Digital systems and the experience 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 people can engage with these heterogeneous collections of information and 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 availability, management, and interpretation of digital information. This work demonstrates that while people certainly ascribe meaning to aspects of their digital information and believe that there is value held in 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. Finally, this work illustrates the ways in which existing systems do not meet the needs of current users who are developing archives of their own digital information nor of future users who might try and derive meaning from information left behind by other people.

Building on that earlier work, my dissertation work investigates how we can develop systems that foster engagement with lifetimes or generations of digital information in ways that are sensitive to how people define and communicate their identity and how they reflect on their life and experiences. For this work, I built a website that uses people's Facebook data to ask them to reflect on the ways their life has changed over time. Participants' experiences using this website illustrate the types of information that are and are not captured by digital systems. In addition, this work highlights the ways in which people engage with memories, artifacts, and experiences of people who have passed away and considers how digital systems and information can support those practices. I also interviewed participants about their experiences researching their family history, the ways in which they remember people who've passed away, and unresolved questions they have about the past. The findings from this aspect of the work contribute 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 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 by 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 and physical possessions. Despite these challenges, it is clear that people do place value on portions of their digital information and there is reason to try and understand how digital systems might help them lift out meaningful aspects of people's digital materials.

The field of personal information management has attempted to develop systems and practices to help people better find and manage digital information. However, the idiosyncratic nature of each person's digital information, both online and offline, has made it difficult to develop solutions that address the challenge of making sense of what are essentially miscellanies of digital information, media, and data. Additionally, work from this discipline has often underplayed 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 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 information that spans 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 of doing so [53, 110, 112], 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 describes several notable considerations, that: (1) digital systems influence the types of content people chose to share, which thereby influences the materials and information that are left behind after their death, (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 some of their digital information and media but are unsure of how those things will be utilized or valued by future generations. These findings support the notion that there is value in sensitively negotiating the tension between the desire to leave a positive or impactful legacy and the difficulty of curating or managing the large amount of digital information that each person generates throughout their life.

In this document, I build on my prior work to describe two studies that explore how we might build systems that help people derive meaning from digital information and media

left behind by other people. The first is a small-scale study, in which I talked with 9 participants from different stages of life about how they understand their legacy and family. This work was used to inform the development of a technology probe called Retrospect, which was deployed in a second, larger study. 10 participants used Retrospect over the course of 9 weeks to reflect on aspects of their life using Facebook data, and also participated in 4 one-on-one interviews discussing subjects including: (1) their experience remembering and researching the lives of people who've passed away, (2) their understanding of what they'll leave behind for future generations, and (3) the aspects of their life that are captured by digital systems. The findings from these two studies illustrate the importance people place on passing down their values and experiences, and the ways in which a person's understanding of legacy (both their own legacy and other people's legacy) changes over time.

This work makes contributions in a number of areas. Within human-computer interaction, this work contributes new knowledge about how people perceive the lifespan, ownership, and management of digital content, how digital information and media relates to traditional models of legacy, and how people ascribe and derive meaning from digital content. This work also contributes an extension to research methods in research through design. I have adapted the design/technology probe method to use people's personal digital data to gather information about people's perceptions of the world and their understanding of how things might be in the future. Finally, this work contributes 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 are interested in engaging with the memories and artifacts left behind by other people.

Chapter 2: Background and Related Work

In the following chapter, I draw together research from a number of disciplines that describes how legacy, identity presentation, and the nature of one's possessions are impacted by the use of digital systems. To ground this discussion, I present examples from existing digital systems and services such as Facebook, Gmail, and Story Corps. The goal of this chapter is to draw together the different ideas, theories, systems, and platforms that have influenced my dissertation work and to identify areas where we can build on those things to design systems that allow people to meaningfully engage with digital data spanning lifetimes and generations.

2.1   Components of a Legacy
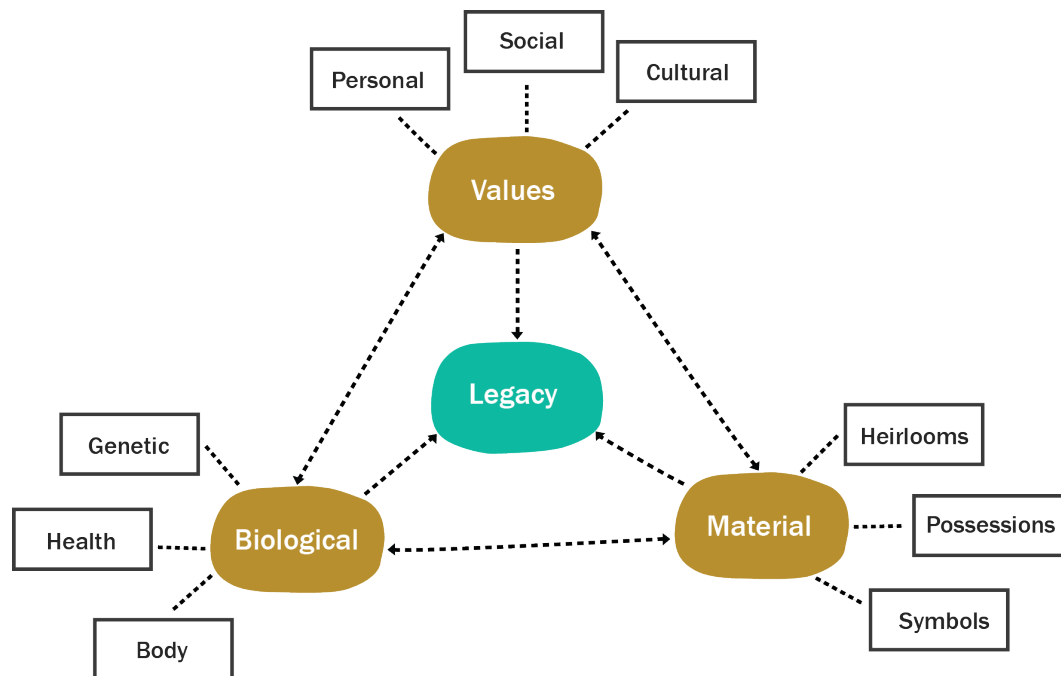
Figure 1: My rendering of the Legacy Framework by Hunter and Rowles [87].

Establishing a legacy is a process by which a person highlights the aspects of their life for which they would like to be remembered [87, 154]. 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 [87]. Though this model does not entirely account for digital possessions, it does help illustrate the different ways people express and realize their legacy. 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 [154]. Legacy building is also a part of a related practice, developing a narrative about one's life and experiences [117]. 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, a legacy is also influenced by how it is interpreted and understood by the recipients.

In life, possessions are a powerful way in which people form, represent, and communicate aspects of their identity [15]. 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 away one's possessions is often a part of how people engage with thoughts about what their legacy might be [145]. 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 [38, 199].

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 [87]. 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 [16, 66, 41] but also illustrates the ways in which digital things are inherently different from, though not inferior to, physical objects [139]. Digital systems make it easier to access, acquire, and accumulate digital possessions [16], but also introduce challenges associated with managing and using them [134]. 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 [110].
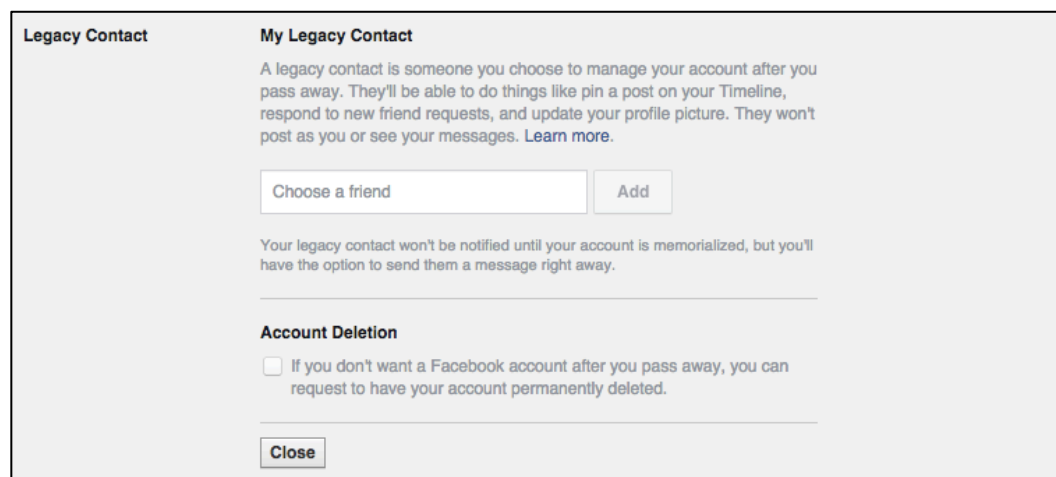
Figure 2: Facebook Legacy Contact [49] settings, retrieved from: Facebook.com on March 15th, 2016.

A small number of identity systems and social media sites have implemented functionality that allows people to pass down digital information and media to other people after their death. The two most prominent sites that have done so are Facebook and Google. Facebook's Legacy Contact [49] allows users to select another Facebook user who will be

able to manage their account if they pass away (Figure 2). Similarly, Google's Inactive Account Manager allows users to specify people with whom they would like to share data if their account has been inactive for a certain amount of time [67]. Beyond Google and Facebook, there are a number of smaller websites that provide people with the ability to preserve or pass down information to other people, but none of these sites or features have achieved widespread use nor do they fully engage with the complexity associated with leaving behind digital materials [62]. There is a need to better understand how people will engage with digital materials as a part of how they reflect on people's lives after they pass away.

2.2   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 [194]. 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 [143]. Working through grief allows a person to move on with their life in a way that reflects the loss they have experienced [174].

Figure 3: A still image the live webcam feed of Andy Warhol's gravesite. Image retrieved from: http://www.warhol.org/figment/

As digital systems capture more information about people's lives, the ways that people grieve and mourn has also shifted to reflect this trend. Digital systems have changed the process of memorialization and grieving by creating opportunities for public or collective grief [20, 195]. For example, in 2013 the Andy Warhol Museum launched a live webcam feed of Andy Warhol's gravesite (Figure 3). Leveraging the abilities of digital systems, the goal of this project was to help people from around the world connect to the dead artist's work and legacy [51]. This project is just one of many examples of how digital systems are changing how people engage with the memories and materials of people who have passed away. More commonly, social media accounts also provide space for people to mourn and share their recollections with other people [20, 24]. 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 practices associated with grieving the deceased, such as attending a funeral [26]. Though social networks a platform on which to publicly memorialize a person who has passed away, this practice predates the rise of social networks [154]. In conjunction with the practice of mourning a person's death online, digital technologies, such as PowerPoint presentations containing images of the deceased, are also being directly integrated into practices such as funerals and visitations [195].

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 [110]. Other work has examined how technology might be integrated into private and familial rituals [185]. The rise in importance of digital information and systems has also contributed to the practice of inheriting digital information and digital hardware like laptops [195]. 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 [110, 132]. This work suggests that, given the difficulty of making sense of someone else's digital information and of negotiating the personal or private nature of that information, there may be reason to consider alternative means of managing that information, such as deep storage and the dispossession of digital materials [132].
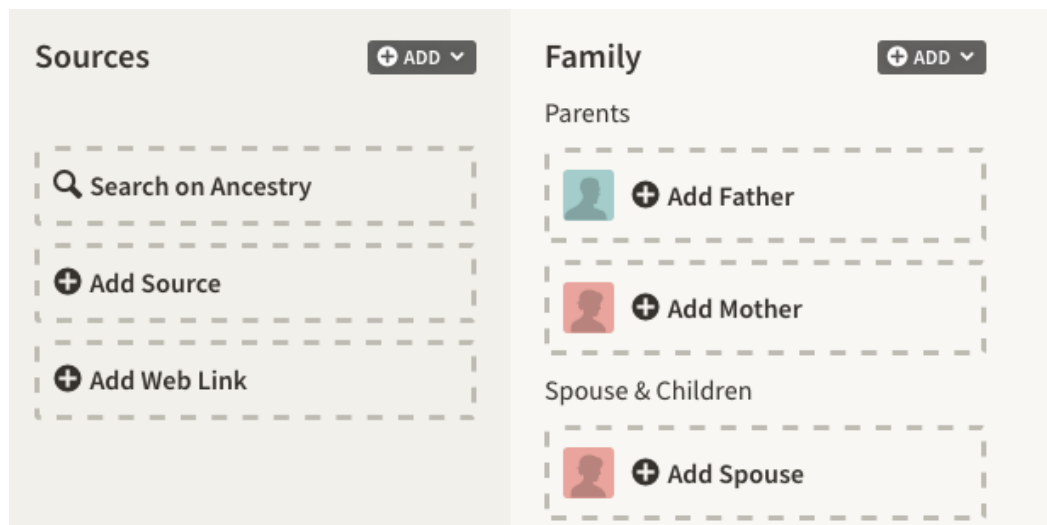
Figure 4: Combining government records and individually contributed information on Ancestry.com [4].

Though not often studied in HCI, family history research is one of the primary ways in which people use systems to engage with information about people who have long since passed away. Genealogy systems and systems that memorialize public tragedies also offer people the opportunity to both learn about the experiences of others and to better understand one's place within different communities and time periods [76, 123, 126]. Indeed, researching one's family history is a meaningful way in which people can better understand their own lives and their relationships to their family members, ancestors, and heritage. Systems that serve this function include websites like Geni.com [61] and Ancestry.com [4] (Figure 4), which combine historical information retrieved from government records with the ability for individuals to contribute and find information

about their own family's history. Studying how people use these resources and conduct family history research may reveal information about how to design systems that help people engage with digital data created by their ancestors.

2.3   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 [15, 193]. 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 [96]. Digital things have many characteristics not present in physical objects – primarily the ability to easily (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 [16, 136]. 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 [95]. 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 [139]. 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 [100].

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 [195]. 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 [75, 188]. Changes in the prevailing format or structure of digital information can render it inaccessible [30], as can difficulties associated with how a website is designed. 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 [34]. 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.

2.4   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 [179]. 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 [17, 92]. Furthermore, the fragmentation of information across different services and systems presents additional challenges to system designers and users [91].

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 [60]. 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 [52]. 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 [110, 112].

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 [45]. 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 [200]. 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 [128, 145].

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 [99, 26, 149]. 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 [128]. 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 (Figure 5) 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 [172]. 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 [173]. Story Corps makes many of these recordings available to the public on their website, on public radio, and through the Library of Congress.
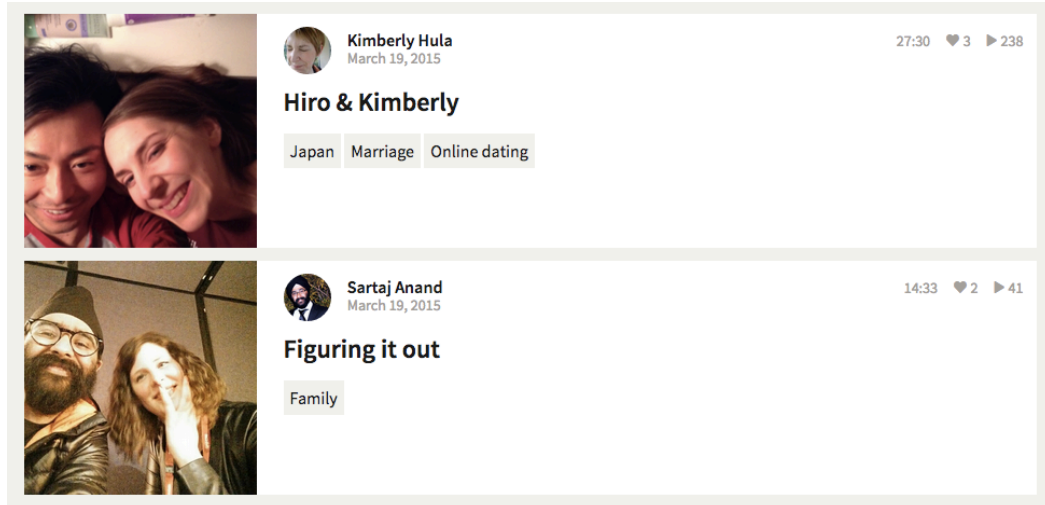
Figure 5: Two stories recorded using the StoryCorps mobile app. Retrieved from: storycorps.me.

2.5 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 [161]. For example, retelling a story of a memory can shape the memory itself, and, therefore, future efforts to recall it [109]. 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 [6].

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 [161, 83]. 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 users to call up digital photographs using physical souvenirs in the home [85]. Another system, Pensieve [145], 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 [38]. 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 [97] and later revised the functionality of the "Year in Review" to give users more input in the content displayed [124].

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 participate in managing their digital materials [92]. Similarly, a project that studied how elderly people record their experiences 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 [102].

Figure 6: Two photos shared on Facebook using the #tbt hashtag. Used here with permission of the user and the subjects of the photos.

People also frequently use commercial systems to reflect on and share aspects of their life online. In some cases, systems offer features to users that support or encourage people to share content from the past. For example, Timehop [126], Facebook Memories [120], and the Repost app [156] all allow people to reshare content they've previously shared online. People have also developed their own reflective practices. One common practice includes using the hashtag #throwbackthursday (also known as #tbt) on websites such as Instagram, Facebook, and Twitter (Figure 6). This hashtag typically accompanies content produced in the past, including a photo from one's childhood, a link that a person shared in the past, or a memory from a particular day or place. Research work on revisiting old content and information online suggests that while users may enjoy such practices, content from the past may not align with the identity they have constructed [165, 204]. Further research on how people revisit content online could shed light on how to design

systems that allow people to better understand their own life or share aspects of that life with other people.

2.6   Identity Presentation, Privacy, and Disclosure

There are many theories about how people engage in identity presentation, performance, and development – each of which describes some aspect of how they think about their own life, how people decide what information people share with others, how they share that information, and with whom they share it. In the context of my research, there are several key concepts from this large body of research on identity and identity presentation that directly relate to my work. One 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 [65]. Others have explored how the different aspects of the self (private, public, and collective) impact both behavior and one's self-concept [181]. Another important concept is that one's identity is dynamic and changes over the course of one's life [108]. Finally, Hogan extends Goffman's identity presentation model as it relates to social media and describes how our social media accounts are both performances spaces (as described by Goffman) and exhibition spaces where we curate information for others to view asynchronously [82].

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 [176]. 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 [106, 186]. 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 [205].

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 [69]. 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 [142]. 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.

2.7   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 deriving 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 [177].

Research focused on personalization systems used for advertising indicates that people feel uncomfortable with being tracked by systems geared towards serving them ad content [182], but that some understand that ads are part of the business model of many websites [157]. In addition, studies reveal that people understand why personalized advertising might provide better value to both them and the products of services being advertised [184]. 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 [119]. Furthermore, the use of personalized advertisements opens up a number of other concerns for users, primarily fears about the privacy of their digital information [182].

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 [46, 98, 154, 168]. 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 [46, 154]. 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 [197].

For the work presented in my dissertation, 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 7 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 7 are intended to be illustrative of 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.
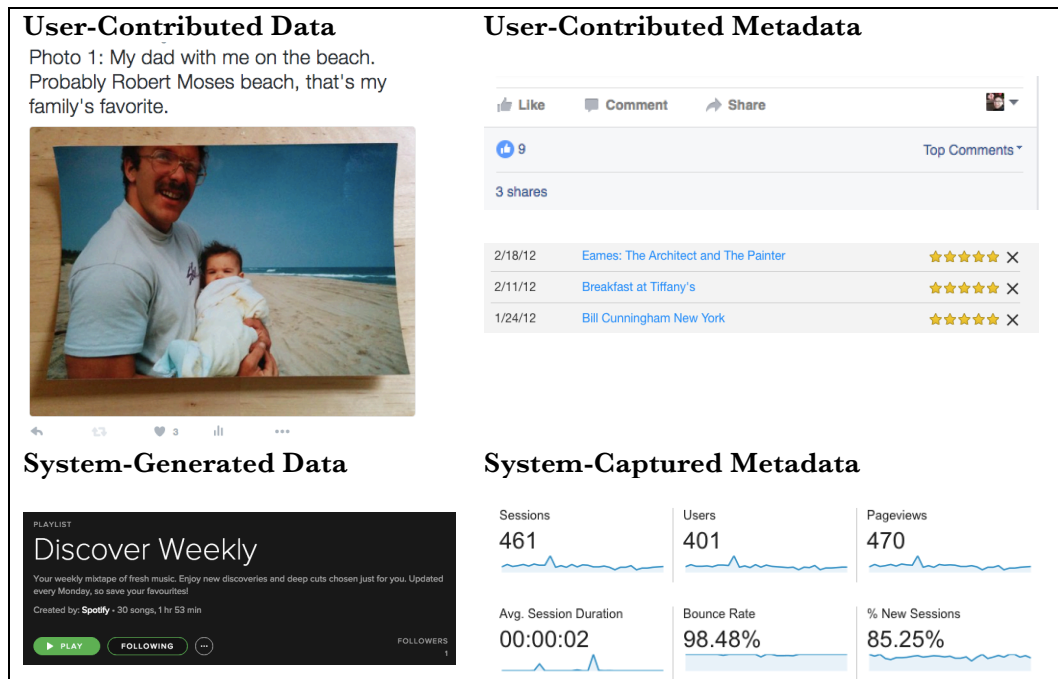
Figure 7: In-situ examples of user-contributed data (from Twitter), user-contributed metadata (from Facebook and Netflix), system-generated data (from Spotify), and system-captured metadata (from Google Analytics).

