data, it was not created to explore location-based records and reminiscence. These topics have been explored by prior work [82, 131]. Instead, the goal was to explore how information contributed by a user, and also autonomously by digital systems, might be used to identify meaningful places, events, and experiences from one's past. In addition, I wanted to investigate how people felt about systems acting on their behalf to provide additional context to their experiences and records.

Gather

Gather was developed to investigate how people react to systems creating new representations of their memories and experiences. This system combined heterogeneous information in the form of an assemblage to tell a story about a time in one's life. Assemblages were curated from data captured from a variety of sources tied to the user about whom the assemblages were created.

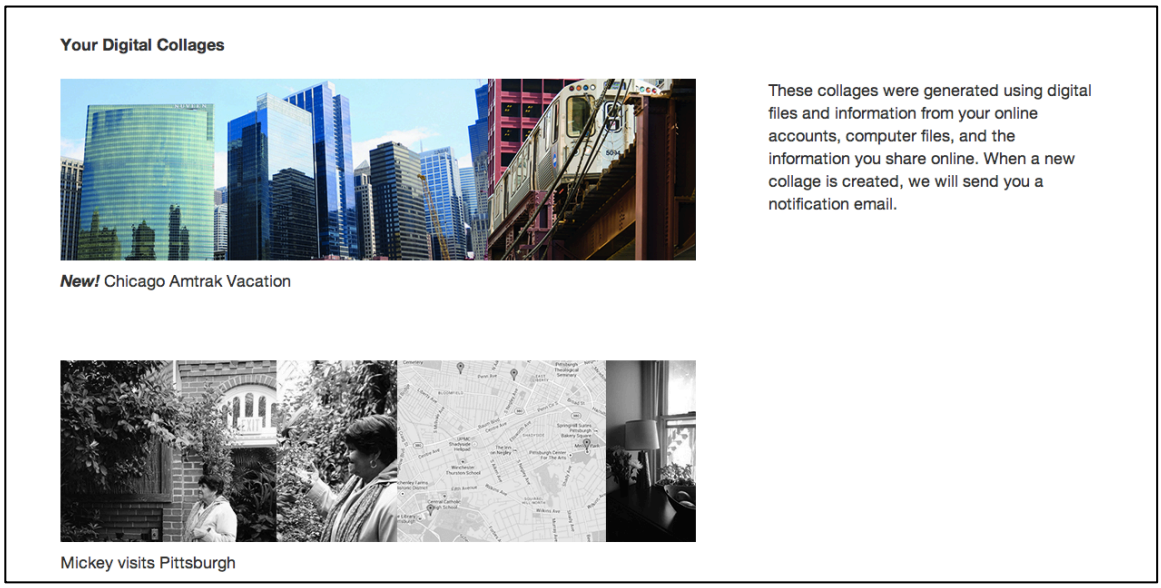


Figure 29: An assemblage from Gather.

I asked participants to explore an assemblage generated for a trip to Chicago. As seen in Figure 29 and Figure 30 the system utilized a number of different types of information for this assemblage including travel records, photographs taken on the trip, credit card expenditures, and location information captured from social network posts. When describing this system to participants, I indicated that the system would do this autonomously, running in the background and revealing these assemblages as it finds, curates, and generates them. Unlike the other systems, *Gather* allowed users to add notes to the system-generated representations.

Building on existing work that explores how digital information and collage can be used for storytelling [46, 162], the goal of *Gather* was to probe participants to think about the potential existence of systems that could autonomously generate new representations of one's experiences. This system was designed to investigate how participants felt about systems generating a representation that might differ from their recollection, or present a new perspective on an event from their past.

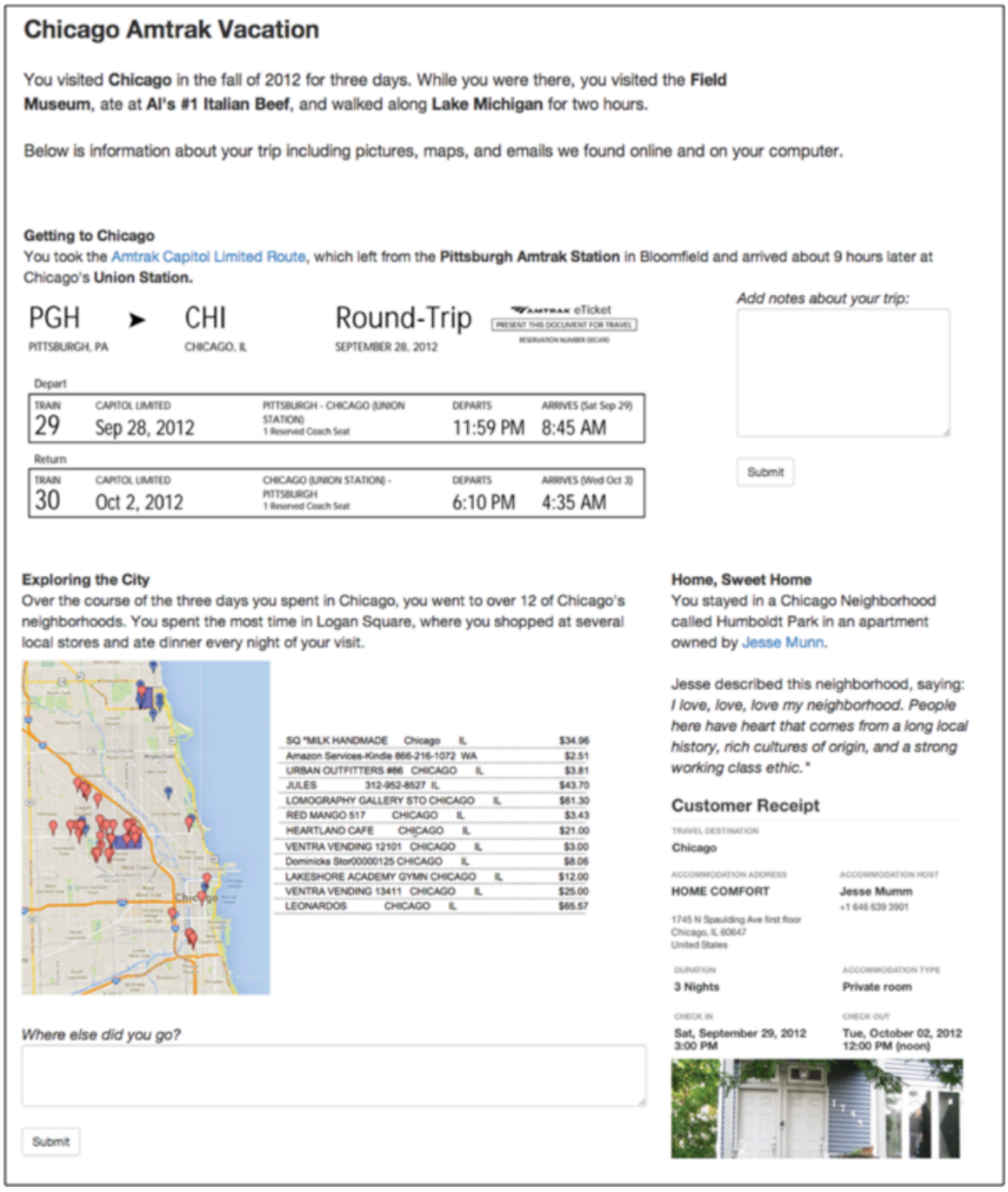


Figure 30: An assemble generated within Gather.