2.8   Moving Forward

This prior work offers a starting point for a discussion about how concepts like identity, privacy, and family might be involved in the practices that emerge as digital systems capture information about people's lives and hold on to that information after their death. In this dissertation, I draw together the concepts described in prior work and focus on three open questions that result from that synthesis: (1) how do digital systems influence how people engage with their own legacy?, (2) how do digital systems influence how people engage with what people leave behind when they pass away?, and (3) how should multigenerational systems be designed to support legacy-oriented practices? There is not yet a large body of work from which we can answer these questions, and so each ties

together what we know about identity, relationships, how people use and create digital things, and the role that aging and death play in how people understand their own life.

Chapter 3: Terminology

Many of the terms used in my work are drawn from other fields, such as death and dying studies, personal information management, and media studies. In this chapter, I define some of the discipline-specific terms that I use in this document to help distinguish these words from how they might be used in other contexts. When possible, I've included examples from my own work, other research work, and existing systems to help clarify how these terms are used in this dissertation.

3.1 Curation

Curation refers to the process by which people or systems select and organize pieces of physical or digital content. Curations are not always deliberate, but there is often a goal that motivates the process of curating (such as wanting to document a child's life) or a theme around which materials are curated (such as a trip). The process of curation can be undertaken by any number of individuals, though in my research it is often the work of a single person who will curate their own content in addition to content that describes the lives of their friends and family. Online, curation is closely tied to the ways in which people manage and archive digital information. Related research has demonstrated that people curate the information they share and store on social media sites like Facebook [207].

3.2 Digital Data, Information, Media, and Artifacts

I use a number of terms to refer to the digital things that people and systems produce, so it seems helpful to talk about the subtle distinctions between those terms. The terms digital data and digital information are used interchangeably to refer to any digital things that people or systems generate. These two terms are intentionally broad and are often used to describe the large variety of digital things that people and systems generate. Digital media refers to a digital form of some type of media, such as an MP3 or a digital photograph. Digital artifact is a closely related idea, and often refers to digital things that have been purposefully created or managed by a person. An example of a digital artifact might be a collage created through Instagram or a series of emails between two people.

3.3 Digital System

Digital system is a term that refers to any website, application, service, or device that people use and that generates digital information. This category is quite broad and is most often used to highlight the differences between some digital information (or data or media or artifact) and the system that generates or captures that information. Examples of digital systems that are frequently included in my research are Facebook, Twitter, Flickr, Gmail, Amazon, Yahoo, laptops, tablets, and mobile phones.

3.4 Dispossession

Dispossession is a term that describes the process of giving away one's possessions. The significance of this practice varies according to one's stage of life and one's goals, but in

my work I am most often interested in dispossession when it takes the form of a process that people go through as they age as a way of redefining their identity and their relationships with others. Giving things away is a way of extending one's self and the ways in which a person will be remembered by other people after their death [107].

3.5   End of Life Care

End of life care refers to the care people receive from caregivers, such as family members, members of the clergy, and medical professionals as they prepare to die. End of life care is a complicated issue for many people and families. It is often the case that people do not communicate their end of life care directives or formally record them, which makes it difficult for people to make decisions about how to handle that person's death. Research on people's desires for end of life care indicates that important concerns include trust between patients and doctors, being able to prepare for the end of one's life, and not being a burden on one's family [80].

3.6   Identity Presentation

Identity presentation refers to the ways in which people communicate aspects of their life and identity to other people. My use of this term is influenced by both Goffman's dramaturgical metaphor for identity [65] and by Bernie Hogan's more recent work outlining the ways in which people express and manage their identities online [82]. My work builds on the understanding that how a person presents themselves changes based on different contexts but also changes in more meaningful ways over time as people age and move through different stages of life.

3.7   Legacy

A person's legacy refers to what they leave behind after they have passed away and can include one's values, possessions, and biological information [87]. Many people are motivated to influence their legacy and subsequently take steps to shape it, such as by telling stories that emphasize important values and experiences, by having children, or by donating money. After a person's death, their legacy is interpreted by the people who are left behind and by future generations who can look back on a person's life and develop their own understanding of that life. In my work, I consider legacy through the lens of a person who is crafting their legacy and through the lens of people who experience that legacy as a part of their own lives.

3.8   Life Stories and Autobiographical Narratives

A life story (or autobiographical narrative) is an understanding of a person's life that is developed to tie together their life experiences and connect these experiences to larger themes. People develop these stories as they age; they help people understand their identity and experiences, and help them articulate what gives their life meaning. A person's life story often changes as they age – children begin by crafting stories that link together aspects of their lives to explain how they were shaped by their experiences and choices. As people enter middle age, they develop narratives that allow them to make sense of the different roles they play (parent, child, employee, student, etc). As people

enter the later stages of their life, they develop narratives that reflect a desire to look back on one's life in a way that highlights aspects of that life that relate to the legacy they want to leave behind [117, 118].

3.9 Meaning-Making

In my work, meaning-making refers to the processes by which people might derive meaning from some collection of digital information and media. The goal of my work is to learn how to build systems that can support meaning-making and that help people to find and engage with digital information that is important or valuable to them. This process is related to that of sense-making [127]; making sense of large databases, archives, or collections of digital information is sometimes an important step in helping people derive meaning from those things.

3.10 Metadata

Metadata is generally described as data that describes other data [122]. As you might expect, it can be difficult to draw a line between what counts as data and what counts as metadata. In my own work, I tend to think of metadata as data that is generated as a by-product of some interaction online. For example, when a person shares a photograph on Facebook, Facebook uploads the photo and also creates records for a whole set of other information, such as how many times the photo is viewed and when it was uploaded. Other information, like comments that people leave in response to the photograph, might fall into the category of 'data' or 'metadata' depending on whether you consider the photograph from the point of view of its creator or from the commenter.

3.11 Pre-Mortem and Post-Mortem

Pre-mortem refers to the time before a person passes away. Though all of a person's life could technically fall into this category, pre-mortem typically refers to the time directly before a person's death. This is a critical time in a person's life and in the lives of family, friends, and people involved in their care. Post-mortem refers to the time after a person dies and is associated with a number of different practices, such as holding a funeral or wake, grieving a person's death, executing their will, and remembering a person's life and experiences.

3.12 Reflection and Reminiscence

Reflection and reminiscence are two related terms that I use to refer to people looking back on experiences they've had in their lives. Though these terms are similar, reminiscence often refers to some sort of positive or nostalgic way of looking back at one's experiences. These terms have been used in a variety of context-specific ways by HCI researchers, see [13, 121] for more information.

Chapter 4: Research Methods

The work described in this document reflects 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 requirements of individual projects. In this chapter, I 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 outlining these methods is to help articulate the different aspects of doing research through design and to clarify how these processes generate knowledge within my work. Each of these methods is described in more detail in its appropriate context in Chapters 5-9.

Method	Use in my work	Selected References
User Enactments, Scenarios, and Personas	Helping participants engage with probes	Odom [135], Carroll [29], Pruitt [152]
Photo-Elicitation	Supporting conversations with participants using their photographs, establishing common ground with participants	Clark-Ibanez [33], Harper [75], Heisley [79]
Directed Storytelling	Supporting conversations with participants, encouraging storytelling	Evenson [47]
Semi Structured Interviews	Engaging in open-ended discussions with participants	Corbin [36], Dickson-Swift [42]
Sketching and Concept Modeling	Exploring relevant concepts, articulating research goals, engaging stakeholders	Buxton [27], Fallman [50], Warr [196]
Design Probes (paper, technology)	Exploring research concepts, conveying ideas to participants, generating research data	Gaver [58, 59] Hutchinson [89], Boehner [20], Wallace[192]
Content Analysis	Analyze the information shared on/by websites and the features they offer	Hseih [86]
Grounded Theory	Analyze data collected from participants, derive findings	Corbin [37]

Table 2: Methods used in my research work with references that describe those methods.

4.1 Conversational Methods

My work often involves discussing sensitive topics with participants, such as preparing for one's death, the experience of losing a loved one, and one's relationships 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 [36, 42], 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 the 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, a participant invited me to conduct the interview in the parlor of a historic home that 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 [74]. 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 [33, 75]. 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 [79]. In the interviews I conducted, participants' 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 [135] 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 the investigation on the concepts represented by the systems.

4.2 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 externalize one's thought process [50, 196]. 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 [27].
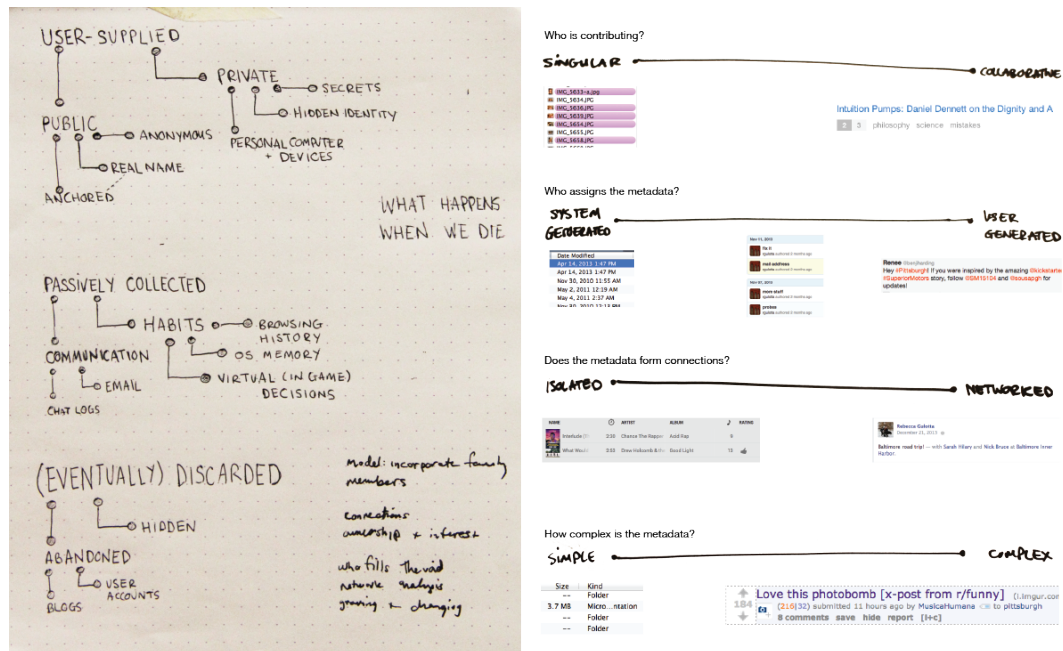
Figure 8: Sketches I created as a part of the work described in Chapter 6.
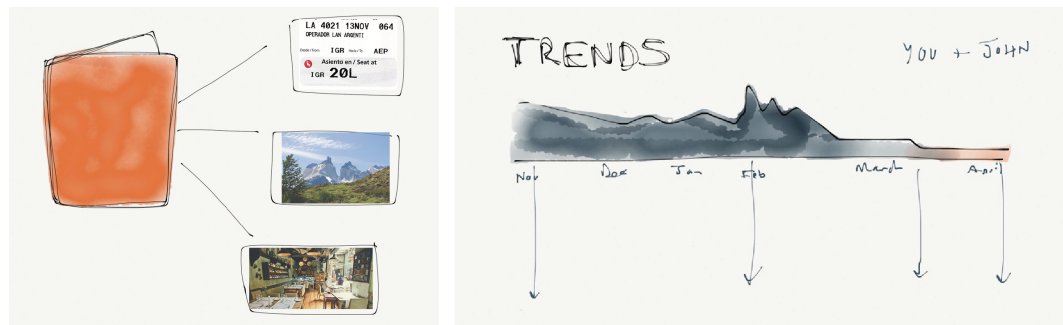
Figure 9: Sketches exploring how systems might utilize metadata to present people with meaningful digital content.

In the early stages of a project, I often create sketches that illustrate a concept and help draw out questions that result from existing research. For example, Figure 8 depicts two sketches I created to explore how different types of information were related to one another. 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 so 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 to aid in the process of designing probes for my work. These sketches, such as those seen in Figure 9, 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.

4.3 Design and Technology Probes

In addition to sketches and visual imagery, I create design probes and technology probes as a part of my work [58, 89]. Probes 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 [58]. Though the intention of this work was not to collect data, the probes technique has been adapted for a variety of purposes (data-driven and otherwise) in HCI [59]. One of the primary adaptations, technology probes, built on cultural probes to explore how researchers could use early-stage representations of technology to engage people in experimental, playful, and participatory design sessions [89]. 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 [20].

Figure 10: Paper probes used to informally gather information about how people think about their digital information.

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 10, 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. 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.

Similarly, I created the probes pictured in Figure 11 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 [192]. 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 10, 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 11: 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, Figure 12), 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.

In addition to these paper probes, I have created and deployed several sets of interactive, digital 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 think critically about what might happen to their

digital information and media in the future. This work draws strongly from the philosophy of technological probes [89] 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.

Figure 12: A Digital Account Inventory.

These probes are valuable for my work because many of my research projects involve trying to understand situations that have not yet come to pass — such as a time in which the majority of people have access to generations of digital information about their ancestors. The probes I create provide my participants with an opportunity to engage with what it might feel like to have inherited their grandparents' 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 13: Three interactive probes exploring the decay of digital media and information.

One set of probes I created was a collection of websites (Figure 13) that slowly destroyed or compromised 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 system's 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 14: Four interactive systems exploring the use of systems to make sense of digital information.

Another set of interactive probes (Figure 14) 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.

4.4 Methods of Analysis

All of the interviews I conduct are recorded using a smartphone or iPad. The recordings are most often transcribed by me, though I occasionally have help from other members of my research group. In addition to transcribing the interviews, I also write up a set of notes 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.

Once I have produced and collected all of the study materials, I begin the process of analyzing the data, primarily using qualitative methods. For the projects discussed in this document, I use a technique adapted from grounded theory [37]. 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 this work builds on, or contradicts, existing prior knowledge about the role of curatorial and legacy-oriented systems.

In addition, my work 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 a result, 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 [163].

Chapter 5: 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.

5.1   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 [183]. 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 [125]. As people share more information about themselves online, and form 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 [124].

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 [137, 63], the roles technology can play in both death and bereavement [113, 195], and differences in in qualities of virtual and material possessions [134, 110]. 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.

5.2   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 [132] 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 15. 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 15: 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 [56, 77, 78]. 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 16, 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.
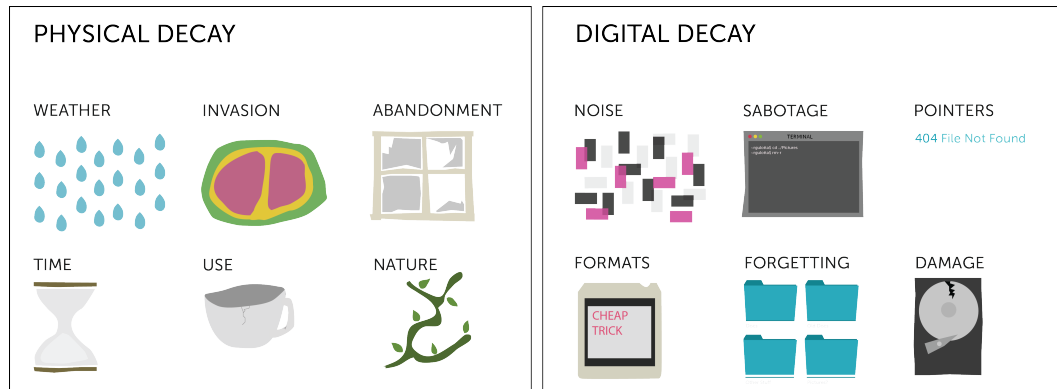
Figure 16: An illustration comparing the different forms of physical and digital decay.

5.3 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 [89]). 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 [198] and have been highlighted as potential ways in which digital systems could help people cope with the large collections of digital information they generate [132]. 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
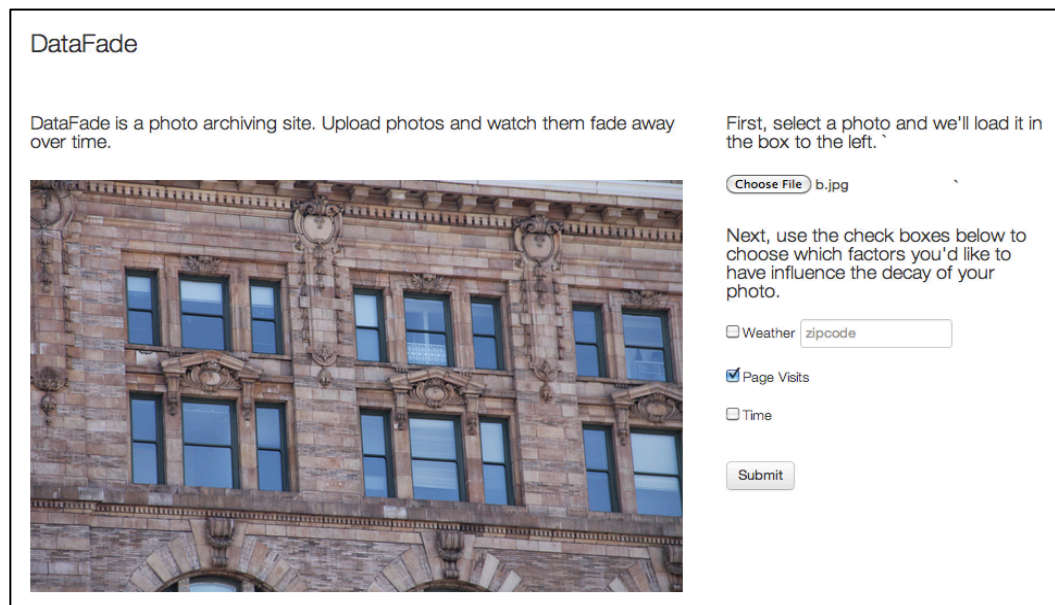
both users and designers as a way to reexamine perceptions, beliefs, and experiences [166]. Development was also influenced by recent work with speculative design [58], critical design [11] and technological probes [89].

5.3.1 DataFade

The first system, DataFade (Figure 17), 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 user's 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 18, 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 17: The main page for DataFade, made using Javascript, PHP, and mySQL.

Figure 18: 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.

5.3.2 BlackBox

The second system, BlackBox (Figure 19) 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 commit, 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.

Figure 19: The main page for BlackBox. On this page, the user is in the process of uploading a photograph to the systems.

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 [95].

BlackBox intentionally pushed this idea to an extreme, provoking users to contemplate how they view the ownership, lifespan, and safekeeping of their digital files.

5.3.3 BitLogic

The third system, BitLogic (Figure 20), 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.
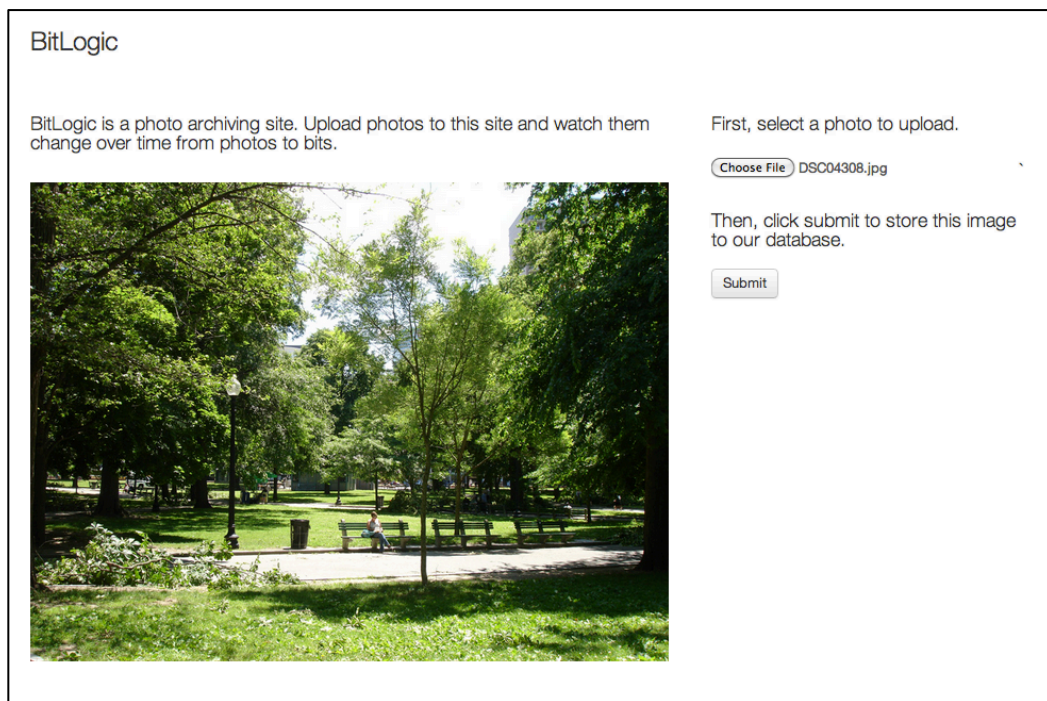
Figure 20: The BitLogic system.

Figure 21: A photo decaying digital in BitLogic. From left to right: the original photo, noise applied to the original photo, and that photo transformed to bits.

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 21. 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.

5.4   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 material 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 [14]. A third group, older adults, typically place value on evocative objects that provide them with the ability to reminisce [14]. 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.

5.5   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.

5.6 Findings

Prior work has indicated that participants might value the opportunity to discard their digital content in a controlled manner [132]. 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 [201]. Given this work, the goals of the 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 related 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 are representative of the information contributed by the participants in response to the three 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.

5.6.1 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 demonstrate how 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. 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).

5.6.2 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.

5.6.3 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 discussed 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 shift in how people's family lives are being changed by new technology.

5.6.4 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.

5.6.5 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 participants' interests 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 [175]. 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.

5.7   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.

5.7.1 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.

5.7.2 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.