Participants

I recruited twelve participants (6 female and 6 male) from Pittsburgh, Pennsylvania. Participants were recruited using reddit.com, craigslist.com, and a local neighborhood email list. The participants in the study ranged in age from 21 to 85, with an average age of 42 and a standard deviation of 22. Participants held a wide range of occupations: activist, artist, caregiver, graduate student, writer, legal assistant, analyst, and retiree. They had varying levels of technical proficiency; experience levels ranged from people who primarily use the computer for email to people who are highly technical.

Methods

Study sessions took place in a lab on the Carnegie Mellon campus that is styled to look and feel like a contemporary home. It contains a kitchen and a living room separated by a room divider. Upon arriving at the lab, participants took part in an open-ended interview. Interview questions covered participants' assessments of what information was being captured by digital systems; their use of digital systems to deliberately generate digital content and data; the extent to which they engage with personalized services; and their perception of how computers make assessments about their life and experiences.

After the interview was completed, I introduced the participants to the systems one at a time. Participants were asked to think of their interaction with the systems as thought exercises. I made it clear that I did not intend to develop these systems further and that I was not interested in their usability or commercial viability. The interactions were instead framed as an opportunity to deeply consider the implications of the systems themselves. For each, I explained a basic scenario that provided context for the information held in the system and asked participants to imagine that the information therein was their own. I then provided them with as much time as they wanted to explore each system. Afterwards, I asked participants questions and provided them with an opportunity to ask their own questions. On average, sessions lasted about an hour and fifteen minutes and participants were compensated for their time.

Findings

All of the study sessions were audio recorded and subsequently transcribed by me and two students who worked on the project. Using an approach adapted from grounded theory, I read and coded all of the statements made by the study participants. These codes were developed iteratively as I went through the process of coding the data. I then categorized those codes into seven different categories: digital information collection, information organization, personalization, user-system relationships, digital lifespan and ownership, reflections and revisitation, and personal information. In order to generate the findings for this work, I then examined the coded materials to identify meaningful threads that highlighted nuances regarding people's perceptions of the role that personalization systems would play in the representation of their digital content.

Though there were no specific hypotheses that guided this work, I did have a number of general predictions based on existing research work and my own prior work. In the *Digital Artifacts as Legacy* project, participants reacted overwhelmingly negatively to the concepts represented by the probes. I expected participants to react similarly to the probes I'd created for this study due to concerns about how systems might misrepresent their experiences or violate their privacy. I also felt as though the ability to make use of multi-generational information, as is explored by the *Calendera* probe, would be the most compelling use case for participants based on the idea that people might be more interested in learning more about their family history than about aspects of their own behavior.

The findings, as described below, offer unique points of reflection on the design dimensions and on the broader themes embodied in the systems themselves: how systems might be employed to make sense of large, diverse collections of digital information and how people feel about digital systems interpreting and making judgments about that information. In what follows, I outline four themes that emerged from the findings: 1) the influence of digital systems on the process of remembering one's life; 2) perceptions of how systems will act as mediators of personal information across time and generations; 3) the ways in which personalization systems act as a lens through which people can better understand how and when digital systems capture information about them; and 4) the role

that metadata might play in helping people engage with the deliberate and automatic accumulation of digital information.

Memory and Recollection

A focal point of discussions with participants centered on an issue of user and system agency: how a person remembers aspects of their life and how those experiences might be interpreted and represented by digital systems. Highlighting their own agency with regards to their interactions with digital systems, several conversations reflected a sense that while systems have control over the process by which information is collected and curated, the data collected by those systems is the product of a person's decision to engage with digital services like email and social networks. Many of the participants remarked that they expected that systems would soon be able to make more sophisticated judgments with their digital information, based in part on their experiences with existing personalization systems, such as those embedded into Netflix and Amazon.

Nearly all of the participants acknowledged that systems might someday be able to create meaningful representations of their experiences. Though they stated that a system's interpretation of their experiences might differ from their own, they felt that the system representation nevertheless had value. In supporting that idea, several people pointed to the variable nature of human memory and suggested that the information held by systems may be tied to a different reflection of the ground truth of a person's experiences. Reflecting on how *Gather* might be able to support the process of looking back at one's experiences, P9 said, "*Well memory is very, you know, variable and changeable. I think sometimes you remember things one way and that's not the, it's not like you're trying to be weird or whatever you just forget that that's what happened*." Another participant, P5 added to this idea by emphasizing that systems may be able to draw from a wider view of one's experiences that are not based in their immediate context: "*And at a certain time, I don't think we have enough sense of our own history to, I don't think we have a sense that we are living in history enough to make decisions about what's important.*"

This is in line with previous work that suggests that given the scale of the archives people generate, system-selected content has the possibility of being just as meaningful as that which people select themselves[127]. This finding potentially extends that idea to that of system-generated curation and meaning making, and encourages the consideration of how systems might work with people to engage in meaning making with diverse collections of data. Given this finding, we can begin to consider how to develop systems that frame this process in a way that provides users with the ability to participate in the authoring or safekeeping of these representations. Additionally, this finding points to the potential limitations of the idea that a well-designed system must feature an alignment of a user's mental model and the designer's mental model as embodied through the system as it is presented to users [98]. Instead, we can rework that idea to account for adaptive, analytical systems like these, that are being understood and utilized by users in a way that is productive but that may differ from the designer's goal.

This finding about memory and recollection also introduces broader questions related to how people's perceptions of the validity and value of system representations of their experiences may shift if digital, centrally held records become one of the primary ways in which people's lives are remembered. That is, if one's legacy is based in digital records, does that change how they view differences between what they remember and how their experiences are represented by a digital system? P4, drawing from his understanding of human memory as he used *MailMem* said: "*It's insulting. 'Cause most of the time, I forget the things I want to forget on purpose and I remember the things*

the way I want to remember them..." Indeed, the mechanisms by which people forget and remember play a valuable role in how they create a life narrative and craft a legacy.

Systems as Multigenerational Mediators

Interacting with systems that integrated multigenerational records and delayed reflection into everyday systems, like *Calendera and Gather,* allowed participants to reflect on the use of systems to transfer content across generations. There was a great deal of divergence on this topic, stemming in part from the complex nature of people's relationships with their family. As such, this finding highlights how the topic and context of one's memories and experiences may impact the ability for systems to help people engage with those parts of a person's life in a way that is meaningful to them. In addition, this finding points to a number of ways in which time changes how people perceive the value of digital media and information.

Seven of the participants felt as though there was value in a system that could capture and make use of multigenerational information. P1, one of the older participants, described how a digital system might be able to address an issue present in her life – the desire to pass things down to her children and grandchildren at a time when those things would have meaning to them: *"[There] is a time in many people's lives when you've got so many other things going on, information that I give my grandchildren today is not something that is going to be very compelling to them at this point in their lives. But they'll probably say 'oh I wish I [remembered] that.' So if there is [a] way of retaining that over a period of time without having stacks of paper that they might not even be able to access."* In this way, systems can support, and perhaps enrich, the process of crafting a legacy by leveraging their inherent ability to archive information.

P6, reflecting on Calendera, described these concerns from the perspective of the receiver of an older family member's records: "There are times I am rather upset of myself for not taking advantage of what was available, i.e. my grandfather. My mom's dad came from Poland. I should've sat down with that man some time and said, 'Grandpa, tell me about Poland. Tell me what you did'. But because the age where you are, on a timeline, I go to school, I go out with friends, at that age was appropriate, as opposed to stop, and talk to my grandfather." These comments show that these types of systems may influence the perception of the value of records and how they are utilized and understood across one's life.

Six participants noted that there is some inherent strangeness associated with utilizing digital systems to communicate information between loved ones. Several participants felt uncomfortable with the idea that any system would engage in unsolicited curation of information related to their family life. P5, projecting into the future, described his reservations: "*I guess I would want to tell my kid [things] that I would want them to know. I wouldn't want the computer to like slurp something out of my email, you know. But I would want to say – 'Oh, hey, this was something important…' I want to share that, I want to make sure it's this family lore that exists, but I would want to consent to that*." These issues are interesting when they are considered in the broader context of how systems are already being integrated into existing practices around reflection, remembrance, and legacy making. Extending those ideas, this finding inspires speculation into how people might react to the need for more sophisticated means of passing down information as a part of a personal legacy.

Systems as Mirrors

Conversations with participants revealed that existing commercial personalization systems provide an opportunity for people to consider what information is being collected and how it is being used.

Several of the participants described having observed content that they believed had been personalized based on information collected by about them, though it is not clear that all of the examples were indeed cases in which content was being personalized as the mechanisms behind that process can be difficult to uncover.

More strikingly, these personalizations also prompted the participants to consider the nuances of their lives that were not being captured or correctly interpreted by digital systems and the role that their own agency played in this process. Describing this experience, P9 said *"I'm pretty complex in my interests and what I like and I'm sure I could be pigeonholed to some degree but there's a part of me that's like, 'so, guess what, I happen to like Ella Fitzgerald from the 50s and this music from the 90s, and I also just downloaded Lana Del Ray'. What are you going to do with that?"* The point here is not that there are deficiencies in how personalization systems operate. Instead, I was interested in how users are interpreting the often opaque information presented by systems as part of a process of defining and exploring their own identity. This speculation about personalized content may also be a way of establishing a greater sense of agency as people understand the implications of increased tracking online.

Trying to contextualize the information about oneself that is interpreted by digital systems also calls forth a question about how systems might make use of sensitive information. While interacting with the systems, six of the participants raised concerns about the ways in which systems that leverage the data and metadata they contain could negatively impact their personal wellbeing and their relationships with other people. For example, P8 described her concerns: *"I don't want other people to know about my family. Like my dad is a racist… I don't want computer programs to analyze that because I already know that."* Given her strained relationship with her family, she was concerned that she might be exposed to information that would be difficult or hurtful. In addition, she was leery that a system could misrepresent the degree to which certain information and people are connected to her life. Clearly, the topic of the information being presented made a significant impact on its significance to the user.

P4 described a similar concern, in which the system exposes aspects of life that do not support the process of moving forward from difficult circumstances. "*Plus, say you have a bad life. Bad things happen to you, no one cares what happens to you… if you're reminded about the things that happen all the time, it can, it's always thrown in your face, it can be upsetting."* These concerns illustrate the potential implications of systems making judgments about people's experiences. That is, as systems are built that are designed to make sense of large collections of information, it is important to consider how the representations produced by systems may influence personal wellbeing and the ways in which people define their identities.

Metadata as a Gateway

Reflecting on the use of metadata as a design material, the findings also highlight how people might build systems that use metadata to help people make sense of large collections of heterogeneous data collected over the course of one's life. When reflecting on the systems in the study, participants expressed divergent perceptions of what types of data were meaningful to them and what they speculated might have value to future generations. What was meaningless to one person could be a source of great inspiration and recollection for another. For example, P2 questioned the value of location information: *"To keep track of the different places you've been. And what you did there. I'm not too sure how useful this kind of information would be,"* while others described ways in which they might

benefit from looking back on where they'd been, especially as they transition to a different part of their life.

This finding challenges existing notions about how people might manage large-scale digital information. Although users may have a preference for systems that don't combine heterogeneous information [81], these types of systems may be an entry point for users to think about what information holds value to them and could also function as a starting point for discussions with family members about how best to treat digital records in the context of one's legacy. In addition, this finding illustrates the potential for metadata and personalization systems to help people curate records in a way that is personally meaningful.

Participants also described more advanced ideas about how systems that leverage data and metadata might help them engage with the mechanisms by which systems and people might work together. P5, talking about his perceptions of what role systems should play in creating reflective experiences said: *"To what extent does a computer have a responsibility to tell me about my past?"* As it stands, most people do not feel as though they have a great deal of involvement in the process by which systems collect information about them. However, it is clear that people are curious about the processes by which this happens and increasing the transparency and user agency built into those systems may facilitate better human-system interaction.

Discussion

These findings highlight a number of issues regarding the ways in which digital systems are becoming a part of how people generate, organize, and revisit digital information. In this section, I discuss these implications, and reflect on the design and use of the four provocative systems.

One of the salient threads in this work is the way in which the increased capabilities of digital systems to capture and interpret information have created a situation in which both the system and the user can exercise agency over how digital data is utilized. Indeed, as systems begin to take on the role of curator or steward, people are shifted to a role in which they are responsible for a different collection of tasks – interpreting the ways in which the information is represented by systems, carrying out the wishes of those who have passed away, and deciding how the system interpretation is to be integrated into one's cultural and familial practices related to death, dying, and remembrance. This idea is also supported by my findings from chapter 5, in which participants shared their concerns about relying on systems to manage the long-term safekeeping of their digital information.