5.7.3 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.

5.8   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.

In the next chapter, I build on these findings to examine the tensions between how people and digital systems each influence the availability and lifespan of particular types of digital content. The information a person creates during their lifetime may have an impact on how they understand their own life and how other people understand their life after they've passed away. In the next project, I explore those ideas in more depth and investigate how we might build systems that allow people to feel a great sense of agency over how their experiences and identity are represented by their digital information.

Chapter 6: Legacy in the Age of the Internet

The work described in the preceding chapter highlighted a number of complexities regarding how digital systems influence 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.

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 exploration 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.

6.1 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 [87]. 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 [183]. After a person's death, that legacy is then subject to the interpretations of those to whom it is left [183]. 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 [53, 110], better engage in meaning-making with digital information [147, 166], and reflect on their family's digital history [70, 131]. 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 [205], 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 [160]. 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 [69].

6.2   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 [144]. 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.

6.3   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 [74]. 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. These topics grew out of the findings from the 'Digital Artifacts as Legacy' project. Here, I wanted to build on that work and really dig into the potential implications of how people share information online. The 'Digital Artifacts as Legacy' study suggested that people felt that digital systems had a deep impact on their understanding of the value and lifespan of their digital data. This study was an opportunity to talk to participants about their use of different types of accounts, services, networks, and websites could influence how people look back on their lives once they've passed away. 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 (Figure 22) 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 the boundaries surrounding and among their online identities.

Figure 22: The digital accounts inventories used in the study.

6.4 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 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.

6.4.1 Identity Management in the Context of Digital Legacy

Engagement with Real Name and Active Identities
While identity construction and information sharing online [44, 177] 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 cords 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.

6.4.2 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.

6.4.3 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.

6.5   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 [162], 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.

6.5.1 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 [166] I am not arguing for all-encompassing life-archiving systems that 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.

6.5.2 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 [138].

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.

6.5.3 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, 77]. 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 [53].

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.

6.6 Conclusion

In this chapter, I built on my earlier work to investigate 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 [103]. 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. In the next chapter, I build on findings from Chapter 5 and Chapter 6 to explore questions

regarding how digital systems can and should use different types of digital information to help people engage with large collections of heterogeneous digital data.

Chapter 7: 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 next developed this study, 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.

In this study, I 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 [89] and reflective design [166], 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. These systems were based on the findings and design implications of the 'Digital Artifacts as Legacy' study (Chapter 5) and the 'Legacy on the Age of the Internet' study (Chapter 6).

Through sessions with 12 adults from Pittsburgh, Pennsylvania, 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.

7.1 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 [16, 112], 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 [136, 148]. However, the idiosyncratic, fragmented nature of people's digital records and their management strategies makes it difficult to develop prescriptive solutions [91, 93].

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 [115] and whether they will hold value to future generations [70]. More broadly, there may be cultural and societal value in building systems that can archive and derive meaning from multigenerational records [53]. 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.

7.2   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 [166], technology probes [89], and user enactments [135]. 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 a number of ideas that surfaced in the 'Digital Artifacts as Legacy' study and the 'Legacy in the Age of the Internet' study. The findings from both studies illustrated that while people value aspects of their digital information and data, they feel as though digital systems play a significant role in representing and maintaining those things over time. Participants also rejected the idea that systems can increase the perceived value of one's digital things by applying physical traits to digital data; they felt as though digital things have their own inherent and important characteristics.

In addition to these findings, I also reviewed the design ideas that I'd proposed as a part of those earlier studies. In summary, I had argued for the (1) creation of archives of family-oriented information and media, (2) the development of systems that help people create less digital information and purge digital debris, (3) the development of systems that allow people to organize all of their digital content in a particular location, and (4) the creation of practices and systems that help people consider the long-term implications of their digital information. The idea of creating centralized archives was abandoned in response to thoughtful work by Lindley et al. [103], which illustrated that despite the mutable nature of digital data, people feel positively about representing and holding different types of data in different ways and using different types of systems. In addition, I decided not to move forward with concepts related to deleting digital information because while it is an interesting and potentially fruitful avenue of investigation, it did not relate to the more central questions I hoped to investigate.

Building on this information from my prior work, I set out to select inter-related design dimensions that would offer a perspective on how systems might make use of a person's

data. The first dimension was *topic*, or the nature of the content captured and represented by the system. In Chapter 5, one of the major findings was that the vastly different content held in people's digital accounts had a major impact on their perception of the value or potential impact of that information, and I wanted to explore that idea in the context of systems that don't just store data, but instead analyze and interpret it. The second dimension was *generativity*, or the extent to which the system generates novel representations of a user's content. Given the ways in which participants rejected the idea of applying physical phenomena to digital data, I was interested in exploring how people felt about systems transforming their data using innate characteristics of digital data. The third dimension was *agency*, or the extent to which the user and system have input in the operation of the system. Participants in my other studies felt that systems exerted a strong influence over the ownership and representation of their digital content. I wanted to explore how we could find a balance between user and system agency. The final dimension was *time*, which described both how the information was presented to users and the timespan of the records used by the system. This dimension was drawn from my interests in creating multigenerational systems and by work in slow technology [72, 133] that suggested that there is an opportunity to create digital systems that foster long-term engagement.

Given those overarching goals, I then set out to create the design probes. Based on my interest in digital systems and the information they capture about people's interactions, I decided to use metadata as the primary material for the probes. Metadata is the information that describes, annotates, or adds onto digital data [68] 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.

I brainstormed a number of concepts with my collaborators. 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 Figure 23 and Figure 24. Figure 23 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.

I chose to move forward with four ideas, each of which was chosen based on how that concept mapped to the goals of this work and to existing literature. The four concepts were: a system that looks for patterns in one's email to highlight potentially meaningful threads (MailMem), a system that integrates multigenerational information into one's daily life (Calendera), a system that integrates private and public information to supplements one's knowledge about their own activities and interests (Locale), and a

system that attempts to collate diverse threads of data into a single record (Gather). Given the goals and constraints of the project, it became clear that it would be more practical to create these systems without the use of a participant's actual data. In some cases (as with Calendera, the multigenerational system), it would have been nearly impossible to build these systems using user data. Instead, the systems were built using simulated data that I produced. For more information, Figure 24 depicts how each of the concepts mapped to each of the four design dimensions.
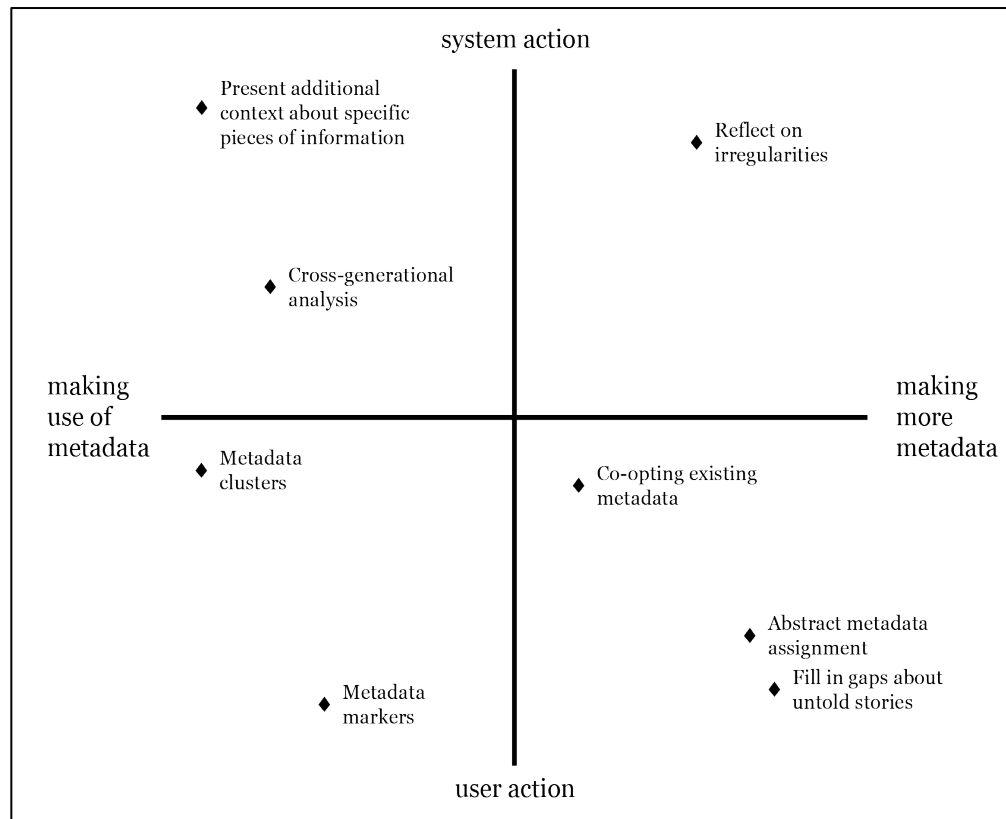
Figure 23: Plotting agency and generativity for metadata-based systems.

Figure 24: A table depicting how each of the probes is connected to each of the four dimensions (topic, generativity, agency, and time).

7.3 System Design

The four systems developed for this project were called MailMem, Calendera, Locale, and Gather. Each system was a separate set of webpages built using simulated data. I created them using basic web programming techniques; they were built using CSS and Javascript. 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 [135].

7.3.1 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 25 is an early sketch of this illustration, demonstrating how it might be integrated into one's email service.
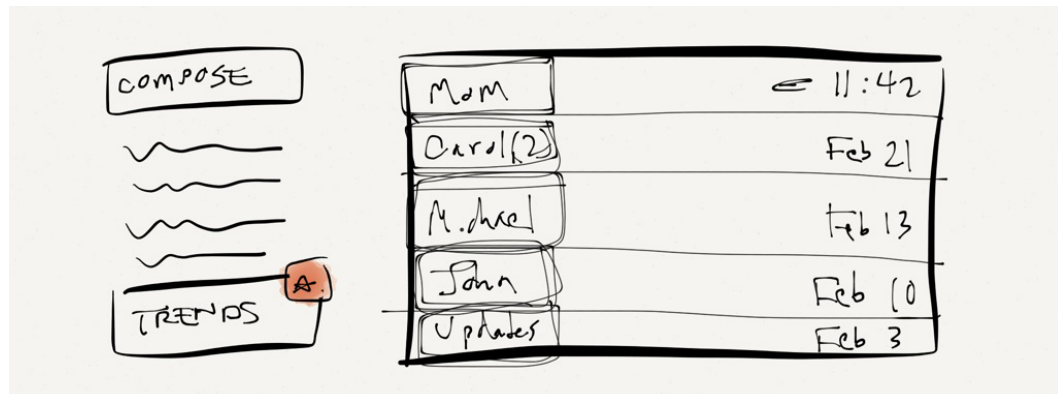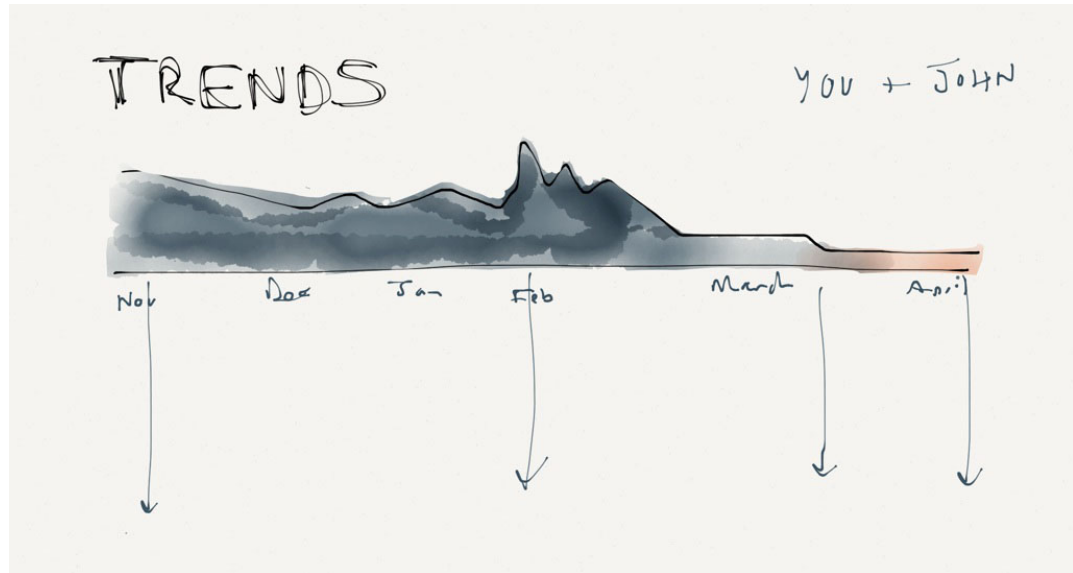
Figure 25: Early, pre-production sketches for the design of MailMem.

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 26: The inbox for the MailMem probe.
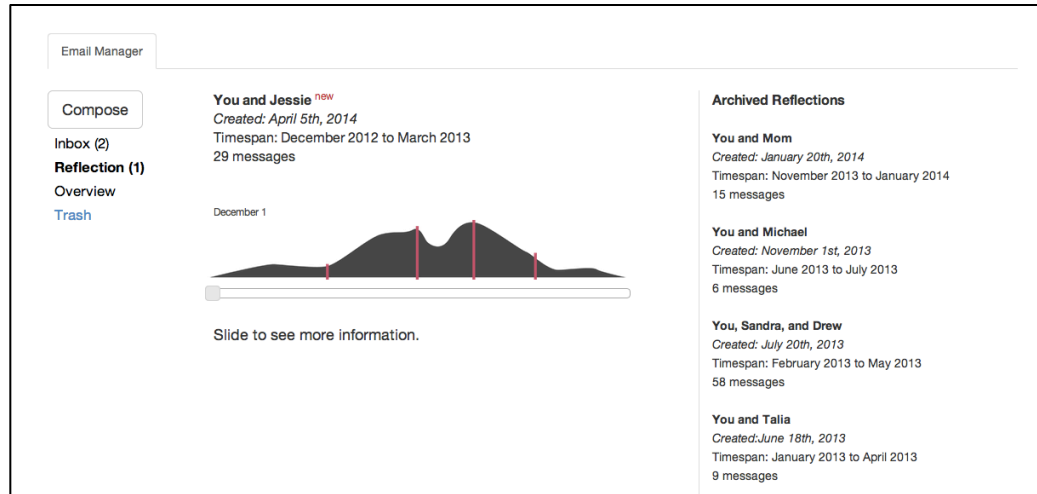
Figure 27: A thread highlighted in the MailMem probe.

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 [117]. 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 [73, 191]. 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.
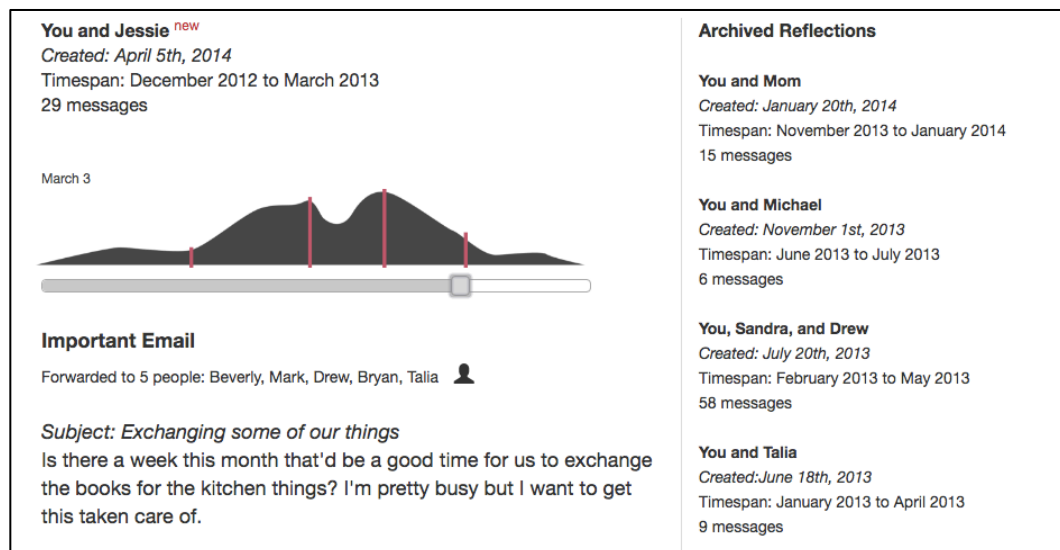
Figure 28: An email thread selected by MailMem in the scenario presented to participants.

7.3.2 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 29. 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.
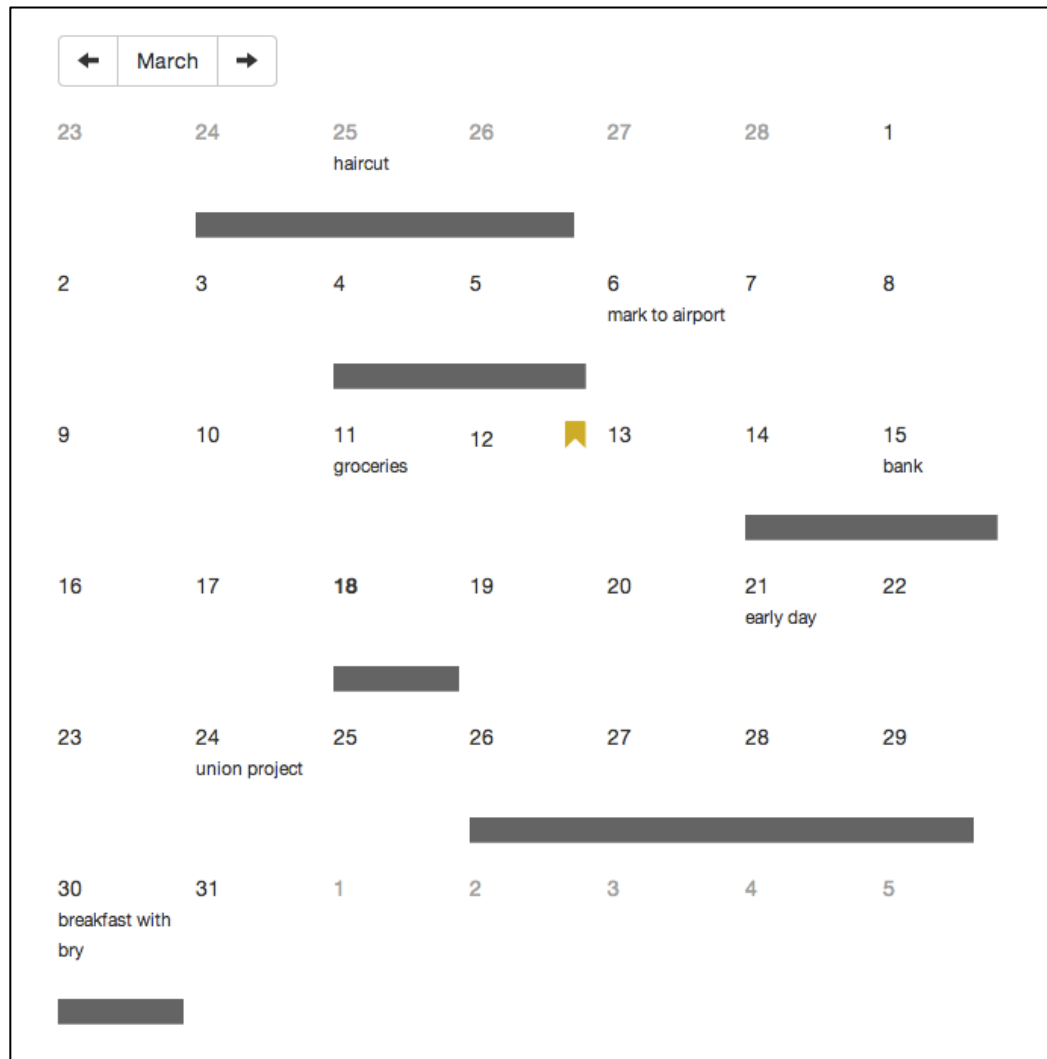
Figure 29: Calendera with a bookmark showing that there is information available for view about a person's family.

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 (Figure 30): 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.