This focus on agency is also tied to concerns about the potential for a system to negatively impact the people whose information it captures and the future generations of people who reflect on that information. To a system, information does not have an inherent connection to the human values that shape how it will be understood by its recipients. But when considering the breadth of information that is collected over the course of one's life, it is impossible to separate that information from the story it tells about that person. There is, therefore, a clear need for mechanisms and practices that can mediate the process of understanding and integrating these stories into the evolving remembrance of a person who has passed away. This idea has been explored with great verve in the library sciences [5, 27], but has received less recognition within human-computer interaction.

Furthermore, it is important to consider how an increased ability for systems to curate and derive judgments from digital information raises concerns about the privacy of the information being used by the systems and the intentions of the original owner of that information. Even if this type of

technology were to stay at its current level of sophistication, it would be difficult to articulate how a person's information should be used once they have passed away and to convey that responsibility and expectation to future generations that are increasingly removed from the original owner of that content.

Of course, this technology will continue to advance, raising a host of questions about how people can make decisions about what future generations will do with the information people leave behind. As is often the case with artifacts generated to do research through design, the systems used in this study played an integral role in helping participants conceptualize potential future capabilities of digital systems and to provide context about scenarios that will not be possible for many years [165]. In addition, the systems described in this chapter also enabled me to collect data in a way that was participatory and that helped articulate how these types of technologies could impact a wide variety of stakeholders [76]. However, it seems important to note that, in this work, the strength of this method was a result of using those systems in conjunction with a flexible protocol that allowed for the participants and the researchers to imagine what the future of this technology might look like and how those ideas might impact our own notions of family and history.

Design Opportunities

Below, I discuss design opportunities that are derived from the findings of this work and a broader consideration of the implications of those ideas, ordered along a spectrum from near-term opportunities for system development to farther reaching ideas for future investigation.

Exposing System Interpretations

Prior work [7, 91] has suggested that we might reintroduce aspects of human memory and forgetting into the creation of digital systems in order to shift thinking about how information is used and reflected upon. On a practical level, outside of specific systems (like Snapchat), this is a provocative idea that might be difficult to encourage because it represents a direct challenge to a common understanding of how computers are supposed to work. As we examine the role that forgetting may play in digital systems, it is worthwhile to consider an intermediate step: providing people with information about how their actions are being interpreted by systems with the goal of fostering more productive relationships with digital systems. In addition, there may be a complementary opportunity for systems to learn from how people respond to system interpretations of their information.

Using Time as a Contextual Variable

An opportunity exists to build systems that help situate digital information in a time in a person's life when it would be most evocative, meaningful, or relevant. Participants discussed how time impacts the meaning, representation, and interpretation of digital information. This phenomenon extends well beyond digital data and artifacts, but is particularly interesting in the digital world given the possibility of automating the process of stewarding and passing on digital content. For example, one can imagine an application that allows people to set aside content that will later be unlocked once the recipient or inheritor has reached some milestone or part of their life. Though this form of information management would impact the way in which its owner understands that information, it offers both the curator and the receiver an opportunity to reflect on that process.

Closing the Gap in Multigenerational Records

An opportunity exists to expose meaningful threads present in collections of digital content. Participants consistently expressed interest in passing on records to future generations and in reflecting on records from those who have passed away. However, this presents a number of

challenges related to helping people make use of content, such as that which you might inherit, some of which might not be directly relevant to one's life. That is, can we leverage existing or future technologies to make sense of and draw out themes from familial archives? This work might include the creation of a system that identifies shared experiences across the members of one's family, like battling with depression or taking trips across the country. In the absence of technology that can automatically identify and reveal these shared life experiences, there is an opportunity to help people assemble shared representations of their experiences or craft personalized recollections of their own experiences.

Limitations

A limitation of this work is that there was small sample size of participants, derived entirely from people living in the United States. Talking with twelve people makes it difficult to identify the extent to which group differences are representative of larger trends. In addition, although several of the participants were citizens of other countries, this work did not explicitly explore how western values may have shaped the information captured through the interviews and provocative systems. In both cases, these limitations expose rich areas for future work: (a) understanding how stage of life and other aspects of one's life influences legacy making with digital data and (b) exploring how cultural differences around technology use and remembrance may intersect to augment existing practices.

Conclusion

This chapter draws from prior research from personalization, memory, and information management to create four interactive, provocative systems that were used to understand people's perceptions regarding access to and management of personal and familial digital information. Findings suggested that these systems can have an influence on the process of curating a legacy and deriving meaning from digital records, and that, employed in the right contexts, they are viewed as beneficial in managing information across time and generations. Based on these findings, this work raises questions about how to design systems that reflect existing practices surrounding death, dying, inheritance, and legacy while leveraging emerging technological capabilities.

CHAPTER 7: PROPOSED WORK

Overview

My prior work illustrates the complexity of trying to understand how the emerging capabilities of digital systems – including their ability to collect, archive, and interpret information – may influence the many factors that impact how a person looks back at their own life or reflects on the lives of others. For my proposed work, I intend to build from this larger area of research work to focus on the mechanisms of legacy and remembrance. This work will provide a better understanding of how to build digital systems that can support these processes while being cognizant of existing practices and traditions.

To do so, I will create a small number of semi-functional systems that I will use as probes to investigate these questions:

1. How can systems enable people to curate content that reflects different aspects of their identity?
2. How will digital information be transmitted between people and generations?
3. How can systems support the process of revisiting this information?
4. How long should curated materials be available?
5. How can legacy-oriented systems better represent aspects of legacy that are not one's material or immaterial possessions?

The goals of this work are twofold. The first goal is to develop design guidelines that can guide the creation of systems that help people construct their legacy using digital materials and that can to shape the design of systems to support the needs of people who have inherited digital materials. It is also my goal to explore how the emerging forms of digital information and emerging capabilities of digital systems might help people better express and create the legacy they intend to leave behind.

In context of the discussion about goals, it is also worthwhile to outline other constraints for this work. Though I am interested in the curatorial process, I do not intend to create large-scale curatorial systems that serve as a central repository for the bulk of a person's digital information. This domain is well trodden and research has pointed to the need to more sensitively consider how users understand the quality and texture of the many different types of digital information to which they are connected. Additionally, I do not intend to make a contribution through the technological development of these curatorial systems. Instead, I intend to use the systems that I create as tools to better understand these key areas of inquiry.

Methods

This work will be completed using design research techniques, including probes, participatory design, and reflective design. I will use these methods to collect data from people about their experiences and perceptions. As an emerging area of inquiry, the design of legacy-oriented systems is fixed within a future that has not yet been realized. For the vast majority of people, leaving behind some sort of digital footprint once they pass away has only become possible in recent years. My prior work, and that proposed here, looks to the future to try and understand how we might design systems that address these emerging phenomena. As I discussed in chapter 3, design research provides methods for conceptualizing this future and working with these constraints in order to understand what people will want or need without the risk of building large-scale systems that ultimately serve no purpose within their current context.