This was the day **your parents** took their **first trip** together. They went to New York City and visited **Central Park.**

View photos from their trip:

This was the **first day** your dad ever **listened to the Beatles.**
He went on to listen to Abbey Road over 200 times over the course of his life. **Listen now?** ▶ ■
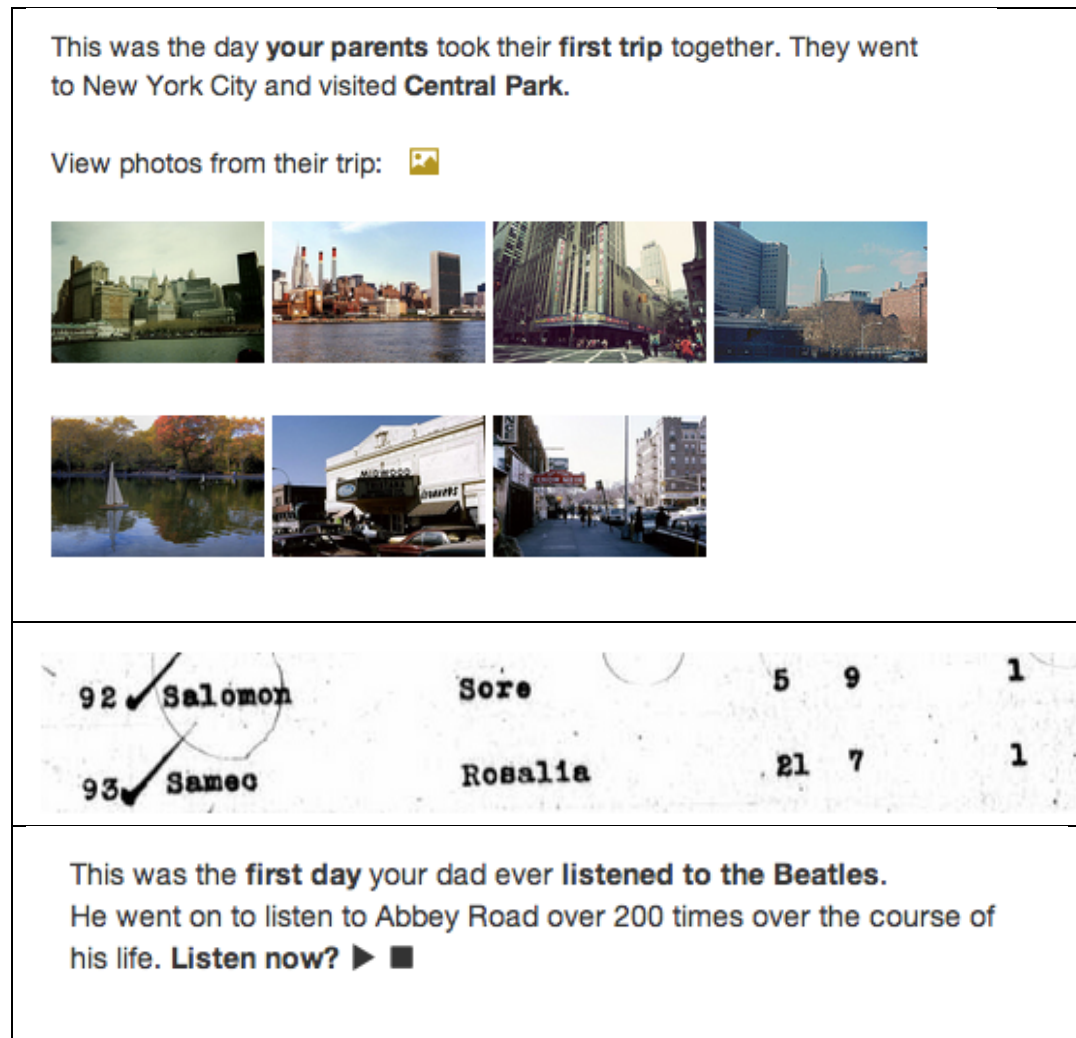
Figure 30: Three micro-remembrances created for Calendera that were presented to participants as they explored the site.

The sketch in Figure 31 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. This sketch was created during the initial system design phase of the project.

Extending work on everyday reminiscence [38], 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.
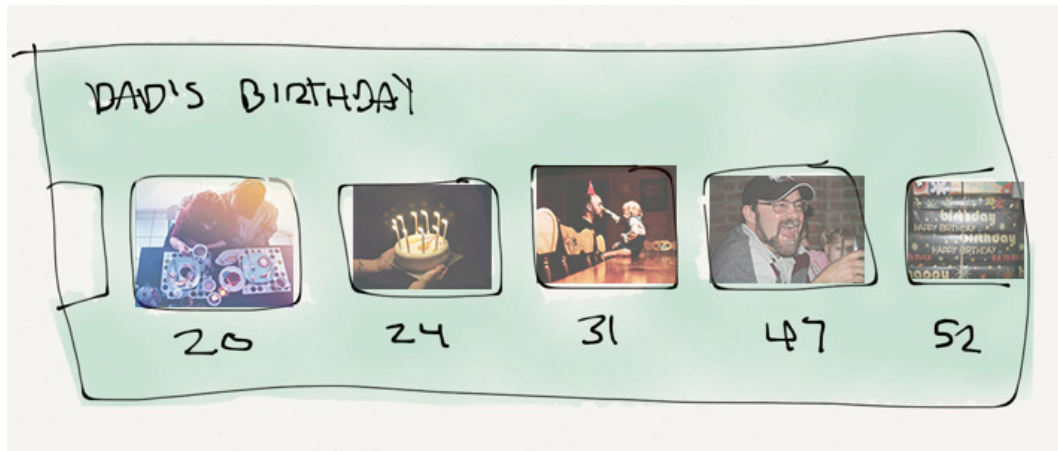
Figure 31: A sketch depicting the different types of information that Calendera could show.

7.3.3   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 (Figure 32) 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.
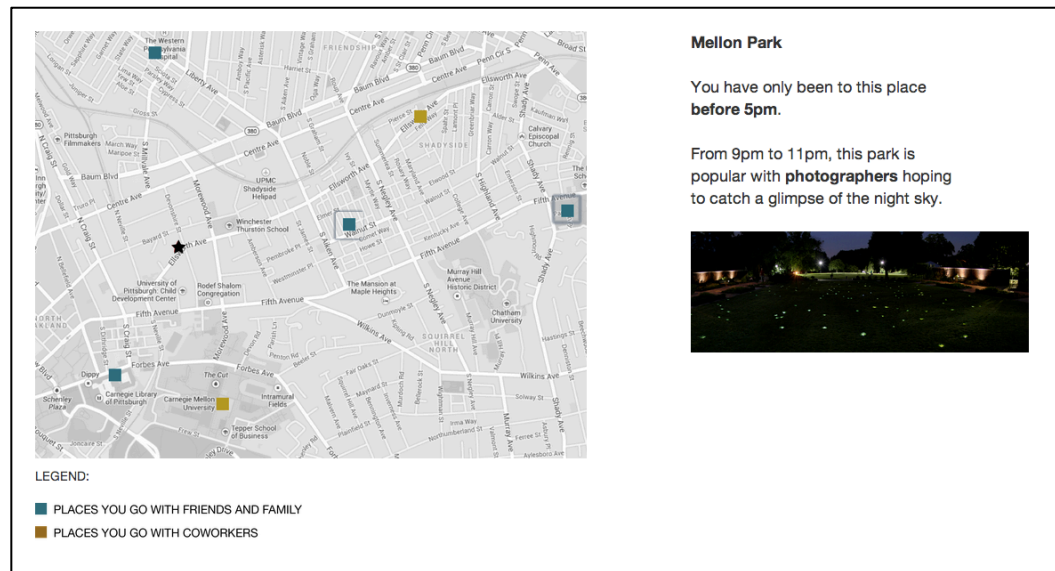
Figure 32: Location information and context in Locale.

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 [104, 170]. 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.

7.3.4 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.
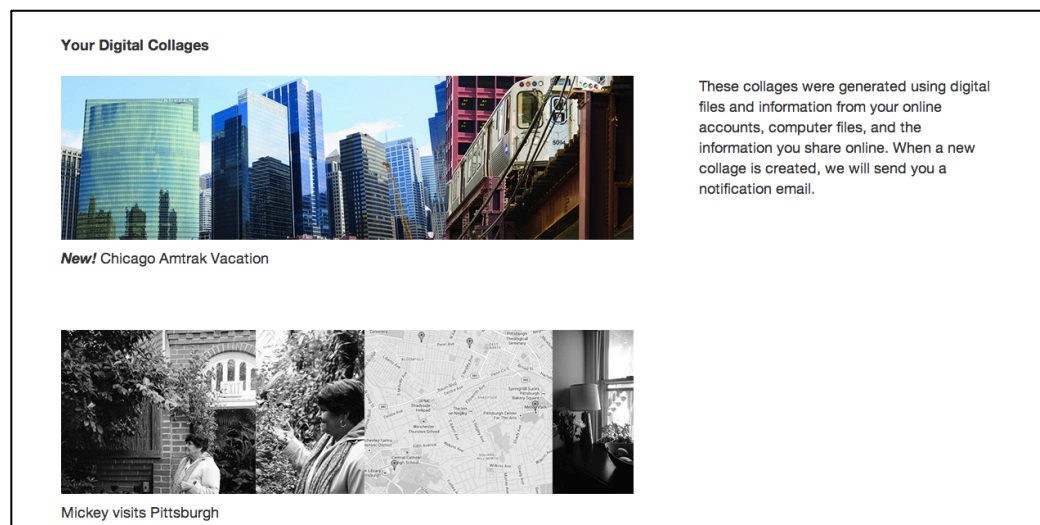
Figure 33: Collages available through the Gather probe.

I asked participants to explore an assemblage generated for a trip to Chicago. As seen in Figure 33 and Figure 34 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 [54], 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 34: An assemblage presented by Gather.

7.4 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.

7.5 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.

7.6 Findings

All of the study sessions were audio recorded and subsequently transcribed by me and two other 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. Finally, based on the findings from my prior work, I suspected that participants would describe a tension between the feeling that systems exert a great influence over how a person's information is managed and a person's desire to express themselves in particular ways using that information.

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.

7.6.1 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 [166]. 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 [129]. 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.

7.6.2   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.

7.6.3 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.

7.6.4 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 [103], 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.

7.7 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 [7, 32], 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 [209]. 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 [118]. 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.

7.8 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.

7.8.1 Exposing System Interpretations

Prior work [9, 116] 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.

7.8.2 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.

7.8.3 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.

7.9 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.

7.10 Conclusion

This chapter draws on 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. These prototypes were based on findings from my prior research and allowed me to collect information that describes opportunity areas and potential issues associated with developing digital tools that analyze and interpret large collections of digital information. Findings from this study suggest 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.

This work raises questions about how to design systems that reflect existing practices surrounding death, dying, inheritance, and legacy while leveraging emerging technological capabilities. These questions ultimately play a central role in my dissertation research.

Chapter 8: Preliminary Dissertation Work

8.1 Introduction

For the first part of my dissertation work, I conducted a preliminary study to better understand how people think about how they'll be remembered after they've passed away. My prior research (covered in Chapters 5, 6, and 7) identified a number of considerations that might influence the impact, value, and availability of a person's digital information many years into the future. In this study, I wanted to explore how that digital information, and its potential influences, might intersect with how a person wants to be remembered and the legacy they'd like to leave behind.

A survey of related literature in this space highlighted a lack of research in human-computer interaction that dealt with (1) how people consider their life and legacy through digital materials and (2) how people engage in family history research to learn more about the lives of people who have passed away. Although there are several well known websites that help people do this type of research, such as Ancestry.com, there has been little academic research in human-computer interaction that examines how and why people research their family history. This information could be helpful as we design systems that allow people to engage with large collections of multigenerational content.

Despite the lack of work exploring legacy and family history research in HCI, prior work from related disciplines informed the design of this study, particularly the understanding of how people think about the qualities, use, and lifespan of different types of information [103], an analysis of the digital objects in a home that people value or place meaning on [147], and information about how people think about the management of large collections of digital materials [110, 112]. This work helped me better understand potential opportunity areas for the development of digital systems and illustrated a number of ways in which experiential qualities of people's relationships with both material and immaterial artifacts are not adequately supported by digital systems.

This project was designed to lay the groundwork for a more comprehensive system-focused study, which I describe in the next chapter. Before designing that larger study, it was important to better understand how people think about the legacy they hope to leave behind, how a person's understanding of their legacy changes over the course of their life, and how people relate to the things (money, objects, traits, stories, etc.) passed on and left behind by previous generations. This first study was designed to explore those ideas and to draw out ideas for the design of the technology probe I could deploy in the second study.

8.2 Participants

I recruited nine participants from the Pittsburgh area. These people were primarily recruited through a local listserv. I sent an email to this list asking for participants who were interested in talking about their life and about how digital services like social media sites influence how they think about what they'll leave behind. Requirements for participants were relatively flexible, the only requirements were that participants needed to be able to use a computer, be over the age of 18, and be willing to have me visit their

home to conduct the interview. I also noted in my email that I was interested in recruiting participants of different ages and from different stages of life.

From the responses I received, I selected three participants from each of the following age groups: 18 to 35 years old, 35 to 55 years old, and 55 to 95 years old. The average age of the participants was 49.3 years old, with ages ranging from 26 years old to 86 years old. Five of the participants were women and four were men. 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. In addition to being diverse with regards to age, the participants were diverse with regards to their proficiency using technology, their marital status, whether or not they have children, and their employment. Table 3 below provides information about each participant to provide some context about the participants' lives and families. In that table, I have generalized some of the information about participants to protect their privacy.

Though the sample size for this study was relatively small, incorporating people from different stages of life yielded valuable insights. 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. Indeed, as is illustrated by the table, many of the older participants had experienced changes (divorce, having a spouse pass away, entering into new relationships) that could influence how a person thinks about their life and legacy.

P#	Age Group	Gender	Occupation	Family
P1	35 to 55	Female	Social Worker	Long-term relationship; has children
P2	35 to 55	Male	Fundraiser	Married; doesn't have children
P3	18 to 35	Male	Programmer	Married; doesn't have children
P4	55 to 95	Male	Health Worker	Long-term relationship; divorced; has children
P5	35 to 55	Female	Professor	Married; doesn't have children
P6	18 to 35	Male	Analyst	Long-term relationship; doesn't have children
P7	55 to 95	Female	Nurse/Student	Long-term relationship; divorced; had children and grandchildren
P8	18 to 35	Female	Membership Coordinator	Long-term relationship; doesn't have children
P9	55 to 95	Female	Artist/Retired	Widowed; has children and grandchildren

Table 3: An overview of information about the participants. Information about their jobs, ages, and families has been generalized to protect the privacy of the participants.

8.3   Methods

For the first part of this study, participants were sent a survey and asked to list between twenty and twenty-five things that they believe will comprise their legacy. The survey (an excerpt of which is shown in Figure 35) described a legacy in very general terms, noting that a legacy could include nearly anything, including one's values, objects, information, and biological traits. In the survey, participants were also asked to answer four other

questions after completing their list. I asked participants these questions so that I could get a better sense of how they think about their legacy and their relationships with important people in their life:

1. What does legacy mean to you?
2. In a sentence or two, please describe the legacy you think you will leave behind.
3. How would you describe your relationship with your family?
4. Do you have children? If not, do you plan to?

Figure 35: A snippet of one participant's survey responses.

After they completed the survey, I scheduled an in-person interview session with each participant. Interviews took place in participants' homes and each participant brought a copy of their survey responses to the session. For the first part of the session, I asked the participants to talk about completing the survey, how their understanding of their legacy has changed over the course of their life, who the intended audience is for the different parts of their legacy, and how they would feel if aspects of their legacy were not known or received by future generations. I also asked participants to go through each item on their list and describe it and why it had been chosen. As a part of this process, participants shared many stories about their life and several took the time to show me some of the objects in their home that they had included in their list. I took notes as participants described the items they had chosen and as they answered interview questions. Interviews lasted between 1 to 2 hours and participants were paid $10 an hour for their time.

After the interviews, I transferred the contents of participants' surveys to a spreadsheet and coded each item according to the legacy framework proposed by Hunter and Rowles [88]. That is, each item was coded according to whether it represented a value, a part of someone's material legacy, or part of someone's biological legacy. This analysis was influenced by each participant's description of why they had included each item and the significance of that item. After the interviews were over, I analyzed the survey responses and the information participants discussed during the interviews to identify a number of findings and opportunity areas for further research.

8.4 Analysis

As I completed the interview sessions and talked with participants, I was surprised to see the many different ways that participants responded to the survey. Responses varied along two main characteristics – the number of items listed by each participant and the

specificity of each of the items. P3, for example, included just 3 high level things on his list of what he hoped to leave behind after his death: financial security, documentation (birth certificates, legal documents), and family property (jewelry, real estate). On the other side of the continuum, P1 responded to the survey with 25 items (the maximum number) that had varying levels of specificity and included things like her love of 'bold colors' and her 'belief in the afterlife.' All told, participants responded with an average of 15.6 items on their lists, with a range of 3 to 25 and a standard deviation of 6.8.

As noted in the previous section, I coded each participant's responses according to the framework described by the legacy framework created by Hunter and Rowles – they were categorized as being connected to one's values, material legacy, or biological legacy. The vast majority of the items people listed referred, in some way, to their desire to pass down values or memories. 86 of the 141 items listed by participants referenced their values, 46 referred to items – either virtual or physical, and 9 referred to biological characteristics or traits. I also conducted a high level analysis of responses to the other questions on the survey and to the interview questions, particularly questions about what people think legacy means and how people engage with things left behind by other people.

8.5 Findings

The analysis yielded a number of notable findings. In this section, I describe the findings, provide example responses from participants that help contextualize these findings, and describe opportunity areas that shaped the follow-up study described in the next chapter.

8.5.1 Rethinking Value

The majority of the items participants included on their lists reflected a desire to pass on traits or ideas that they valued, such as the importance of kindness and a good work ethic (P4), a commitment to creativity (P7), and generosity to others (P8). In the HCI community, much of the work (including my own) that touches on legacy, death, and dying has focused on the transmission, ownership, and management of digital and physical materials. This prior work has grown out research that studied how people engage with material possessions, in an attempt to leverage that information to understand how we can help people engage in meaning-making with digital things. My interviews with participants, however, made it clear that when you focus on a person's legacy (or how they'll be remembered after their death), there is a strong desire for people to communicate and be remembered for their values, memories, and experiences.

When participants chose to include physical or digital objects on their lists, they often chose things that were emblematic of their values or meaningful experiences, regardless of the monetary value of the object. For example, P6 discussed wanting to pass down his grandmother's paintings and several recipes he had collected over time. These objects were not particularly valuable in a financial sense, but conveyed information about his life and that of his grandmother. Participants who demonstrated a desire to pass down things with financial value often emphasized the impact those things could have on the quality of life of the people who received them. In our interview, P2 talked about his belief that money had the most value as a way to improve other people's lives. He included three money-related items on his list of 10 items, all three of which were framed as a way to help others, including a belief in "better lives achieved through charitable contributions", fostering "strong community institutions through charitable contributions", and "sharing

financial gains with friends". Similarly, P3, who listed just 3 things on his list, included only items that he felt would help his family cope with the short-term and long-term aftermath of his death. If you were to look at his list: financial security, documentation, and family property, it might not be clear initially that his main goal in selecting those items was to help his wife and family in the event of his untimely death.

The takeaway here is not that passing down possessions or things with monetary value isn't meaningful. Instead, this work demonstrates the importance of considering what money or objects might signify to both the person passing them down and to the people who will receive them. Objects or money may not endure or play a role in people's everyday lives, but there is the potential for some representation of a person's values to be captured, represented, and communicated using digital systems in a way that allows other people to remember a person's life long after they've passed away. Interviews with participants highlighted the importance of focusing on the experiential and value-oriented aspects of one's legacy.

8.5.2 Legacy from Different Angles

Participants' understanding of their legacy was often framed by the impact they would have on family or friends. Participants hoped to have a legacy that positively impacted the lives of future generations and that captured a sense of their identity and values.

Though this conversation often centered on their familial and personal relationships, participants also touched on the legacy of their work. Some participants viewed their job as a way to acquire resources that they hoped could help shape other people's lives. Other participants identified ways that their work could impact the people they serve and work with. For example, P5 talked about the potential contributions of her work as a researcher and professor. She hoped that her academic contributions would have an impact on her field and on future generations of researchers. She also hoped that she had made an impact on the lives of other women and people of color who worked with her and took her classes. P4, a health worker, listed selflessness as a value he hoped to leave behind and talked during the interview about his experience helping patients regardless of their ability to pay for his services. He was clearly passionate about his commitment to helping those in need and hoped his actions would help encourage others to do so as well.

It is not surprising that some people consider their work to be a part of their legacy – either through the direct consequences of their work or through the way it reflects some values they hold. It is, however, interesting to consider how aspects of a person's legacy might be expressed in different social groups and contexts, particularly outside of one's close friends or family. A person's family might know them to be a caring person without knowing details about how their work, or life outside the home, has impacted others. People's work can also make an impact on other ways – many people make sacrifices with their work and education so that they can help other people live a better life. A person may not love their job, commute, or schedule, but their work allows them to contribute to their family and loved ones. The challenge of connecting different aspects of a person's life at home and elsewhere elicits questions about how systems that curate and share information about a person's life after their death can be designed to support these distinct, but related, narratives.

8.5.3 Considering the Future of One's Legacy

Participants in the youngest age groups often talked about their legacy in a prospective sense – as something that was in progress or that had yet to take shape. Several provided examples of how they hoped their legacy would change in the near and distant future. In one example, P8 included several items on her list that she someday hoped to own or to have accomplished. This included her hope that her work would have a major impact on different religious communities. In addition, she described how she someday hoped to receive objects of religious significance from her family that she could then use with her future children. Similarly, P6 included a number of items that he hoped to share with any children he might someday have. Participants who included these types of items in their responses were often influenced by family and religious traditions, their experiences as children, and their observations of how other people experience significant milestones.

In some ways, a person's legacy is inherently aspirational. Regardless of a person's age, experiences, or stage of life, the legacy they hope to leave behind may not align with how people look back on their life once they've died. Additionally, few people are able to have an impact that extends beyond a few generations or beyond one's direct social circles. Digital systems, like Facebook and obituaries websites, may have made the grieving process more accessible to a wider audience, but it is not clear if they will influence how people reflect on or look back on a person's life beyond that. This sense that a person's legacy is continually in progress raises issues regarding how a person's life should be remembered online. Additionally, it encourages us to consider how digital systems that create representations of a person's life reflect the ways in which a person's life and legacy change over time and how the desire to be remembered in a particular way might reflect some broader values.

8.5.4 A Moving Target

Several of the older participants talked about the ways in which their life, and consequently their legacy, had changed over time. P1 described how, several years after her divorce from her ex-husband, she had reconnected with and started dating a man she had dated in high school. This man had two children from another marriage and she talked about how she was grateful for, and excited about, the opportunity to be a part of his children's life. This major and unexpected change was clearly something that had made a tremendous difference in how she understood her life's trajectory and meaning. Several other participants with children also talked about how the process of raising children had shaped their understanding of their legacy. In particular, some expressed dissatisfaction with their relationships with their children. Participants also talked about their relationships with their partners and how those relationships had changed over time. One participant had recently lost her husband and was adjusting to a new chapter of her life, having combined households with her daughter, son-in-law, and their children.

The changing nature of people's relationships with their families emphasizes the complexity involved with communicating one's legacy after that person has died. That is, the way a person is remembered at different points of their life may not reflect how they want to be remembered nor how their life will be interpreted through the lives and experiences of other people. This finding illustrates that there is an opportunity to build systems that reflect the many ways in which a person's life may change and be interpreted over time, not only during their own lifetime but also long after they've passed away.

8.5.5 Family History

I also spoke to participants about questions they had about their family members or ancestors. Some of the responses were specific – P1, P3, and P4 wanted to know what had happened to particular family heirlooms (such as watches and vases) that had been lost, damaged, or stolen while in the care of other family members. Others, like P2, P5, and P6 had questions about decisions made by their relatives, and about their relative's experiences living through challenging circumstances like war and social injustice. P6, for example, wanted to know more about his grandfather's experience being deployed as part of the invasion of Normandy in World War II. My goal was to better understand how people learn from and engage with what people leave behind when they pass away. It was clear from participants' responses that people have complex relationships with their relatives, even those who have long since died. One's family history provides a lens through which a person can understand their own life, and the questions they have about that history can reflect the desire to better understand their own identity, experiences, and relationships.

There are few existing digital systems that allow people to engage with personal information about the lives of people who have passed away; the development of practices that encourage people to document their lives online with some regularity may change how people understand their own life and the lives of others. However, it is not clear what impact information held by websites like Facebook or Twitter will have on how a person grapples with deeper questions about a person's life. That is, even with all of the information that is captured about a person's life online, these systems may not capture information that aligns with questions asked by future generations. Furthermore, digital systems may not be able to identify and present this information to the people to whom it would be valuable in the appropriate contexts. These potential misalignments are opportunities to consider how we might build digital systems that support the ability to reflect on the lives of people who have passed away.

8.6   Moving Forward

The ultimate goal of this research is to understand how to best build digital systems that help people engage with legacy-oriented practices like passing things down to future generations and researching one's family history. This work draws attention to a number of complexities that have not yet been addressed by digital systems: (1) the relative importance of a person's values and experiences, (2) the various lenses through which a person's life can be viewed, (3) the notion that a person's legacy is continually in progress, (4) the process by which a person's legacy may not live up their expectations, and (5) the ways in which people's lives are influenced by other people's legacies.

Existing systems have only begun to consider the issues that arise when a user passes away, but there is tremendous potential to use the information that is collected by digital systems to help people better understand their own lives and the lives of people who have passed away. This project, and the rest of my prior work ask how digital systems can be developed to reach this goal. Some limited progress has been made, but to move forward we need to better understand how people and systems can work together to address the complexities identified in my work: questions about the ownership and long-term management of digital information, the difficulty of deriving meaning from large but

selective digital archives, the potential benefits and consequences of systems that help people engage with their digital information, and the challenges associated with identifying and communicating the important aspects of a person's life. I developed the study described in the next chapter to draw together and investigate these questions. The findings from that work identify how we can build systems that support a person's ability to engage with multigenerational data in a way that helps them better understand their own life.

Chapter 9: Retrospect Field Study

9.1   Introduction

This chapter presents Retrospect, a website I developed and then deployed in a field study with ten participants over the course of nine weeks. In the preceding chapter, I presented a study that illustrated ways in which people's desire to be remembered or to remember others were not being addressed by existing systems. As a reflection of a person's life, values, relationships, and hopes, a person's legacy changes over time in ways that are significant but not always predictable or desirable. Though services like Facebook and Google have developed practical tools that allow people to deal with complications that arise after a person's death, few, if any systems support the ability to engage with a person's digital information over the long-term.

This project was designed to explore a collection of ideas that grew out of my prior work, particularly the relationship between people and systems as they work together to manage digital information before and after a person's death. In this study, I investigated the role digital systems should play 1) in representing different aspects of a person's life and legacy, 2) in communicating media and information after a person's death, 3) in helping people revisit information about their own life and about the lives of people who have passed away, and 4) in contributing to the maintenance of digital materials. This work also investigated how we might reimagine existing models of legacy to better reflect the aspects of a person's life that are represented by their digital information and data.

In this chapter, I describe a collection of high-level questions that I explore in this work. These questions reflect the cumulative findings of my prior work and research that I did in preparation for this project. I then outline the creation and deployment of Retrospect, a website/probe that I developed for this study. After that, I discuss the methods used to deploy and collect data using this probe and other qualitative techniques including semi-structured interviews. Finally, I close the chapter with a description of the findings and a discussion about how researchers might build on and make use of this information in the future.

9.2   Research Questions

This work draws from a number of existing bodies of research in HCI and in other disciplines. In this section, I describe five research questions that frame this work, all of which were drawn from an overarching question about the ability for systems to help people communicate and engage with legacy-oriented practices and from specific findings from my prior work. For each of the research questions, I discuss related research that helps ground these questions and describe how these questions were integrated into the study design.

9.2.1 Faceted Identity

Research Question: How should digital systems represent different aspects of people's life in the context of their legacy?

A person's presentation or enactment of their identity is shaped by different contexts and situations [65]. For example, a person may present a different identity at work than they do when they are among close friends or when they are out at a concert. As was indicated by the preliminary study described in Chapter 8, 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, but related legacy to different groups of people or through different aspects of their life [102]. Additionally, people may want to emphasize different parts of their life when they consider their life through the lens of contributing to a personal, familial, cultural, or societal legacy. The preliminary study and the studies described in Chapters 6 and 7 highlight the many ways in which people make decisions about what to share in different social contests.

The distinctions between different presentations of one's identity offer an interesting opportunity to develop applications that 1) allow people to articulate the type of impact they hope their legacy has within different contexts or 2) help people understand the relationships between one's values and the way they communicate those values to other people across the many different aspects of their life. In addition, systems that can perceive and communicate the connections between different aspects of a person's life may provide a platform for people to convey how they want different types of digital information and media to be managed after their death, reducing concerns about the provenance and management of digital materials over time.

In this final study, I explore the idea of faceted identity in interviews with participants. As I describe in the methods section, participants in the study created participant-aided sociograms and the information they shared as a part of this process was used to ask questions about how they'd like to be remembered by different groups of people after they've passed away. Their experiences interacting with their digital data through Retrospect also helped to ground a conversation about the different aspects of their life that are captured by digital systems and devices.

9.2.2 Communicating and Transferring Personal Digital Information

Research Question: What role should systems play in communicating information about a person's life after they've passed away?

As discussed in Chapter 5, the lifespan of digital materials is highly dependent on the systems that hold those materials [70]. People often feel as though systems will have the final say in how long a photograph or post will be accessible and that websites like Facebook, Twitter, and Google exert considerable influence over the lifespan of the information they have shared online. This understanding 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 addition, the scale and fragmentation of people's digital records and archives poses challenges for people who want to manage the information that is available about them online. As was illustrated by the study described in Chapter 6, most people do not keep track of all of the places where they have shared information online and don't have a complete inventory of all of the services and systems that hold their personal information.

In this study, it was my goal to explore how and if systems should play a role in the transmission of digital content between generations of people. When a person passes away, they may indicate, such as through a will, that different assets or objects should be

given to another person or institution. Some websites, like Facebook, have begun to develop features that allow people to assign management privileges to other people post-mortem, in some ways mimicking the ways in which people leave behind physical possessions. These new features solve some immediate problems, such as needing to access a dead person's Facebook profile to convert it to a memorial page or share information about funeral services, but raise larger questions about how people should manage the dozens of active accounts they may have at the time of their death. Allowing people to specify an individual to inherit or manage each of their digital accounts may not be a viable solution, and this practice is limited to a small set of accounts and services. These features raise additional questions about what happens to these accounts generations later, after the account manager has also passed away.

After talking to participants about the aspects of their life that they hope will endure after their death, I became interested in how digital systems might represent those things in a way that does not require people to make formal decisions about the ownership and transfer of their accounts. That is, while people may be interested in assigning a legacy contact or account manager for their Facebook or Gmail accounts, they may not be interested in, or able to, assign individuals to manage the dozens of other places where they've shared information online. Instead, we can ask how digital systems can independently take information that is available about a person's life and display it in a way that communicates information that person would want to share posthumously and that would have value for future generations.

To investigate this question, I developed interview questions that gathered information about each participant's experiences inheriting things from other people, being impacted by their memories of people who had passed away, and their own plans to pass things down to people after their death.

9.2.3 Revisitation and Family History Research

Research Question: How can digital systems leverage digital materials and resources to connect people with information about their family history?

A number of digital systems have been designed to encourage people to revisit their own digital materials, including research products like Pensieve [38] and new features for existing social networks, like Facebook's On This Day feature. These systems prompt people to reflect on their past and leverage digital information they've shared to foster recollection or reminiscence. Research on systems that foster reminiscence and self-reflection suggests that these practices have value as a way for people to learn more about themselves [83, 161]. However, there has been little research on how people use tools like On This Day in social contexts (where one's goals may be different). For example, a person re-sharing an old photograph on Facebook may be motivated by a number of factors, including demonstrating the strength of their connection with another person, conveying some information about their past, or calling attention to a particular experience.

With regards to inherited or multigenerational digital records, it is not clear if people will make sense of, or make use of the information held in digital accounts in a similar way. 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 digital systems can help support the process of revisiting another person's digital materials in meaningful ways. Part of this work involves identifying contexts in which people are open to reminiscing about people who have passed away, and this study provides an opportunity to learn more about people's experience living with, researching, and managing materials left behind by other people.

The Retrospect probe asks participants to revisit their digital content and to reflect on different aspects of the information they've shared online. The design of the system, coupled with interview questions about participants' practices revisiting their own digital content, were used in this study to better understand opportunities for system design. In addition, I spoke to participants about their experience researching their own family history to get a better sense of what motivates people to do this kind of research, and consequently, what types of services future systems should support.

9.2.4 Experiencing Legacy

Research Question: How can digital systems represent experiential or value-oriented aspects of a person's life?

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 and making sense of one's life. However, after a person's death, people left behind may not perceive that information in the same ways, 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. Indeed, the ways in which people experience legacy may be vastly different than a person's understanding of what they'll leave behind after their death.

In this study, I was interested in learning more about how people experience the legacy of others and how that influences how they think about their own ability and desire to have an impact on future generations. Many of the people I spoke to in the preliminary study gave examples of how their life had been impacted by others but struggled with the idea that they were contributing to a legacy of their own – the word itself seemed to be associated with people who are in positions of privilege and power. This has two interesting implications: the first being that it requires a certain amount of empowerment or confidence to believe that you have an impact on other people posthumously and the second being that people are constantly being influenced by decisions that were made by other people long before they were born. These ideas highlight the potential value in helping people understand how their life might be perceived by others and in developing systems that can lift out meaningful aspects of a person's life from their digital materials.

In this study, I follow up on that work and use the Retrospect system to provoke conversations about the aspects of each participant's life that is captured by digital systems and how that information reflects how they'd like to be remembered. Retrospect was purposefully designed to encourage people to talk about aspects of their life that might not otherwise be recorded online, and this aspect of the design helped ground conversations about the ways in which systems shape a person's ability to reflect on their own life.

9.2.5 Legacy and Digital Things

Research Question: How can we adapt existing models of legacy to account for digital materials?

The Hunter and Rowles legacy framework [88] describes legacy as something that is composed of one's values, biological information, and material possessions. As might be obvious, some of these components are easier to represent and transmit than others. For example, passing down a scrapbook is typically less complicated than instilling your children with your values or passing on your genetic material through organ donation. The emerging importance of (some of) people's digital information evokes questions about how digital materials might be integrated into this model and might represent different aspects of it. Prior work in this area has often focused on one's information and media as both a possession and a representation of one's experiences [70, 147, 95].

The increasing scope and capability of digital systems opens a number of new possibilities for using digital information to pass on aspects of one's legacy instead of simply passing on one's accounts without editing or interpretation. 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.

In this study, I talked to participants about the ways in which digital information does and does not factor into the legacy they hope to leave behind. Using the information I collected during those interviews, I worked to develop a small number of models that re-frame legacy in ways that reflects the emerging significance of digital things and that represent the ways that people experience the legacy of others.

9.3 System Development and Design

After identifying the research questions I wanted to explore in this study, I started working on a system that could be deployed over a number of weeks to help participants engage with those ideas, both as they used the website and during one-on-one interviews. This was my first long-term deployment of a research probe; all of the other probes I'd developed had been used exclusively during interview sessions. The design and development of this probe reflected the challenges and opportunities posed by creating a system that participants would use outside of interview sessions. On a high level, my goals were for the system to be engaging, reflective, and enriching for participants. It was also important that the website be robust and able to handle potential issues with gathering and presenting user data over the duration of the study.

The website I ultimately created, called Retrospect, took several months to design and develop. Designs for the website went through a great number of iterations, but started with an analysis of other probes I'd developed over the course of my PhD. Though each system I'd develop had been analyzed in its own paper or in relation to systems that had come before, it seemed potentially useful to take a broad look at these systems and better understand how I might build on what I'd learned from developing these systems and from asking participants to use them. This analysis helped me better connect my

dissertation work with research opportunities I'd identified using those systems in my prior work and highlighted the opportunity to continue to explore how people understand the roles that various stakeholders might play in making sense of and managing digital data over the course of lifetimes or generations.

I then undertook an exploration of what data could be harvested from the APIs provided by different websites and social media sites. The data available through these APIs served as the materials I used to experiment with different potential designs and provided constraints for what I could build. As a part of this process, I explored and tested a number of different APIs and databases to get a better sense of what would be feasible to build for this study. I also tested different methods for collecting information from social media services (including Facebook and Twitter), publicly available data sources (such as the US Census), and different location-based services like Google Maps and Yelp. Figure 36, Figure 37, and Figure 38 show some early designs I developed during this stage of the development process. These designs reflect the many different data sources I initially considered for this study.

After developing some early design ideas and exploring existing APIs, I decided to build the probe using Facebook data, which could be accessed via Facebook's developer tools. I chose to use Facebook's API for a number of reasons. Their API functionality was well documented and there was a large group of developers using the API (which turned out to be immensely helpful when I ran into issues developing the site). In addition, the popularity of Facebook helped ensure that I could find participants who had Facebook accounts from which the website could gather data. The decision to use Facebook data and the Facebook API resulted in new constraints for the design of the probe.

Figure 36: A potential design idea for the technology probe. This idea proposed building a system that would allow a person to reflect on media created during a particular time period.

Figure 37: A potential design for the technology probe. This design proposed using public archives to facilitate capturing information about a person's family history.

Figure 38: A potential design idea for the technology probe. This idea focused on using different places from a person's past as a resource for reflection.

After choosing to focus on information available through Facebook's API, I took the many designs I'd developed and experimented with ways that I could adapt some of these designs to make use of information available through the Facebook API while still addressing the larger goals of the study. I also changed my design plan in response to university guidelines that limited what information could be displayed, solicited, and captured about third parties, which limited my ability to ask participants detailed information about other people or to display pictures that might accidentally solicit this

type of information. Through this process of exploration and experimentation, I ultimately designed a website, called Retrospect, that uses a person's Facebook data to prompt them to reflect on different changes and life stages they've experienced over the course of their life.

This design allowed me to investigate the central research questions that motivated this research and also build on existing work that explored how people reflect and reminiscence. Though I was not interested in making any primary contributions to research on everyday reflection and reminiscence, this work provided guidance as I sought to build a system that would allow me to explore the research questions I identified in section 9.2, while also providing participants with an engaging experience.

9.4   Retrospect

The Retrospect website was developed using the Python programming language and was translated to the web using Flask, a framework that allows you to build and deploy websites using Python and a host of related services like, SQLite3, a data management tool. The website was hosted on a platform called Python Anywhere, which offered secure hosting and an appropriate level of functionality for a small website. This combination of programming languages, frameworks, and web hosts was one of many I considered and experimented with as I created Retrospect. It was difficult to find services that could support the functionality I needed (the ability to create user accounts, access and write to simple databases, access external databases through APIs), and were accessible to a person who was new to developing this type of website. Ultimately, this combination of Python, Flask, and SQLite3 was chosen because these services were flexible and well-documented.

Each participant had a unique account on the Retrospect website that they set up during the first interview by picking a username, password, and by authorizing Retrospect to access some of the information in their Facebook account. Figure 39 shows the process by which Retrospect explained the setup process to participants and asked for permission to access and download Facebook data. I worked through the setup process with each participant, explained what it meant for Facebook to grant Retrospect access to this information, and described how the information would be used.

Retrospect collected the following data from participants:

1. Their 50 most recent profile pictures. Participants were not excluded if they did not have 50 photos; the system simply collected however many they had if the number was less than 50.
2. Location information, including a person's hometown, current city, and any location they had tagged in a photograph or post.
3. Information about milestones or major events. This included a person's work history, education history, and relationship status.

HOME   CONTACT

Almost Done!

There's one last step to finishing setting up the system - authorizing access to some of your Facebook information. The system will use this information to create reflection tasks.

We are collecting the following information from your account:
1. **Photographs**: profile photos from your account.
2. **Locations**: your current location, hometown, and any places you've tagged in a photo or post.
3. **Major events**: milestones with work, school, and relationships.

Figure 39: A page explaining the process of authorizing Retrospect to access a person's Facebook data.

All of the participant Facebook data used during the entire course of the study was immediately stored in Retrospect's database as it was collected from the Facebook API during setup, which meant that the system did not have any information that was shared to a person's Facebook account after the start of the study. As a result, participants were welcome to rescind their Facebook authorization for Retrospect after this setup process had been completed. Another potential implementation of this website would have collected information as it was needed for each task. Though this would have provided slightly more up-to-date information about each participant, it would also have introduced an opportunity for errors if the authorization process went awry at any point.

Website Setup
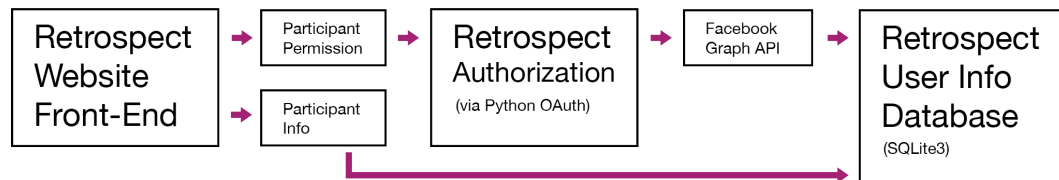
Figure 40: A system diagram depicting the different processes that were involved with setting up each user's account on the site.

With the setup complete, I gave participants a chance to check out the website and ask questions. I then reiterated the expectations of the study, that participants were being asked to use the system over the course of 9 weeks, completing approximately one task each week. When a participant logged into the system, they were directed to their homepage (Figure 41), which displayed how many tasks they had completed, how many tasks they should have completed by that time (if they had fallen behind), and that also invited them to review (but not edit) information they'd completed in previous weeks. Participants who were up to date with their tasks were also invited to answer bonus questions about their life and experiences. These questions were not used in the analysis, but were designed for participants who wanted more opportunities to write and reflect.

The nine tasks participants were asked to complete were broken into three different categories: place tasks, milestone tasks, and gallery tasks. Participants completed three of

each of these types of tasks (for a total of nine tasks). For the places task, participants were asked to reflect on (1) what it was like to live in their hometown, (2) what motivated their decision to come to their current city, and (3) a place they'd been in the past that had been significant to them in some way. For the milestone task, participants were asked to reflect on what it was like to (1) attend and graduate or leave a school they'd attended, (2) work at some job they'd had, and (3) be a part of a relationship with another person. For the gallery tasks, participants were shown 2 profile pictures from different times and were asked to write about how their life had changed between the times when the photographs were taken. Participants had the option to refresh the page to get two new photos if they weren't interested in the photos that were being displayed.
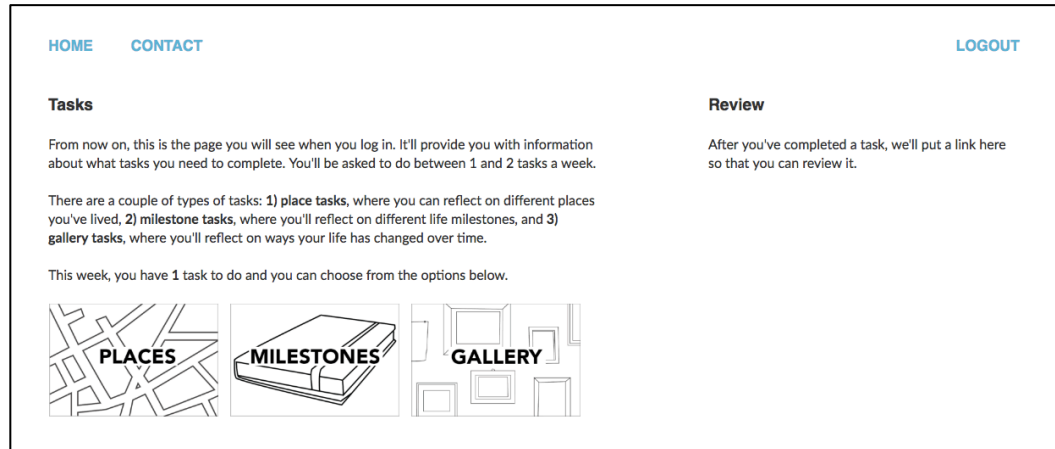
Figure 41: The Retrospect homepage for first time users.