Technology and design probes have been utilized extensively as an orientation for the deployment of systems in HCI research [17, 69]. The semi-functional systems, or probes, that I create for this study will serve as a way to collect data, engage in a discourse with participants, and refine my thinking about the design of curatorial systems. These systems will not be fully functional systems and will work with a combination of user data and canned data that will allow participants to take part in scenarios that are set within imagined or speculative contexts. For example, although it is not yet the case that many people have inherited digital materials, I can simulate what that data might look like and build probes around that idea to help users articulate their thoughts about it.

The values highlighted by participatory design [96] and reflective design [127] provide an overarching set of guidelines for how I think about this work, interactions with the people who participate in study sessions, and for the values that are represented and expressed by that work. Participatory design emphasizes the value of involving different stakeholders in the design process and encourages a thoughtful consideration of who is affected by design work. In a complementary fashion, reflective design describes how design work offers an opportunity for stakeholders (such as researchers, participants, and the end users of a systems) to consider how that process reflects their own values and their understanding of the world. In both cases, these schools of thought offer a way to understand how to approach this work.

Part One – Understanding Legacy

My planned work has two components, the first of which is a small-scale exploratory study and the second of which is a larger, more formal deployment of a set of design probes. The purpose of this first, smaller study is to generate ideas and insights that will be used to develop the small collection of systems focused on the curation, representation, and transmission of digital materials in the context of legacy that will be used in the second study. This study will be aimed at answering a number of questions:

1. How does a person's understanding of their legacy change as they age?
2. What are the systems and services that people are using to organize their legacy-related materials?
3. How do people think about the different types of legacy they leave behind?
4. For the recipients of a legacy, how do those people look back on the lives of people who have passed away?

Prior work makes a number of contributions that influence this inquiry, particularly the understanding of how people think about the qualities, use, and lifespan of different types of information [81], an analysis of the digital objects in a home that people value or place meaning on [114], and information about how people think about the management of large collections of digital materials [87, 88]. Building on this work, I will use these interviews to collect information that will be used to identify opportunity areas for the creation of legacy-oriented systems.

Participants

For this first study, I will recruit nine people, three in each of the following age groups: 18 to 35 years old, 35 to 55 years old, and 55 to 95 years old. Research work on legacy, autobiographical narrative, and material possessions suggests that there are differences between how people in different life stages contextualize their experiences and place value on representations of those experiences. Though the sample size will be small, incorporating people from different stages of life will yield a more nuanced understanding of the topics at hand. In addition, people in different age groups are likely to have a

different understanding of the legacy they hope to leave behind and different experiences interacting with the legacies of loved ones who have passed away. Drawing from these diverse experiences will strengthen my understanding of people's needs.

Methods

Participants in this study will fill out an online survey that asks them to list between twenty and twenty-five things that they believe will comprise their legacy. In order to help participants engage in a broader consideration of what their legacy might be, the survey will contain a general note that this legacy can include anything, including values, objects, information, and genetic information. Participants will also be asked to briefly describe relationships with families, coworkers, and friends to provide context for their responses.

The data collected in these surveys will be coded using the legacy framework created by Hunter and Rowles [68], which breaks down legacy into three components: material possessions, values, and one's biological legacy. Though this framework does not address virtual materials, it is a useful framework to understand the different ways in which a person can influence the lives of others after they've passed away. Each of these three categories has sub-categories. Coding the information according to this framework will help me understand how participant's description of their own legacy maps to these concepts. I expect that this process will expose ways in which people's needs are underserved by existing systems and which aspects of legacy digital information, data, and systems will be able to support.

After they fill out the survey, I will schedule an in-person interview session with each participant. During the interviews, participants and I will discuss the information shared in the survey. Regarding the data they shared, I will ask them to talk about the process of putting together the list, how their own understanding of legacy has changed over the course of their life, who the intended audience is for this legacy, and how they would feel if aspects of their legacy were not known or received by future generations. I will also discuss a number of higher-level questions that are not specifically tied to the information shared on the surveys:

1. How do individuals think about what constitutes a legacy?
2. How does the legacy they think they'll leave behind differ from their ideal legacy?
3. How can digital systems be employed to reflect aspects of one's legacy that extend beyond material possessions?
4. What are the most meaningful contexts for each person's legacy?
5. Do people have an idea of who will be responsible for the stewardship of any of their digital materials?

Analysis

The information collected from the study will be analyzed using a grounded theory approach. Though some analysis will occur when I receive the results from the survey, the additional information provided during the interviews will provide more information about what motivates each participant's selections. Salient findings from this analysis will inform the development of three to five systems which will be used in the second part of this work. The systems I develop will be speculative and provocative, aimed at better understanding how digital systems in the future can help people navigate the data created during their own lives and that which is left behind by other people. In addition, the information I collect from this study will be used to extend the Hunter and Rowles [68] framework to better understand how it could reflect digital information, media, and data.

I expect that this study will take approximately two months to complete. This includes the process of recruiting participants, scheduling study sessions in their homes, conducting the study, analyzing the data that is collected, and writing a paper about this work. The paper will be submitted to CHI 2016.

Part Two – Legacy-Oriented Systems

Overview

The second component of this research study involves the creation and deployment of three to five semi-functional design probes, the creation of which will be informed by the findings from the smaller interview study. Though the design of the probes will be informed by the findings from the first stage, the systems will also be designed explore the research questions. As such, I will focus on the five concepts identified in those research questions and in my prior work: the faceted nature of each person's identity, the transmission of digital content, revisitation of multigenerational records, the lifespan and purpose of curated materials, and the representation of legacy using digital information.

Key Concepts for the Design of the Technological Probes

These five concepts were selected based on my prior work and on related work that explores reflection, slow technologies, stewardship, and legacy-oriented archives. Below, I describe each concept and illustrate how it might be employ in one of the systems I develop.

1. Faceted Identity – A person's presentation or enactment of their identity is shaped by the context in which that occurs [53]. That is, a person may have a different identity at work than they do when they are among close friends. The different facets of one's identity may also have meaning in the context of legacy – a person may feel as though they leave behind a different legacy to different groups of people [80]. Additionally, people may want to emphasize different aspects of their life when they consider their life through the lens of contributing to a personal, familial, cultural, or societal legacy.

   The distinctions between different presentations of one's identity offer an interesting opportunity to develop applications that allow people to articulate the type of impact they hope their legacy has within each context. In addition, systems that acknowledge different aspects of a person's life may provide a platform to convey how they want different types of information to be managed after their death.