Website Use Post-Setup
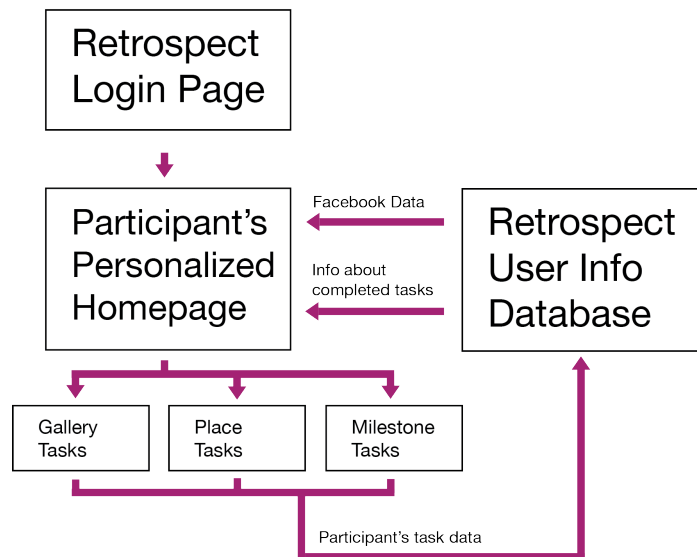
Figure 42: A system diagram depicting how information collected from Facebook and from participants was used by the website.

Participants were not screened or excluded from the study based on the information they had in their Facebook profiles. As a result, the system did not always have all of the information that was used to build tasks for participants. When information was missing, participants were asked to choose or supply their own. For example, if information was missing for a place or milestone task, participants were invited to choose a relevant milestone or location that had some significance to them and to answer the questions based on what they'd chosen. Because the gallery task depended on having access to multiple photographs, the only participant with less than 5 photographs was told to skip gallery tasks after completing the first one. Despite not completing the task, his motivations for having a small number of photographs available online led to an interesting conversation about managing one's personal and professional identities. This aligned with a larger goal of the study: to understand how one's life is represented online and through digital materials.

	Places Task	Milestone Task	Gallery Task
Task 1	Hometown	School	2 profile pictures
Task 2	Current city	Work	2 profile pictures
Task 3	Any tagged location	Relationship	2 profile pictures

Table 4: A table showing the different tasks participants were asked to complete.

In addition to task functionality, the website had other functionality implemented to meet logistical needs associated with using this website for over 9 weeks. For example, users could reset their password, send messages to the researchers from within the website, and access information about the study and the researchers (including a copy of the consent form). After I built Retrospect, I conducted a number of informal pilot tests of the system to screen for errors and for potential security issues. This process was time consuming, but revealed a number of issues that I was able to address before the study started. Across the entire study, only one participant experienced a system error. This error was minor and was fixed within a few hours.

Figure 43: An example of a Gallery task (using my data to protect participant privacy).

Places: Your Hometown

In this task, we are going to ask you to write about your hometown: **Huntington Station, New York.**
The questions below are designed to help you think about the significance of this place and to consider
how this place relates to how you look back on your life and how your life will be remembered after
you pass away.

1. What year were you born?

2. About how many years did live there?

(If you lived there for less than a year, put '0' into the answer for question 2.)

3. Is this place an important part of your life? (Please explain)

4. Can you share a memory about this place?

5. Can you share a second memory about this place?

Submit

Figure 44: An example Place task.

Milestones

It looks like you attended Walt Whitman High School. We're interested in learning m

1. What was this place like? How would you describe it?

2. Can you talk about something valuable you learned while you were there?

3. What was it like to leave or graduate from this place?

4. Can you share a memory about this place?

5. Can you share a second memory about this place?

Figure 45: An example Milestone task.

9.5 Predictions

There were five overarching research questions that framed this work:

Q1. How should digital systems represent different aspects of people's life in the context of their legacy?

Q2. What role should systems play in communicating information about a person's life after they've passed away?

Q3. How can digital systems leverage digital materials and resources to connect people with information about their family history?

Q4. How can digital systems represent experiential or value-oriented aspects of a person's life?

Q5. How can we adapt existing models of legacy to account for digital materials?

Though I had no specific hypotheses, it seems useful here to talk about the predictions I had for each of these research questions. These predictions were based on my experience talking to participants in prior studies and on related research work that influenced my thinking [25, 52, 59, 82 111103, 111, 164, 185].

Q1: I predicted that participants would want to be remembered by different people and social groups in different ways and that there would be sufficient motivation for the development of systems that organize content around these groups. Conversations with participants in the preliminary study provided examples of how a person could be perceived differently by different people and how those differences might help a person identify a number of potential ways in which had made an impact on people's lives.

Q2: I predicted that there was a need for digital systems features that help people transmit digital materials between generations. This prediction was based on my experiences talking to participants about their valued digital possessions and their experience inheriting things from people who had passed away. Findings from studies described in Chapters 5, 6, and 7 supported the idea that people feel as though digital systems have a significant (perhaps the most significant) influence over the long-term availability of their digital data, and it followed that they might also look to digital systems to address issues of ownership over the long term.

Q3: I predicted that participants would be interested in the potential for digital systems to connect them to information about their ancestors. I also predicted that participants would be open to the idea that their descendants might use their digital information to learn more about them. Findings from the study described in Chapter 5 describe some potential limitations to this idea; such as when digital systems gain or have access to private or deeply personal information about a person's life.

Q4: I predicted that participants would be interested in the ability for digital systems to communicate information about their experiences, but that they would be skeptical about a system's ability to do this successfully. Participants in the study described in Chapter 7 detailed a number of concerns regarding how systems might communicate aspects of a person life that they did not want to share or remembered.

Q5: This research question reflects a major contribution of my work: bridging and building on existing literature around aging, death, and dying [107, 108, 118, 88, 183] and other literature about the processes by which people derive meaning from digital information and media [16, 40, 63, 66, 92, 136, 148]. It was my goal to use interviews with participants as a way to better understand how to integrate digital materials into a consideration of a person's life and legacy. I did not have any particular predictions for this question, but hoped that conversations with participants would help me better understand the relationship between digital materials and a person's legacy.

9.6 Participants

I recruited 10 adults from the Pittsburgh area to participate in this study. These 10 participants were recruited using a local email list, and were selected to ensure a participant group that was diverse with regards to age, stage of life, technological proficiency, family size and situation, gender, and socioeconomic status. To participate in

this study, participants had to be at least 18 years old, have a tablet, laptop, or desktop computer in their home that could access the internet, and have a Facebook account. They also had to be comfortable with sharing their Facebook data with the Retrospect system, with participating in in-home interview sessions, and with joining a study that was designed to last over 9 weeks. I provided potential participants with detailed information about these aspects of the study so that they could make an informed decision about whether or not they'd like to participate. At least one potential participant declined to participate after learning more about the requirement that they allow the system to access their Facebook data.

Of the 10 participants, 5 were men and 5 were women. The age of participants ranged from 23 years old to 52 years old, with an average age of 33.8 years old. 7 of the participants were married and 5 of the participants had children. Participants had a wide range of occupations, including a small business owner, a professor, and a nurse. In addition, participants varied with regards to their interest in and proficiency with computers, though all had some means of connecting to the internet, a presence on Facebook, and an email account. Participants also had a wide range of life experiences. For example, nine of the ten participants were not originally from Pittsburgh but had come to Pittsburgh at different stages of their life for work, to go to school, or to move closer to friends and loved ones. They also had varying experiences thinking about death, legacy, and end-of-life care. Several had recently experienced the death of a family member, friend, or classmate.

P#	Age	Gender	Industry	Married	Children	Will?
P1	31	Female	Banking/Housing	Yes	No	No
P2	25	Female	Healthcare	Yes	No	No
P3	34	Female	Small Business	Yes	Yes	No
P4	46	Male	Advertising	Yes	Yes	In Progress
P5	52	Female	Education	Yes	Yes	Yes
P6	24	Male	Banking	No	No	No
P7	23	Female	Student	No	No	No
P8	44	Male	Food Industry	Yes	Yes	Yes
P9	35	Male	Government	Yes	Yes	In Progress
P10	24	Male	Consultant	No	No	No

Table 5: An general overview of information about participants.

9.7 Methods

The study lasted about 9 weeks and had two main elements: 4 interviews and Retrospect, the website I built. Interviews took place primarily in participants' homes, but also took place on campus at Carnegie Mellon when that was more convenient for a participant. Participants were paid a total of $80 for their participation in the entire study. They were paid $20 after the first interview, $10 for the second interview, $15 for the third interview, and $35 for completing the fourth and last interview. All of the participants completed all four interviews and did at least one task of each of the three types. Six participants did all nine tasks - more information about each participant is provided in Table 6.

P#	Total Tasks	Places Task	Milestone Task	Gallery Task	Bonus Tasks	Number of Visits
P1	9	3	3	3	1	35
P2	9	3	3	3	2	40
P3	9	3	3	3	0	36
P4	5	2	2	1	0	161
P5	9	3	3	3	13	54
P6	8	2	3	3	0	66
P7	9	3	3	3	1	59
P8	7	3	2	2	0	25
P9	9	3	3	3	0	74
P10	8	2	3	3	2	41

Table 6: Information about participant activity on the Retrospect website.

During the first interview session, I initially talked with participants about the details of the study. After making sure that they were still interested in participating, I helped them set up their accounts on the Retrospect website, answered any questions they had about the process of authorizing the website to access their Facebook data, and explained Carnegie Mellon's policy on participant data management and security. I then showed them the different types of tasks they'd be asked to do over the course of the study and showed them how to do things like request a new password or report an error. I also explained that Retrospect was a research prototype and that we did not intend to develop it further beyond the scope of the study. Participants were told that the goal of using Retrospect was to help them interact with their digital data, help me get a sense of that data, and to generate materials that could ground the interview questions.

After we were done looking at the website, I then conducted a short interview, lasting between 15 to 30 minutes, to learn more about them and get a better sense of their life and family. I asked them to give a brief overview of their life, to talk about the different websites they visit online, to talk about their experience using websites to revisit older content, and to describe their interest in reflecting on their own life. I also had participants complete a participant-aided sociogram [81], which took an additional 15 to 30 minutes for each participant and which helped me get a sense of the participants' relationships with other people. To create a sociogram, participants were first asked to write out the names of all of the people with whom they had 'very close' and 'somewhat close' relationships. Following [81], we defined 'very close' as "people with whom you discuss important matters, with whom you regularly keep in touch, or who are there for you when you need help" (p. 8) and 'somewhat close' as "people who are more than casual acquaintances but not very close" (p. 8). Each of these categories was assigned it's own different colored post-its, and participants wrote those names on the corresponding post-its. Participants were then asked to arrange the post-its on a set of concentric circles, the circles closest to the center indicating a higher level of closeness. They were also instructed to group the post-its according to which people knew each other and belonged to related social groups. After the participant completed, and was satisfied with, their sociogram, I asked them to explain it to me while I took notes. Figure 46 shows a sociogram created by P10. To protect P10's privacy, I've blurred out all of the names used in the sociogram.

Figure 46: P10's participant-aided sociogram. Red post-its were used for 'very close' relationships and blue post-its were used for 'somewhat close' relatinoships. All of the names have been blurred to protect the participant from being identified.

After I confirmed that each participant had completed at least one task on Retrospect, I scheduled a second interview. I began the second interview by talking to participants about their experiences using Retrospect. For example, I asked them how long it had taken them to complete the tasks, the rationale they used to choose what task to do, and any errors they'd encountered while using the system. I then asked participants to talk more generally about their experiences making plans for their death (such as creating a will), their experiences talking to their parents or relatives about their deaths, their experience inheriting things from people who have passed away, and any recent or significance experience they've had with the death of someone who was close to them. These interviews lasted about an hour. Before concluding the interview sessions, I asked participants to fill out a legacy survey before the third interview. This legacy survey was the same one I'd used in the Legacy and Family study, and asked participants to list different aspects of their life they hoped to pass on to future generations.

The third interview was scheduled for the 6th or 7th week of the study, depending on the participant's schedule. During this interview, the participants described each of the items they included on their legacy survey. I also asked participants to talk about how they define legacy and how they had been impacted by the legacy or memory of other people. We also talked about their sense of how their life and legacy had changed over time. On average, these interviews lasted about an hour.

I scheduled a final interview with each participant after they'd been using the system for 9 weeks. During this interview, I asked them to talk about the experience of using Retrospect. To aid their memory, I created a small booklet for each participant with excerpts of the information they'd shared in each task. Participants were presented with their booklet and many looked through it as they answered questions about their experience using the system. I also asked them to talk about their experiences researching their family history. Finally, I interviewed them about the different ways in which they document their own life online and offline. These interviews lasted about an hour.

9.8   Data Analysis

I digitized information collected during the interviews as they were completed. For each participant, I had three recorded interviews (the first interview was mostly a preliminary session and was not recorded) in addition to many pages of notes and documents. All of the recorded interviews were transcribed, and I also typed up my handwritten notes and any relevant information from documents (like the legacy survey) that I'd received from participants.

After all of the information was transcribed and digitized, I started to analyze the data. I used an iterative, open coding process to analyze the data. I began by reading through each of the interviews to get a better sense of the connections between the information provided by each of the participants. From there, I started to create a collection of codes that described the data and that connected the information I'd collected with the larger goals of the study. The codes went through a series of changes and edits as I continued to review the transcripts. After several revisions, this coding scheme contained 80 codes distributed among ten higher-level categories. Once a final set of codes was developed, I re-coded each interview and began to formally identify meaningful findings from the study. The coding scheme I developed for this study is provided in Appendix D.

As you might note, the information that participants contributed to Retrospect was not included in my analysis. In the tradition of probe work in HCI, Retrospect was used as a tool to draw out interesting tensions and nuances. In this case, I was primarily interested in 1) getting a better sense of what aspects of a person's past is shared online, 2) drawing out examples of when people use Facebook in context-specific ways that might be hard to understand as an outsider, and 3) talking to participants about how that information might shape how they're viewed after their death. The information collected and then surfaced in Retrospect helped me explore these ideas with participants and elicited a rich set of examples drawn directly from participants' experiences using and thinking about the Retrospect website. Although the stories and experiences shared with Retrospect were not formally analyzed, they did influence the interview process in other ways; I read through the responses before the last interview with each participant so that I could ask them detailed questions about their experiences and about the information they'd shared.

9.9   Findings and Discussion

This analysis yielded a number of findings that build on my prior work and on preliminary work from the Legacy and Family Study. Below, I present these findings, starting with those that address the five key areas I originally set out to investigate and concluding with a number of related findings that resulted from this work.

9.9.1 Faceted Identity

For this study, I was interested in understanding how people think about the audience for their legacy; that is, the people who would be affected by their death and would engage in some reflection on, or remembrance of, their life. The goal here was to learn more about how systems should communicate aspects of a person's digital information after their death. The first step of this work was to talk to participants about the different social groups and communities to which they belong. These groups were a product of one's circumstances and a reflection of the decisions a person has made, and had changed over time as people had experienced the transitions that often come with getting older. Participants described many occasions in which their relationships with particular people or groups of people had changed, such as when they got married, changed jobs, moved to a different place, graduated, and so on. It's common for relationships to wane as people forge new connections or set out on a new path. However, it was clear that changes in one's relationship with a person or a group of people does not necessarily change the impact those people had on a person's life nor a person's high level understanding of the significance of that person.

For this reason, understanding the communities to which a person belonged or identified was not entirely straightforward. The sociograms that participants created in this study offered insights about how they thought about their relationships with people from different parts of their life, including: family members, co-workers, former neighbors, and childhood friends. A few details stood out; many participants identified members of their immediate family that they did not have a strong relationship with. Some participants struggled with where to place these people (including, on a few occasion, parents) on their sociogram and struggled similarly as they described their decision to place some people outside of the inner circle. People also felt conflicted about people who had been an important part of their life in the past, but who they did not have a strong connection to at the present.

Systems like Twitter, Facebook, and Google+ use metrics to try and understand the strength of the connections between people who use their service. In some cases, people can directly specify their relationship with another person, such as by identifying them as a family member or partner, or by granting them particular permissions and access to their information. In other cases, these relationships are predicted by systems using other signals, such as likes, comments, and social networks graphs. These methods are certainly valuable (and constantly improving), but gaps often exist between a person's model and a website's model of the important people in their life. For example, parents sometimes limit the types of content they share about their children online [2, 3]. In my own prior work [71], I have identified a number of ways that digital systems, and how they are used, can influence the types of information we generate about our lives (and, the types of information that we do not generate or share).

So, how do we design digital systems that can connect the right people with the right aspects of a person's digital materials? The answer to that question is complex not only because of changes to a person's relationship and because of technological considerations, but also because a person may want to be remembered in a way that does not align with the aspects of their life that are interesting or meaningful to others. I asked participants to talk about their feelings about being remembered differently by different groups of people. Most of the participants felt as though they'd be remembered similarly by people from different aspects of their life, noting how the core of their personality remained the same in different contexts. P2, for example, responded by saying *"I don't think so, it's not like I do different things with different people. I'm pretty much the same person with all of my different groups of friends. Obviously they'd have their own memories, but me as a person I think I'm pretty much the same."* While people may enact different roles in different contexts, there was a strong sense that one's true nature was relatively stable. This finding contradicts my prediction that people would want to be remembered by different people in different ways.

As we consider how to build multigenerational systems that allow people to engage with information left behind by other people, this work emphasizes the importance of three particular design considerations. The first is that the gap between a person's understanding of their relationships and data describing those relationships can differ in significant ways; any systems that attempt to represent this information should be sensitive to the impact those representations can have, and should provide people with the ability to provide input. The second is that a person's relationships with other people change in pivotal ways over time. A snapshot of a person's social network at 14 years old, 33 years old, and 57 years old may tell vastly different stories. None of these stories are inherently more accurate than the others, and all offer an opportunity to reflect not only on what a person's life was like at that time but also how it has changed. Participants using Retrospect often noted that they valued the opportunity to reflect on things that they "hadn't thought about in a while" (P2) and multigenerational systems can help facilitate this way of engaging with information from the past, rather than presenting a singular, static representation of a person's life. Finally, digital systems must find a balance between presenting a person in a way that reflects their own understanding of their life and the ways in which they are perceived by others after their death.

9.9.2 Communicating and Transferring Personal Digital Information

Another key aspect of this work was to better understand how people think about the mechanisms by which other people will access their digital information after they've passed away. Prior work in this area has put forth a number of thought provoking ideas about how people might navigate the process of managing and stewarding digital information after a person has passed away [25], ideas that are put into practice through features like the Facebook's Legacy Contact and Google's Account Manager. My goal with this topic was to understand people's perceptions of those features and to gauge the extent to which we should pursue those models as more systems add functionality the reflects needs that arise from a users' deaths.

On the whole, participants felt some combination of caution and excitement about a future in which their descendants might be able to learn about their lives through digital materials. This echoes findings from my prior work [70], but also points to some considerations for the design of systems that capture information about people's lives. When I set out to complete my dissertation, I was interested in understanding how we might develop mechanisms for transferring digital materials as a part of an inheritance or

other formal practices. Contrary to my prediction, interviews with participants in this study and the preliminary study indicated that doing so may not provide value for many people.

While features like Facebook's Legacy Contact or Google's Account Manager can be immensely valuable tools for some people, it may not be realistic to think a large number of people will use these features or that people would be willing to use them for anything outside of a small portion of the digital information they create. Instead, we should consider alternative models that do not require people to use advanced features or to deliberately specify their wishes. Here, it may be useful to draw from the less formal processes people use to give things to other people. Though significant numbers of people do not have a will [120], people are able to make decisions about what should happen to their things after they've passed away. In addition to developing features like Facebook's Legacy Contact and Google's Account Manager, there is an opportunity to develop complementary tools that help people outline their general wishes for their digital materials and that help people carry out those wishes.

None of the participants had used post-mortem account management features on sites like Google or Facebook, though a small number said that they've heard of them. Some had seen memorial accounts for Facebook users who had passed away, and others had seen other people sharing information on the (un-memorialized) Facebook pages of people who had passed away. Indeed, several (including P3, P8, and P9) had recently experienced the death of a family member of close friend. Participants had mixed feelings about using these types of features, communicating an uncertainty about 1) the value of maintaining a digital presence after their death, 2) whether digital information would have value many years in the future, and 3) the effort that would be required from the person assigned to manage their accounts. P2, P4, and P7 described their desire for other people to shut down their Facebook accounts after they've died. P2, for example, said *"I don't know why I think that's so weird, but I think it's kind of odd. No, I probably… would want someone to turn it off, but, I don't think I'd have someone update it."* Several other participants were not sure what would happen to their digital information after their death, but acknowledged the potential benefits the information might have for other people in the future. For example, P8 noted that people who are interested in family history who may find value in the information, saying *"You know I guess if, if Facebook has been around for 50 years I wouldn't mind going back and looking at my grandparents stuff looking at pictures they posted or things they were doing."*

Despite the uncertainty and mixed feelings that accompanied participants' Facebook accounts and information, participants did value some aspects of their digital materials, particularly pictures and digital media. Participants talked about wanting to preserve and share pictures of significant events, like weddings and trips, and pictures that depicted important people, like members of their family. This is in line with prior work that identified what digital materials people value and treasure [66, 148]. Participants were also asked to talk about how they felt about people being able to look back at their lives through their digital materials. Though many participants expressed uncertainty regarding the Facebook Legacy contact feature, five participants (P2, P3, P7, P8, P9) felt as though their children might find value in the digital information they'd leave behind. P9, talking about a picture of his daughter he'd recently shared on Facebook through the Facebook 'On This Day' feature said *"Yesterday there was like the, you know, [Facebook] memories. So yesterday there were a whole bunch [of photos]- I changed my profile picture to my daughter when she was two weeks old and I was like 'oh that's really cool'… She could potentially see that kind of*

thing in the future and my son could potentially see that kind of thing in the future. Oh, look at what I looked like or look at what I did, so I think that's really cool." Though only a few participants definitively rejected the idea that that'd use such a feature, several identified potential issues, including the concern that changing norms about what people share online would influence the potential value the information would have and concerns regarding how other people would interpret what they'd shared.