2. Transmission of Digital Content – As discussed in chapter 4, the lifespan of digital materials is highly dependent on the systems that hold them [57]. This feature of digital systems results in a great deal of uncertainty from users, who often have a hard time grappling with the long-term management of their digital content. In the probes, I intend to explore how systems might play a role in developing rituals and practices related to the passing on of digital materials.

   Such a system might encourage people to have conversations with family members about the value (or lack thereof) of their digital information, to think deeply about the impact of the digital materials they will leave behind, or to incorporate digital materials into existing legacy-related practices.

3. Revisitation of Multigenerational Records – A number of systems have been designed to encourage people to revisit their own digital materials. However, with regards to inherited or

multigenerational digital records, it is not clear how people will make sense of, or make use of the information held therein. This question was explored, in part, in the project described in chapter 6, but this space is still widely underspecified by existing knowledge in HCI, personal information management, and death and dying studies.

I believe that systems can help support this process in meaningful ways. Part of this work involves identifying contexts in which people are open to reminiscing about people who have passed away, and I intend to use the systems I create to experiment with the ways that people can draw meaning from their interaction with records that once belonged to other people.

4. Lifespan of Curated Materials – As is demonstrated by work on autobiographical narrative and life stories, constructing a narrative to explain and convey one's experiences is a meaningful part of getting older. However, the recipient of that narrative may not perceive it in the same way, nor is there any guarantee that one's representation or curation of something will have meaning to a person to whom it is later transmitted or given.

   In line with work that describes the "putting to rest" of digital materials [101], I will build a system that puts into practice several techniques for simplifying, deleting, or forgetting digital records. This system will be used to better understand what needs are addressed through the curation of digital materials and how systems might employ more destructive or minimizing techniques to emphasis a person's intended legacy.

5. Representation of Legacy – The Hunter and Rowles framework illustrates that a person's legacy is comprised of many different kinds of things. However, some of these components are easier to represent and transmit than others. For example, passing down a scrapbook is, typically, a less complicated task than instilling your children with your values or in passing on your genetic material through organ donation. Furthermore, the representation of legacy using digital materials has often focused on one's information and media as both a possession and a representation of one's experience [57, 114, 73].

   The increasing scope and capability of digital systems opens a number of new possibilities for using digital information to pass on other components of one's legacy. For example, a system that analyses your social media posts and creates a profile of your personality may make it possible to curate digital materials in a way that directly reflects the aspects of your personality that you wish to highlight. Additionally, services that sequence one's DNA and capture health information, such as personal informatics systems, are creating records that represent one's biological characteristics and history. The systems I build will explore how developing technologies are making it possible to integrate other aspects of one's identity into legacy-oriented curations.

These concepts will allow us to address a number of questions regarding how to make systems that provide people with the ability to manage and look back at one's legacy-oriented materials. Once I refine the designs for these systems, I will code them as web or mobile applications, depending on the specific questions we'd like to ask about the concepts they embody. As is often the case for design or technological probes, these systems will be semi-functional but will not be intended for release beyond the scope of the study. As such, I am interested in their ability to generate insightful discussions and behaviors more so than their usability or commercial viability.

Study Details

I will recruit approximately 15 people from the Pittsburgh area to use these systems over the course of three months. I will endeavor to recruit participants that are diverse with regard to their age, stage of life, technological proficiency, family size and situation, cultural heritage, race, and socioeconomic status. As with the first study, I do not intend to search for any sort of statistically significant differences across these groups, but am instead concerned with capturing a more representative perspective on the issues of legacy and technology than is traditionally available.

In an initial session that will take place in participant's homes, I will show the participants how to use the systems, and conduct an interview to get a sense of how they think about their own legacy and the legacy of others. The participants will be asked to use the systems on a weekly basis (at a minimum) over the course of the three-month study. To encourage use of the systems, I will correspond with the participants once each week to gather feedback about their experiences and interim updates about the systems. I will visit the participants three times, exclusive of the initial session and a final session and interview. During these visits, I will talk to the participants about their use of the systems and also ask them to participate in reflective and participatory design exercises aimed at helping us all better articulate the thoughts on the questions at hand.

During the first session, participants will be guided through the creation of a simple sociogram, which is a diagram that illustrates the different social links people have to others [65]. The creation of this sociogram allow for a more nuanced conversation with participants. For participants, the sociogram will act as a memory trigger and visual aid as we discuss issues regarding their identities and social groups.

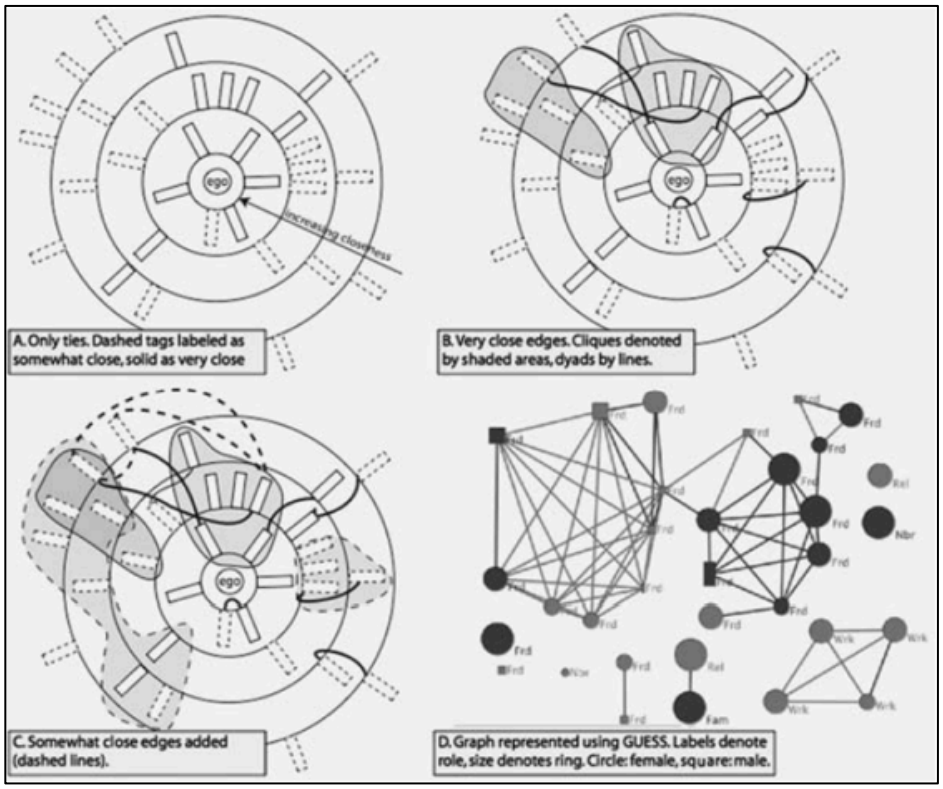


Figure 31: Different stages of creating a participant aided sociogram [65].