9.9.3 Revisitation of Digital Content

A key aspect of Retrospect was that it prompted users to reflect on pieces of digital media and information from different parts of their life. Interviews with participants revealed that few of the participants engaged in deliberate, unprompted revisitation of their digital content. When asked to describe situations in which they had looked back at digital content they'd made in the past, participants described a variety of tasks that necessarily required a person to look at old content, such as searching for a particular email in one's inbox (P1), searching for a file on an external hard drive or flash drive (P8), removing Facebook posts (P5), or deleting photos from one's phone to (P2, P6). Though participants had different opinions about which tasks were more and less interesting, many of the participants enjoyed having the time and motivation to revisit aspects of their past. P1 described how seeing a photo of an old friend motivated her take a short trip to go visit that friend: *"These [photos] were older, like [my friend] Mary, I hadn't seen in so long. We just went to visit her, [seeing the picture] might have even prompted me to say 'I need to go visit' - they live in Cincinnati so seeing that just reminded me of how close we were and you know, that one meant a lot."* Participants also responded positively to the ability to choose from a small number of options when deciding what aspect of their life to write about and appreciated that Retrospect drew from a wide range of information and sources within Facebook.

Though Retrospect differed in a number of ways from Facebook's 'On This Day' (OTD) feature, it naturally invited comparisons to OTD, which is a feature that prompts people to revisit and share pictures and status updates from the past. Nine participants had seen OTD information presented to them by Facebook and five of the participants had shared at least one piece of revisited content using this feature. All of the participants who had seen personal OTD content said that they did, on occasion, enjoy seeing their old content. After getting a sense of how people use and interact with this feature, I asked participants to talk about how they made decisions about what OTD content to share. Participants who used the feature described being selective about what they share, sharing just a small portion of that Facebook had presented to them. Other participants described their reticence to re-share content they'd already shared in the past. P5, describing her decision not to share OTD content said *"I guess, you know, if I shared it in 2008, why would I re-share it. I don't know. Unless there's some new meaning attached to it I'm never going to say 'Oh, you guys, look at this photo of my kid in a blizzard when he was a baby'."* Participants felt more positively about sharing content that would more appropriately be tagged as a 'throwback', including content from their childhood that had never been shared on a digital platform. In contrast to OTD, throwback photos offered participants the ability to contribute new information to their social networks and to participate in nostalgia and reminiscence.

Participants also talked about their impressions about OTD content shared by other people; nine had seen other people use this feature on Facebook. On the whole, this content was received with mild disinterest; participants did not strongly negative or positive about most of what people chose to share. P7, describing his experience seeing

other people's OTD content said "*A lot of the times, it is just, right, for personal affirmation or its something that I just personally would never be interested in. So I'm like, oh, okay, that's what you looked like when you were 5. You were cute, but that doesn't do anything for me.*" P4, in a similar statement described his feelings: "*Often, yeah, they're sharing things that are uninteresting or boring that probably have relevance to them and not that much to me. I've never been that amazed by it.*"

Participants' feelings about Retrospect, OTD, and also practices like #throwbackthursday highlight complexities regarding the revisitation of digital content. Although people do often feel positively about looking back at their digital content, they are not motivated to do so on their own. This isn't inherently problematic, it may be the case that people feel satisfied with the revisitation or reflection that they engage in as they search for old files or delete photos from their phone. However, it does raise questions about how we can invite people to reflect on multigenerational content. Facebook's OTD feature is successful, in part, because it is built into a service that is already a part of people's regular habits. In the Curatorial Agents project discussed in Chapter 7, I spoke to participants about the idea of reflecting on information about their parents' and grandparents' lives and while they were excited by the idea that this information could be integrated into the services they already use, it's not clear that they would find value in reflecting on that information on a regular interval or if there are particular moments in one's life when they are more inclined to explore and engage with information about other people.

9.9.4   Family History Research

This study also investigated how we might facilitate people's interest in, and ability to, engage with digital information left behind by other people. For some people, researching one's family history is a part of how they connect to prior generations and how they use that connection to develop a sense of who they are and where they came from. Family history research has typically used an establish set of resources and tools, such as immigration data, census records, and burial records. Digital tools, like Ancestry.com, have shaped how people research their family history by making it easier to access some of this information, but the practice is likely to change in more fundamental ways when people from future generations set out to learn more about people whose lives were captured, in some way, by digital systems.

I talked to participants about their experiences conducting research about their family history. Few had investigated their family history using external sources, such as by searching for records about one's history. Participants who had not conducted research about their family history often noted that there were other people in their family that had done this research already or described the difficulty of finding records. However, some participants had made an effort to learn more about the lives of the parents, grandparents, and other close relatives. For example, P4's family had signed up for a service called StoryWorth, which facilitated the process of collecting stories from his father and the rest of his family. Similarly, P10 described making a concerted effort to learn more about what his parents' lives were like before he was born.

Although none of the participants were fervently interested in family history, all of the participants were interested in knowing more information about specific aspects of the lives of their parents, grandparents, and ancestors. This finding was in agreement with my prediction, and interviews drew out a number of trends regarding what people wanted to

know about the past. Participants' interests were typically related to one of the following topics: the extent to which a person's physical appearance, attitude, or demeanor was similar to the participant's, a curiosity about what life was like when that person was alive, and the desire to know more about what informed significant or impactful decisions they'd made. P6 described her interest in knowing more about why her dad had decided to move overseas for work, noting that she would not have made the same decision: *"Um, I think with my dad, I know I mentioned this before, he works overseas and it's like this weird situation. So I think it'd be interesting to know his motivation, because it's not something I would ever envision myself or my mother doing. But the motivation behind that."* P5 shared her desire to better understand her mother's life: *"I wish I knew what she was like in college. And I wish I knew how she liked to have fun. Because when I knew her, she was struggling with, she didn't really have a good time. She was a thwarted extravert, she was a very social person. If she were sitting here now, she would love to be gabbing. My father's presence caused her to shut down. So, I wonder what she would have been like if I could have taken her on her own when she was younger."*

Surveying the responses from participants, it is clear that digital systems may be better suited to address some questions than others. Questions about what life was like 50 years ago are inherently different than those that involve peering into unresolved tensions with one's family. Even if digital systems are someday capable of helping people address or resolve these questions, system designers must consider how digital systems might play a role those processes. It may be the case that some questions contribute more to a person's development and understanding of their own life than the answers to those questions would contribute. Additionally, there are likely instances in which the answers to some questions could damage a person's relationship with other people in their life. Furthermore, for some people the effort expended to find information and answer questions may be an important part of the research process.

Another important consideration is that the existence of some information about a person's life is not enough to make it interesting, understandable, or accessible. Indeed, much of the information that people reflected on using Retrospect was related to important milestones, people, and facets of participants' lives, but did not describe or provide details about those things. As P5 noted while looking through her responses for the places task, *"I think if you wanted to get a full picture of my life, because I lived in so many places, I would like to go on with this…"* There is an opportunity to build systems and features that use the information we know about how and why people do family history research to help people benefit from that information. An example of how we might implement these ideas would be through the creation of systems that allow people to ask targeted or pre-designated questions about their ancestors. These questions, easily answered by digital systems, could help foster a person's interest in learning about the past and their interest in engaging with information left behind by other people.

9.9.5 The Experience of Legacy

Interviews with participants elicited information about how they engage with legacies and memories that other people have left behind. Seven of the participants reported that they'd inherited things from people who had passed away; five had inherited money, one had inherited jewelry, and P2 had inherited a treasured possession from her grandfather. Participants also described objects that they had been given by older relatives or had claimed after the death of a loved one. These objects weren't inherited directly from the person who had passed away but were instead given to the participant by an intermediary (such as a parent) or were taken as a part of organizing and giving away a person's

possessions at they reached the end of their life. This included a set of gloves and a brooch from a participant's great-aunt and a jacket a participant's grandparent had worn. Though the participants appreciated the money they'd inherited, people seemed to be more deeply impacted by objects that reminded them of people who had passed away. As physical objects that occupy space in a person's home, they were more likely to prompt reflection.

Participants also engaged with memories of other people through their every day experiences. These experiences, which rarely involved any valuable, old, or rare objects, instead focused on specific memories people had about people who'd passed away. P1, illustrated this idea by describing one of the ways in which she is reminded of her grandmother *"Every time I see a red cardinal we always say 'That's grandma!' because she loved red cardinals. We have so many cardinals in my backyard, we say 'Hi Grandma!!' So things in that way I think is kind of a legacy because the red cardinal was insignificant until grandma made it something. That's something, like, our whole family does now. I guess that's kind of a legacy, it's just a bit of her that we remember even though she's been gone for several years now."* Nearly all of the participants were able to provide an example of this type of remembrance. P6, for example, also shared a way he is reminded of his deceased grandfather: *"[My grandfather] really enjoyed walking. A lot. He used to- whenever we'd visit, or whenever he visited here when we first moved out to America, he would, he Would uh, like leave the house and then just go start walking and then he'd be back like 5 hours later. We'd be like where'd you go? and he'd be like I just walked until it ended. I was like "uh, alright!" As you know New York city could be a while. So we figured out he basically just walked to the ocean and back. Anytime I go on like long walks or hikes I guess it's a little bit, send mini reminders."* As with these two examples, many of these remembrances were connected to nature in some way.

It's unlikely that digital information would form the basis for this type of remembrance; many of these examples resulted from a person internalizing some memory about a loved one. There is, however, the potential that digital information could be used to trigger the process of remembering and experiencing some aspect of a person's legacy in a similar way. Just as seeing a red cardinal evokes memories of P1's grandmother, there is an opportunity to build systems that foster mundane or everyday reminiscence about people who have passed away. Though these systems would need to be sensitive to potential harm that could result from reminding a person about a deceased loved one, such systems could also provide people with a new way to connect with treasured memories and experiences.

Another important consideration for how people experience and engage with other people's legacies is the idea that a person's understanding of another's person's life will change over time. In one of our interview sessions, P5 discussed how raising a child had changed how she understood her mother's life and interest in elementary education. Similarly, the actions that people take can also shape how future generations might experience another person's legacy. Several participants described family traditions, traits, and memories they hoped to instill in the next generation of their family. Creating a legacy is a process that is undertaken, in part, because a person wants to establish some form of enduring remembrance of their life. The ability for that legacy to change and grow can support these goals, and digital systems operating in this space should account for the ways in which a legacy can change over time as it is interpreted and reinterpreted by new generations. For example, a system might allow a person to select and integrate particular aspects of another person's digital information into their existing accounts or profiles. This would provide people with an opportunity to connect with that information and to share that information with other people.

9.9.6 Models of Legacy

As I described in the research question section of this chapter, one of my goals for this study was to contribute to our understanding of what comprises a legacy and to develop a small collection of models that offer perspectives or lenses on (1) the ways in which digital information and media fit into a person's legacy, (2) the ways in which people experience legacy as a part of their everyday life, and (3) opportunities for digital systems to play a role in legacy-oriented practices. I developed the models and diagrams below to explore these questions, which represent knowledge that has been developed over the course of my doctoral research.

The first model reflects the findings from the studies described in Chapters 5 and 6, which drew out the different types of digital materials that are left behind when a person passes away and that could be a part of how a person is remembered. In Chapter 7, these different types of data were integrated to explore how people perceive the information that systems collected about their interactions online. The different categories of data described in this model are the materials that future digital systems can use to interpret and represent a person's life after they've passed away.

WHAT (DIGITAL STUFF) IS LEFT BEHIND WHEN A PERSON PASSES AWAY?
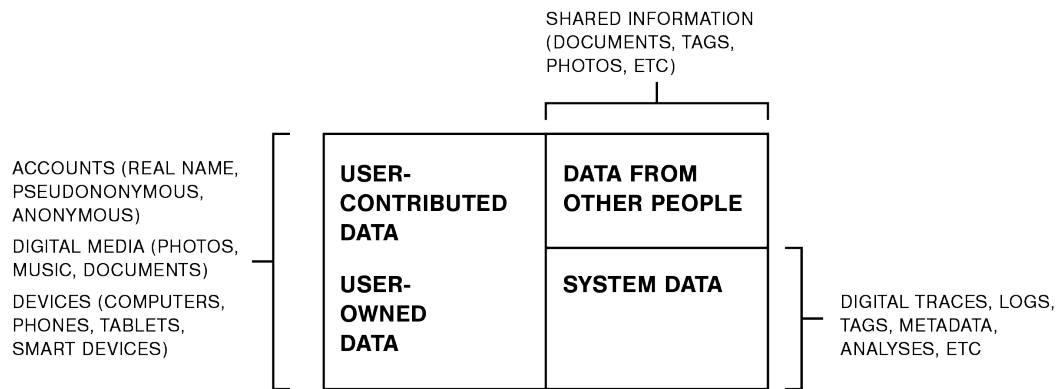
Figure 47: Different types of digital information, data, and media that is available post-mortem.

Given those materials, we can speculate about how digital systems might help people make sense of a person's life after they've passed away. Based on the ideas put forth in Chapter 7, the model below describes some of the potential ways in which systems might leverage what they know about a person's data to help other people engage with that data. This model is not all-encompassing, but does begin to fill out a spectrum between how a person might engage with a person's materials with varying levels of intervention from digital systems. On the left side of the spectrum, people would interact with data without processing by digital systems, in similar ways to how people conducted family history research before the digitization of historical records. On the right side of the spectrum, people would interact with information about a person's life without having to actually interact with that data as it existed when a person passed away but would instead be presented with some analysis or synthesis of that information.

HOW MIGHT PEOPLE ENGAGE WITH DIGITAL STUFF THAT IS LEFT BEHIND?

NO PROCESSING ————————————————————————— ADVANCED ANALYSIS

FILTER   LINK   CONTEXTUALIZE INTERPRET
SORT   or COMPARE
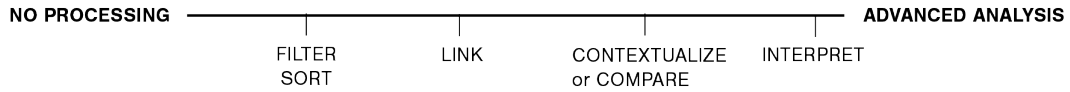
Figure 48: A spectrum depicting how systems might help people engage with a person's information after they've passed away.

Figure 49 and Figure 50 describe the different ways in which people experience the impact of other people's lives and legacies. The diagram in Figure 49 is intended to be a complement to the Hunter and Rowles model, which describes legacy through the lens of a person who is creating a legacy that they hope people will someday experience. Figure 50 describes the different ways in which people engage with legacy-oriented materials and suggests a number of aspects of that engagement where digital systems might support people's ability to derive meaning with digital information.

Both of these diagrams were developed as a product of my conversations with participants about their experiences remembering and being impacted by the lives of people who had passed away, as described in the section direction preceding this one. This work demonstrated the importance of considering legacy through the lens of people who experience it and are impacted by it. Though the Hunter and Rowles model is a valuable way of understanding what a person might leave behind when they pass away, few of my participants identified with the idea of a formal legacy that might include money or valuable possessions. However, many hoped that their life would have an impact on other people and recalled many examples of how their life had been shaped by the lives of others. It is my hope that these models will help researchers consider the experience of legacy and how a person's consideration of what they might leave behind is shaped by their perception of people's legacies and memories.

HOW DO PEOPLE EXPERIENCE LEGACY?

BODY | VALUES | MEMORIES | POSSESSIONS | ENVIRONMENT

PERCEPTION OF THE WORLD
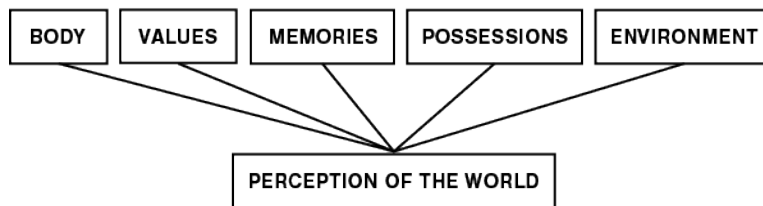
Figure 49: Different aspects of a person's life and identity that sometimes reflect the impact of other people's legacies.

HOW DO PEOPLE EXPERIENCE LEGACY?