The data collected during these sessions and during the initial and final interviews will be analyzed using a grounded theory approach. I will analyze the transcripts to develop a set of codes, categorize those codes, and then build findings from an analysis of the relationships between those categories and a reflection on how those categories relate to prior work. The insights generated from that analysis will be used to create a collection of design guidelines for the development of systems that deal with both the curation of one's records and the reception of another person's records. I will also put forth an analysis of how digital systems will shape interactions with archives of legacy-oriented digital information. This process of knowledge generation is heavily influence by the tradition of research through design [10] and will offer direction for how to build systems that support meaningful engagement with legacy-making practices. In addition, this work will contribute an extended representation of Hunter and Rowles legacy framework [68] that reflects how digital information impacts the aspects of one's legacy.

Scenarios of Use

Based on my experience in this area and the desired contributions of this proposed work, I developed three scenarios that demonstrate the topics that the probes I develop will explore. These scenarios are likely to change as I gather more information from the first stage of the proposed work, but are demonstrative of the types of probes I intend to create.

The first scenario, shown in Figure 32, illustrates am example of how we might build systems that integrate curating a person's media and information into their everyday practices. In this scenario a person who is browsing their photos is asked to answer questions about photos that have been assessed by the system as being potentially meaningful. This system is an example of how we might integrate system-analyzed content with user-supplied data to aid in the process of curating one's materials and memories.

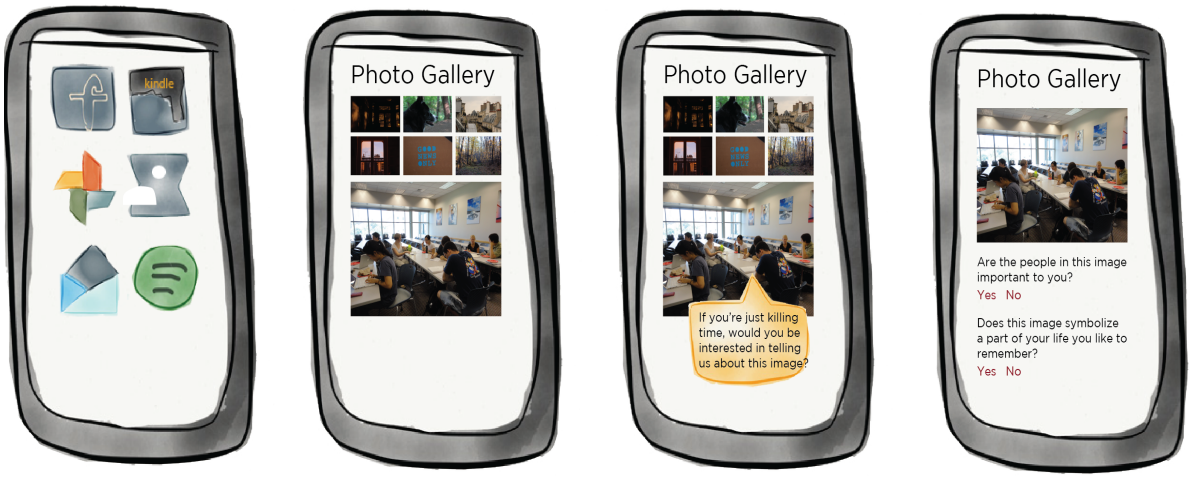
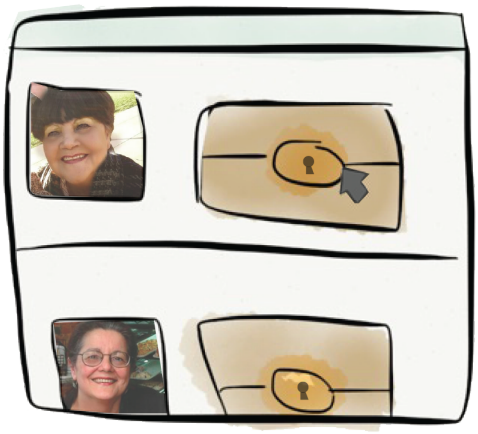


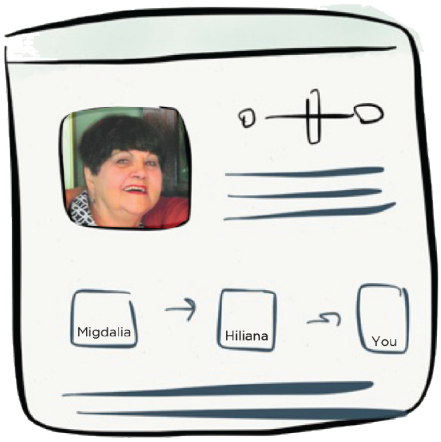
Figure 32: A scenario exploring context-based collection of information.

Another scenario, seen in Figure 33, explores the idea of building an archive of inherited familial digital materials. This system would help a user organize and reflect on the things left behind by their family members and ancestors and will also help them make decisions about what to do with that content. In this case, the system suggests that the person might consider donating a loved one's health records to organizations that can analyze that data for the public good or selling that information to a

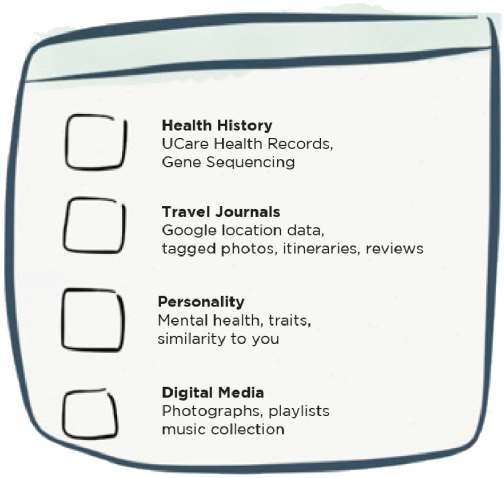
company that has a private interest in it. This scenario was made to highlight some of the different ways people might make use of multigenerational data and information.



1. Database of familial materials



2. Reviewing a person's life through their digital media and information



3. System organization of those materials

4. The system helps you understand your options to donate or sell access to those materials

Figure 33: A scenario exploring how to make use of multigenerational information.

Finally, Figure 34 depicts a third potential scenario in which a system helps foster conversations about legacy between a mother and her daughter, upon sensing that they are in the same physical space. This scenario explores how system might be employed to facilitate the transmission of digital information and content between generations. Though this work is at an early stage, I believe that the probes I create will create an opportunity to discuss how the wide range of digital data people generate will influence how people look back on their lives and help generate a more nuanced understanding of how different stakeholders are involved in the process of curating a legacy with digital information.

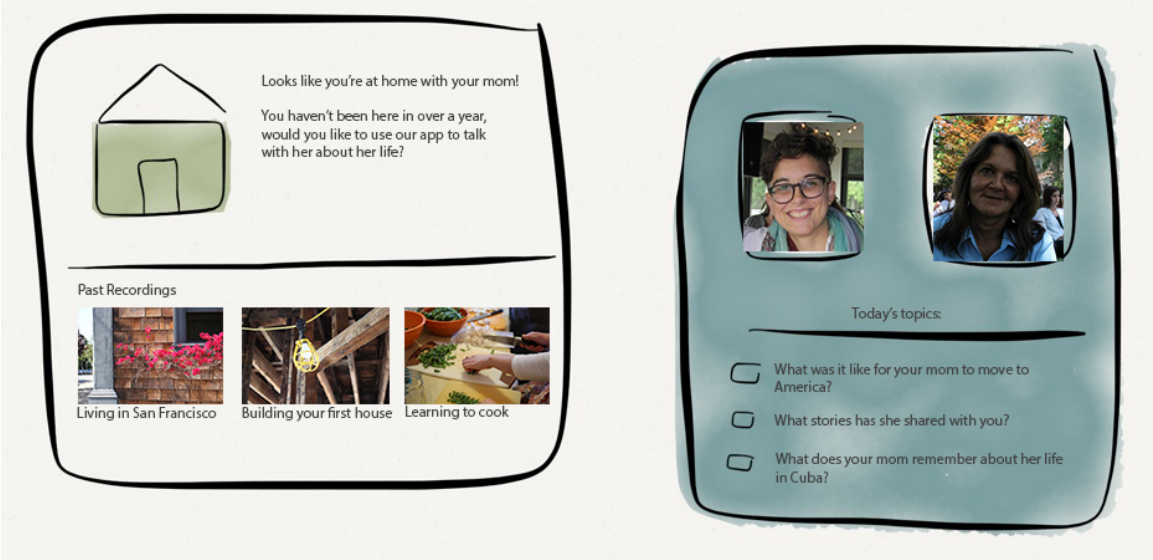


Figure 34: A scenario depicting how an app might facilitate conversations between a parent and her child. In this scenario, the system has already captured information from the parent about the types of information she'd like to pass down and suggests these topics to her daughter.

Contributions of the Proposed Work

Though this work is in an early stage, I believe that the work proposed herein will expose a number of opportunity areas for the development of systems that help people engage in meaningful interactions with legacy-oriented systems. My assessment of the contributions of this work is based on existing research work and on my own prior work.

1. Identifying stakeholders and their interests - Looking at emerging advancements in technology, there are a large number of possibilities for whom might be considered a 'recipient' of digital information once a person has died. Recent work has only begun to explore how information is received and managed after a person has passed away and, to date, has had a narrow focus on the immediate concerns of post-mortem data management. As illustrated by Table 3, there are a number of different ways to think about who, or what entities, receive content after a person has died. This is not a complete list of these stakeholders, but represents a starting point for a deeper exploration of this idea.

Potential 'Recipients'		
1. Individuals – Those currently living and also future generations of people.	2. Digital systems – Social networks and identity based systems.	3. Society as a whole – Society may benefit from the knowledge and experiences contained in a person's digital info.

Table 3: Potential recipients of information left behind by a person who has died.

2. Defining Value for Different Stakeholders – The way in which a person assesses the value of some digital data, information, or media is highly subjective and influenced by the needs of both the original owner and, later, its recipients. For the original owner of the content, digital information may be meaningful as a representation of their life's experiences, as a material for composing a life narrative, and as a trigger for remembering aspects of their past. For the recipient, there may be an entirely different perception of the value (or lack thereof) of this

information. In Table 3, I outline some of the different types of value that one might draw from another person's digital information. These types of values are not exclusive of one another, but illustrative different perspectives on how value might be interpreted.

Different Kinds of Value
1. Financial –This could encompass pieces of one's digital information that are valuable in and of themselves (such as photographs or one's writings) and also the collective financial value of one's information that could result from the ability to analyze that information for different purposes.
2. Collective Knowledge – Once analyzed, the data someone leaves behind may contribute to a collective knowledge base or collective understanding.
3. Reminiscence – Once a person has passed away, their digital data may offer a way for people to publicly or privately reflect on that person's life as a part of the grieving process and as a way of remembering them as years go by.
4. Self-reflection – Reflecting on another person's digital data may be a way for people to learn more about themselves. This may be particularly useful in the context of trying to understand one place in a larger network like a family, group of friends, or a workplace.

Table 4: Different perspectives on the value of other people's digital information.

3. Opportunities for Content-Sensitive Revisitation - Understanding different stakeholders and their interests will help identify opportunities for people to revisit and reflect on other people's digital information. Research work on revisitation and reminiscence has demonstrated that the content of the information presented to a user has a large influence over its ability to engage that person in reflection. I will build on this work to examine how to integrate information into people's existing practices in a way that is sensitive to those practices and to their broader interests.

4. Development of Mechanisms for Transferring Digital Information and Artifacts – There are a number of formal and informal practices that guide people through the process of passing on both materials possessions such as furniture, photographs, and real estate, and immaterial possessions such as money. As many previously material possessions become virtual, and as digital systems capture an increasingly significant portion of people's experiences, there is a need to understand how the transfer of those things from one person to another might occur.

   A number of companies have created services aimed at addressing these needs. However, while these companies may offer a technological solution to needs such as being able to access information after a person has passed away, they do not speak to the personal needs faced by those who have lost a loved one and the ways in which the transfer of possessions plays into those practices. My proposed work will build on my prior work in this space to better articulate the needs of people who want digital materials to be integrated into the process of leaving an inheritance and being remembered after they've passed away.

Timeline

Spring 2015 – Summer 2015
Complete part one of the proposed research
Analyze research and write paper for submission to CHI 2016
Start system development for part two of the proposed research

Fall 2015
Complete system development for part two
Design and execute a study using those systems
Submit work in progress to DIS 2016

Spring 2016 – May 2016
Analyze data collected from both studies
Write up studies for CHI 2017
Write and defend thesis

Conclusion

In this chapter, I present an overview of my proposed work. This work has emerged from several years of prior work in this area, in which I have studies how systems influence different aspects of practices related to legacy, remembrance, and inheritance. During the next year, I intend to carry out two studies, a smaller-scale study to gather information about this area of inquiry and a larger research study in which I deploy a collection of technological probes. The information gathered from this work, once analyzed and interpreted, will be used to further our understanding of how to build systems that support people's needs with regards to the management, curation, and reflection on data that spans one or more lifetimes. This is an emerging concern as more of people's information is captured and represented by digital systems and represents the culmination of many inquiries into the ways in which systems intersect with existing legacy-oriented practices.

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