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┌─────────────────┐              ┌─────────────────┐
│   ENCOUNTER     │              │     RECORD      │
└─────────────────┘  ┌─────────┐ ├─────────────────┤
┌─────────────────┐  │INTERPRET│ │     SHARE       │
│   REMEMBER      │  └─────────┘ ├─────────────────┤
└─────────────────┘              │     CHANGE      │
                                 └─────────────────┘
```
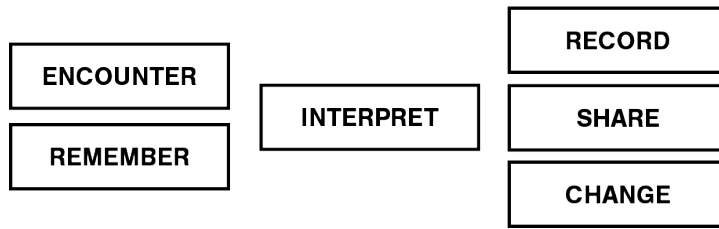
Figure 50: The different practices and processes involved in experiencing a person's legacy.

9.9.7 What Metadata Does and Does Not Say

In line with my prediction about the potential for systems to curate or organize a person's digital content, the information participants shared about their experiences using Retrospect drew attention to a number of ways in which people's use of digital systems might diverge from a function that system was designed to serve. For example, as participants looked through profile photos in the gallery task, there were many occasions in which those photos were not photos of the participant. A person hoping to chart the changes to a person's life over time using these photos might find this task difficult without additional context. For example, P3 talked about changing her profile picture to a photo of the deceased actor Philip Seymour Hoffman when he died. Though there is an expectation that a person's profile picture will have them in it, there is no formal requirement to do so and many people choose profile pictures that feature a place, object, or different person. Choosing to share a photo of someone or something else is a way for people to demonstrate their connection to that thing and to foster conversations about it. Similarly, several participants described occasions in which they updated their profile picture to be an old photo of themselves, such as a photo of when they were a child. In these cases, its clear to see how the metadata about those photos might not offer a chronological perspective on a person's appearance but would instead point to some other aspect of how they used social media to express themselves and connect with other people. Systems that attempt to use metadata need to be sensitive to the ways in which people use websites like Facebook to meet their needs.

Another consideration for using metadata is that people do not always feel a strong connection to the people, places, and things that populate their account. For example, nearly all of the participants had their hometown listed on their Facebook account but few were interested in reflecting on it as a part of the place task in Retrospect. Providing information about one's hometown, high school, or college serves a logistical function on Facebook as a way for people to identify and connect with other users. However, though these fields describe some aspect of a person's life, that information may not be as meaningful to a person as other information that is not documented in the same way. As a result, system designers must consider the implications of using this data to help people reflect on the lives of other people; though this information is structured and relatively easy to access, representing a person' life through that lens may not reflect how they would want to be remembered. Instead, we might build systems that can identify photos, posts, or other types of content that deviate from system expectations and use those as a starting point to capture more detailed information about a person's experiences.

Chapter 10: Designing Legacy-Oriented Systems

The research I've done over the course of my PhD identifies a number of opportunities to develop systems that help people engage with legacy and remembrance using digital materials. In this chapter, I expand on that work to outline design considerations for building systems that engage with multigenerational data. I first describe high-level goals for the design of these systems and then describe recommendations for achieving those goals. This work in informed by my graduate research and by related work on meaning-making with physical and digital things [9, 16, 21, 39, 147], aging [64, 80, 118, 151, 153], identity presentation [82, 206], personal information management [19, 60, 91, 110], and legacy [25, 40, 88, 183].

10.1 Design Goals

The high level goals of my work are framed by a central question: What does it mean for a digital system to support meaningful interactions with lifetimes of digital information? The information I've collected from my research work yields several characteristics that define such a system.

These include the ability for systems to:
1. capture and communicate aspects of a person's life for which they would like to be remembered,
2. help people find relevant, interesting, or meaningful content in large amounts of heterogeneous information,
3. help people interact with or make use of that information in a way that sensitively navigates personal or private content,
4. put information into the appropriate context so that it may be understood relative to contemporary norms and practices.

In summary, the goal is to create systems that allow people to access lifetimes of digital information in a way that is sensitive to the needs of various stakeholders and that reduces the difficulty of engaging with a large de-contextualized archive. This is no easy task, but offers direction as we consider a future in which people have access to digital information left behind by generations of people.

10.2 Design Considerations

The next step in this work is to understand how systems can address these criteria, and in this section I outline some potential options for doing so. Where appropriate, I use scenarios and examples from existing systems and practices.

10.2.1 Capturing and communicating aspects of a person's life

Legacy-making is a way that people try to shape the impact and interpretation of their life after they've passed away. Traditionally, physical artifacts have played a significant role in this process; the objects that people leave behind help communicate who they were and what they'd done during their lifetime. Giving objects to others is a way that people

extend the reach of their legacy. While digital information has not fundamentally changed how people think about their legacy or the desires that influence legacy-making, there are not direct parallels for how people might use digital materials to accomplish these goals.

As a result, there is an opportunity to understand how we can use digital information, and the digital systems that capture and hold that information, to help people communicate important aspects of their life. One way of doing this is to develop systems (or features for existing systems) that facilitate this process by leveraging what systems know about a person's preferences, hobbies, and personality to organize content around those topics in formats that can be easily shared with other people. Most social networks have an internal assessment of a user's personality, hobbies, and interests, and this information can help systems identify meaningful representations of a person's life in their digital materials. For example, if a system observes that a person has an interest in travel, they might generate a slideshow of travel-related content that they can reflect on and share.

Another option is to explore more ways of transforming digital content to physical formats. While people do value some of their digital materials, physical artifacts play a more significant role in a number of practices related to death, legacy, and remembrance. This may change in the future, but at this point in time there is an opportunity to explore how we might bridge the gap between practices that make use of physical artifacts and the large collections of digital materials that people generate.

10.2.2 Helping people find relevant, interesting, and meaningful content

Because people and systems generate so much information about a person's life, it will be difficult for other people to sort and make sense of this information after that person passes away. This is a twist on a classic problem: managing personal digital information is challenging even for individuals who are trying to manage their own. When a person passes away, people who are interested in engaging with this information face some additional hurdles including: making sense of information generated in the distant past, accessing information without appropriate permissions, a lack of context to help explain the connections between different information and accounts, and so on.

Systems can help with this process, much in the same ways that they've helped people make sense of their own digital information. One way to do so is for systems to offer people the ability to get a quick sense of a large amount of information. For example, a system might analyze the content from an old online diary and present the viewer with a summary of what's contained therein. This information could include the topics covered in the posts, the names that are mentioned, any photographs that were posted, or the dates when the service was used. This information could then help a person decide whether they'd like to explore that account more deeply.

Another way to address this issue would be to develop systems that search directly for content relevant to particular interests. Participants in my research described that they were particularly interested in knowing what their dead relatives had been like at a particular age. A system could search for information that meets this criteria. Finding content related to particular questions could help people approach or become interested in research their family history using digital information (which might otherwise be a daunting task).

10.2.3 Sensitively navigating personal or private content

The digital information and media that people generate sometimes captures information about personal or private aspects of a person's life including information about one's relationships, finances, and health. In some cases, a person may have taken steps to secure this information, such as by deleting old accounts or by password-protecting sensitive information. However, even with these precautions it is likely that future generations of people will occasionally be exposed to this type of information online and on old devices as they use them to gather information about people who have passed away. Unlike the physical places where people keep personal or sensitive things, digital accounts sometimes lack signals that might help a person assess whether the information that account contains is private.

One way to address this issue is to make this potential risk clear to people before they are granted access to some account or information. For example, if a person tries to view the email account of a long-dead relative, the system might offer a note that the account might contain sensitive or personal information. Furthermore, systems could couple this information with a statement that reinforces two ideas: (1) that people change over time and (2) that this information only represents a particular, often limited lens on a person's life. In addition, systems might take steps to separate information that discusses sensitive topics in order to reduce the potential for people to find this information accidentally and to help people make deliberate decisions to access that information.

10.2.4 Putting things into context

A major challenge to a person's ability to engage with information created in the distant past is that the norms and practices that influence the use of digital systems will likely have changed over time. This is inevitable and has happened many times already with social networks on the internet (including once prominent sites like Friendster, Orkut, and Myspace which no longer operate in the same contexts). Norms for the content and format of what people share has also changed on websites that are currently popular. For example, for many years all Facebook status updates started with a person's name and the word 'is' (so, one of my posts would have read "Rebecca Gulotta is..."). Similarly, changes to people's understanding of their audience have shaped how people engage in identity presentation and management on these websites. The potential difficulty of understanding the context of some piece of digital information and media is not unique to digital things, but the scale and spacelessness of digital things exacerbates this issue.

One option for addressing this issue is to create better resources that people can use to research digital systems. Currently, the best resource for this type of information is academic papers, which may not be accessible to the general public and which are often focused on the specific details of particular social networks or practices. Instead, we might consider a more comprehensive web-based historical archive of prominent social networks and services written from a perspective that reflects the user experience on those websites. As a less centralized alternative, particular services could be encouraged to maintain their own detailed archives that are available for the public to access.

There is also an opportunity to build features that allow people to explore how websites were used in the past. One could imagine, for example, a feature that allows a person to rollback their own Facebook or Twitter feed to see what the experience of using the site

was like a decade ago. This feature could be built into existing functionality, such as Facebook's security-based 'View As' feature, which allows people to see what their profile looks like from the perspective of other people.

Chapter 11: Contributions and Future Work

Research that explores the intersection of identity, death, and digital systems is a relatively new, but growing field of inquiry. It is my hope that this work will be helpful for researchers, system designers, and anyone who is interested in the challenges and opportunities posed by digital systems and information that endure long after a person's lifetime. This work makes a number of contributions to existing literature in this area, and points to a collection of opportunity areas for the design of digital systems. In this chapter, I summarize these contributions and also outline areas where future researchers can build on this work.

11.1 Contributions

11.1.1 Contributions to knowledge in human-computer interaction

This work contributes knowledge about how we consider the different groups that play a role in the creation, dissemination, and management of multigenerational records. Existing practices for passing down assets and physical artifacts depend on an infrastructure of intermediaries (lawyers, banks, family members) that help transfer those items to their recipients. My research work investigated the extent to which the use of digital systems adds to or changes the stakeholders who are involved in communicating or transferring digital information and materials to other people. In particular, my work has argued that users of digital systems believe that those systems exert a great deal of control over the ownership of their digital content and have come to expect that digital systems will manage and maintain that content over time.

In Table 7, I outline the different potential stakeholders involved in the creation and management of multigenerational records and the various ways in which each group of stakeholders may engage with those records. This table is not intended to be exclusive or complete, but instead to offer a summary of people's understanding of how each group of stakeholders might support beneficial outcomes for everyone involved.

	The original user	The bereaved	People in the future	Digital systems
Responsibilities	Create records, share those records with other people	Understand and carry out a person's wishes	Mange or steward those records	Maintain digital records, allow for wishes to be carried out
Opportunities	Engage in self-reflection and personal growth, create records that have meaning in the context of one's legacy	Share information about the deceased, contribute to an enduring representation of their life	Learn from the information left behind by other people, create new interpretations of a person's digital records, contribute to family-oriented archives	Foster engagement with new generations of users, better understand user identity

Table 7: Stakeholders involved in the creation, management, and interpretation of multigenerational records.

My work also contributes an alternative perspective on legacy and remembrance. Traditional models focus on legacy in an aspirational sense: the legacy a person wants to

leave behind and the ways in which a person wants to be remembered. Interviews with many participants over the past six years have illustrated that the idea of having an impactful or deliberate legacy is often considered a privilege of the powerful or the wealthy. The people I've talked to draw a distinction between the desire to leave a 'legacy' and the desire to take small actions that can make life better for other people and help a person be remembered. Based on these conversations, I put forth a number of models that capture how we might understand a person's legacy through the lives of people who are influenced and impacted by that legacy. In addition, my work describes considerations for designing systems that represent experience-based perspectives on legacy and that contribute to a person's ability to learn from and contribute to a legacy that has influenced their own life.

11.1.2 Contributions to the Design of Digital Systems

My work has also argued that the long-term success of multigenerational systems depends on their ability to make use of the emerging capabilities of digital systems. To date, no solutions or tools have solved issues associated with the scale, heterogeneity, and fragmentation of people's digital records. It seems unlikely that people in the future will generate less digital information or that they will find ways to manage that information that greatly limit the amount of information available about their lives.

The research described in this document has put forth a number of considerations for designing systems that operate under the assumption that people's information will only continue to grow and to be distributed across private and public databases associated with different digital services. I argue that while a study of how people derive meaning from physical objects provides useful insights into how we might shape people's perceptions of digital things, the nature of how people generate and consider digital information means that systems will be more successful if they embrace the qualities and characteristics of digital data. Prior work in HCI had suggested that there was an opportunity to increase the perceived value of digital possessions by drawing from how people develop attachment to physical objects. My work does not inherently contradict those claims, but argues that efforts to foster attachment to digital materials must be executed in a way that reflects the innate characteristics of digital materials. The same processes that give meaning to physical things, and the evidence of that meaning, does not seem to transfer to digital objects. Instead, future work must consider how we can expose people to information that might help foster value (evidence of use, connections to important people or experiences) in a way that does not diminish the objects digital qualities and capabilities.

11.1.3 Contributions to HCI/Design Research Methods

My doctoral research also advances research methods in human-computer interaction and design research. Over the course of my PhD, I have deployed and developed a number of research probes. Retrospect, the most sophisticated of those probes, extended existing variations of the design probes method by using a person's own digital data to support speculative conversations about the future of digital information and systems. This approach builds on work by Wallace et al. [126], which described particular advantages of creating personalized probes but extends that work by using digital data and work by Khovanskaya et al. [94] that explored using people's metadata as a part of a

design probe. In addition, this work explores how we might give participants access to the information that they contribute as a part of their interaction with a design probe.

11.2 Directions for Future Work

It has been a great privilege to conduct research that merges developments in technology with fundamental questions about how people live and find meaning in their lives. Though this work has made a number of contributions in this space, there are still many questions that need to be addressed as we approach a future in which people have access to digital information created by and about their ancestors.

11.2.1 New Forms of Meaning-Making

Looking forward, there is an opportunity to understand how people might engage in alternative forms of meaning making with digital materials. One potential avenue for doing so is by transferring the ownership or stewardship of some information to another person. Many generations from now, when people have access to digital information about their distant relatives or ancestors, they may not be interested in interacting with or examining that information. It may be the case that a collection of digital information describing a distant relative's life may only be interesting to people at a high-level. Or, people may only be interested in specific aspects of that person's life. As an alternative practice to holding onto these records indefinitely, it may be worthwhile to develop systems that allow people to give away some digital information or transfer the responsibilities of stewardship to another person or entity. For example, a person might consider giving away their grandmother's health and physical activity records to an organization that can make use of that data in exchange for protecting sensitive information contained therein. In a related vein, people might extend ownership or access to other people, distributing the responsibilities associated those records. In this example, a family might decide to donate records as a way of contributing to the impact their life has on other people. Similarly, a person might decide to grant access to some information about their ancestor's lives in exchange for services that are personalized and adapted to their family history.

To date, there has been a limited amount of research exploring these ideas and there is a tremendous opportunity to conduct this research at a time when there is an emerging need for services that help people engage with the digital records of people who have passed away.

11.2.2 Contextualizing Multi-Generational Information

More work is also needed to understand how multigenerational information might be integrated into people's everyday experiences. A physical object that a person has inherited has the ability to spark remembrance because of its physical presence in a person's environment. Digital information does not have the same type of footprint, and there is a need to develop systems that can foster the revisitation of multigenerational records. This is untrodden territory. Few studies exist that investigate how people revisit their own digital content and there are many more complexities associated with revisiting content created by other people. We are at the beginning of an age in which people create enduring and easily accessible digital records about a great number of their life's

experiences. We will need to develop systems that can help other people grapple with and learn from this information once those people have passed away.

11.2.3 Further Extending Design Probes

Finally, there is an opportunity to extend the use of design probes in HCI research. There is a rich and diverse body of work in HCI and Design that utilizes probes to better understand people, their perceptions, and their needs. My work draws from artifacts and techniques that other people have created, but builds on these techniques through the creation of interactive, personalized systems that are used in a variety of contexts. This work is a middle ground between design and technology probes, but only scratches the surface about what might be possible if researchers continue to design provocative systems that allow people to enact potential futures. I look forward to the next generation of work in this space.

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Appendix A – Materials for Chapter 6

Digital Account Inventory

You and your accounts

Daily Life

EMAIL _____

MESSAGES _____

PHOTOS _____

POSTS _____

MUSIC _____

SCHEDULE _____

SHOPPING _____

NEWS _____

LEARNING _____

MONEY _____

Superlatives

FIRST ACCOUNT _____

MOST EMBARRASSING ACCOUNT _____

FAVORITE ACCOUNT _____

MOST SECRET _____

MOST PUBLIC _____

LEAST USED ACCOUNT _____

Networks

FAMILY _____

COWORKERS _____

BOSSES _____

CLOSE FRIENDS _____

FRIENDS _____

ACQUAINTANCES _____

Coding Scheme

Privacy	1	General Privacy Concerns	Any general comments about privacy concerns
	1.1	Sensitivity about sharing pictures	Thoughts about sharing a photo on a digital system, whether it is accessible to the public or not
	1.2	Exposure Scares	Situations in which there were privacy breaches or worries about exposure of information online
	1.3	Disclosing information	The process of figuring out how and when it is appropriate to disclose information online.
	1.4	Hesitancy about inheritance	Discomfort with looking through another's digital records, especially a relative
	1.5	Changing Perceptions	Changing opinions about how and when to be anonymous online
	1.6	Protection	Steps taken to protect one's privacy or identity
Digital History	2.1	Misrepresentation	Things that are over or under represented in digital accounts relative to their significance offline.
	2.2	Digital Regrets	Having information that is a source of embarrassment or that you would not want made public or exposure to your social groups.
	2.3	Distancing from Undesirable Information	Distancing yourself from online discussions or content that could portray you in a negative light.
	2.4	Acceptance of Web History	Acceptance that there is a lot of information about you online
	2.5	Reflecting on Digital History	Valuing or using digital records as a way to reflect on your life.
	2.6	Scale	Reflections on the scale and scope of digital content
	2.7	Inactive Accounts	References to having unused accounts online
Digital Omissions	3.1	Digital Deficiencies	Descriptions of what digital systems do not capture [general]

	3.2	Losing Track	Losing track of an old account or information
	3.3	Digital Lapses	Intentionally keeping information offline so that it does not become a part of your digital history
	3.4	Deletion	Deleting digital information
Identity	4	Separated identity	General comments about facets of identity on or offline
	4.1	Ties to Offline Self	Accounts that are tied or able to be connected to a person's name or offline self.
	4.2	Handle as long term identity	Attachment to a handle as an online identity
	4.3	Anonymity and Throwaway accounts	The use of accounts that you want to separate from your main identity and are intended to be discarded. This could happen for a number of reasons: convenience, shame, etc
	4.4	Professional Public Identity	Creation and acceptance of a professional, public identity
	4.5	Concerns regarding groups in which you have a social role	Being concerned with what members of your close social groups will think about the things you've shared online.
	4.6	Concerns regarding abstract groups	Being concerned about what unknown or future people would think about the things you've posted.
	4.7	Digital Authenticity	Valuing the things you've said online because they represent you
Value Assessments	5.1	Value judgments about digital information	Assessing the value of digital information, either high or low.
	5.2	Digital Evolution	Predictions or experiences related to the idea that your digital accounts/self will change in the future to reflect changing values
	5.3	Disappointment of Loss	Sadness related to losing digital information
	5.4	Accidental Attachment	Creating an account that you put low value on that later went on to be important
	5.5	Actively Saving the Digital	The practice of saving digital records

	5.6	Meaningless-ness	Viewing older accounts as meaningless
The Future of Digital Information	6.1	Skepticism about Systems	Concerns about the motives and policies of digital companies that hold on to your digital information
	6.2	Ephemeral Nature of Digital Info	Concern that digital information is easily lost
	6.3	Digital Indefinite	It's hard to pinpoint how long digital information will be around
	6.4	Hopes of Preservation	Hoping that digital information will persist for a long time
	6.5	Onus on Others	Believing that preservation and persistence are controlled by others
Past Self	7.1	Creation of digital accounts	Reasons for making digital accounts
	7.2	Changing Perceptions	Perceptions about digital things that have changed over time
	7.3	Preservation Practices	Non-digital practices related to preservation and saving things
	7.4	Information Inheritance	Experience finding out previously unknown information from family members

Appendix B – Materials for Chapter 7

Coding Scheme

	Digital Information Collection
1.1	Turning data collection off or taking precautions
1.2	Emotions about data collection
1.3	Discussing acceptable permissions and tracking
1.4	Assessment of tradeoffs
1.5	Obscuring your identity or info from digital systems
1.6	Feeling embarrassed about what systems know
1.7	Everything is tracked/kept
1.8	Describing distinct dangers about tracking
1.9	Being mislead about what's being collected
1.1.0	Being worried about what other people might do with your information.
	Information Organization
2.1	Offload-ed information organization
2.2	DIY solutions + descriptions
2.3	We don't need to keep/remember everything
2.4	Systems could do it better
2.5	Mentioning a way that they use metadata to sort or organize
2.6	Feelings about systems mediating digital content
2.7	Preferring one's own system
2.8	Losing things
2.9	Systems misplacing or obscuring things
2.1.0	Information overload
	Personalization
3.1	Noticing personalization
3.2	Examples, 3.2.1 good and 3.2.2 bad and 3.2.3 extreme
3.3	Conjecture about how it works
3.4	Questioning the notion that a computer can know you
3.5	Embracing imperfect personalization
3.6	Personalization could/does focus large collections of data

3.7	Reflecting on what a system thinks/says about you
3.8	Personalization bubble
	User-System Relationship
4.1	Companies and tracking are a business
4.2	Belief that system use is voluntary
4.3	Reflection on transparency
4.4	Barriers to systems being better at personalization or organization
4.4b	Systems might be able to do a good job
4.5	It's not personal
4.6	User agency is Important
4.7	Drawing a line for what systems should do
4.8	This (advanced personalization) is just the next step to what computers currently do
4.9	Valuing systems that work on your behalf
4.1.0	Talking about *why* companies are tracking your information
4.1.1	Working together with a digital system
	Digital Lifespan + Ownership
5.1	Things are ephemeral or replaceable
5.2	Things will be around forever
5.3	Things from the distant past are more interesting
5.4	Things worth saving for the future
5.5	You don't own things you create or put online
5.6	Different nature of physical things
5.7	Comments about how long you've been using digital systems
5.8	Taking over someone else's files
	Reflections + Revisitation
6.1	Things that are important but not often revisited
6.2	Discomfort with systems interpreting significant events
6.3	Mention of significant places worth revisiting or reflecting on
6.4	Human memory is variable/unpredictable

6.5	Using systems to reflect on personal development
6.6	Looking to systems as a way to pass on information
6.7	Reflections on how time might influence the value of reflecting on digital data
6.8	Reflecting on digital/physical transition
6.9	Systems can expose you to new (ways of seeing) information
6.1.0	Reflection on difference between human thinking and computer thinking
	Personal Information
7.1	Reflection on stage of life
7.2	Discussing family history
7.3	Reflection on aging
7.4	Discussing passing things down or across generations
7.5	Examples of things that you want to save

Appendix C – Materials for Chapter 8

Legacy Worksheet – Page 1

Carnegie Mellon Legacy Study

Instructions

Thanks for taking part in our study. We are interested in learning about how people want to remembered by future generations. Before we meet for the interview, we need you to complete this survey.

General Information

What is your name?

What is your age?

What is your gender?

Legacy

Please list between 20 and 25 things that comprise the legacy you'd like to leave behind for future generations. This can be anything - values, objects, information, genetic information, etc. We'll talk about these things during our interview.

1.	11.	21.
2.	12.	22.
3.	13.	23.
4.	14.	24.
5.	15.	25.
6.	16.	
7.	17.	
8.	18.	
9.	19.	
10.	20.	

Legacy Worksheet – Page 2

Carnegie Mellon Legacy Study

Final Questions

What does legacy mean to you?

In a sentence or two, please describe the legacy you think you will leave behind.

How would you describe your relationship with your family?

Do you have children? If not, do you plan to?

Thank you for completing this survey! I am looking forward to talking to you.

- Beka

Appendix D – Materials for Chapter 9

Coding Scheme

	Looking back at one's life online
1.1	Examples of when/how people revisit digital content
1.2	Appreciate digital prompting to reflect or revisit
1.3	Don't often revisit digital archives
	1.3.a: Searching through digital archives to find something
	1.3.b: Looking back at old content to delete it
1.4	Re-sharing content online (like through on this day ot #tbt)
1.5	Choosing not to share content that you're being invited to share
1.6	Judgment about content created in the past
	1.6.a: Noting that sharing behavior has changed over time
1.7	Reflecting on things that are not a part of your daily life
1.8	Using the system
	1.8.a: Things that were interesting/evocative
	1.8.b: Things that were boring or not interesting
	Reflecting on other people's content
2.1	Impressions of seeing old content people have re-shared
2.2	Experiences looking through other people's content or information online, feelings about doing so
2.3	Seeing or contributing digital content about/by a person after their death
	Organizing and managing physical and digital things
3.1	Examples of how people organize around particular experiences, relationships, or time periods
3.2	Ways/methods/places that people organize physical and digital things
3.3	Occasions when they revisit curated things or collections, or the things that people revisit
3.4	Does not often revisit curated things or collections
3.5	Getting rid of objects from collections or curations
3.6	Turning to algorithms to manage, sort, or curate
3.7	Transforming things between physical and digital

	Planning for one's own death
4.1	Doesn't have a will
4.2	Plans to make a will in the future
	4.2.a: Motivation to do so
	4.2.b: When they plan to make it
	4.2.c: What they'll include in it
4.3	Has a will right now
	4.3.a: Why did they make it?
	4.3.b: When did they make it?
4.4	Communicating end of life care decisions
4.5	'value' and 'legacy' associated with things or money
	Other people's deaths
5.1	Parents or family members have talked to them about their will, death, or end of life care
	5.1.a: When/why did that happen?
5.2	Have a copy of someone else's will
	5.2.a: Why they have it
5.3	Things you have received/ inherited from other people
5.4	Things you think you will inherit from other people
5.5	Holding onto inherited/family things that you don't necessarily want
	Remembering people who have passed away
6.1	Remembering someone through an experience or activity
6.2	Remembering someone through a family tradition
6.3	Remembering someone through their family
6.4	Remembering someone through objects or records
6.5	Reflecting on a person's everyday life or essential nature
	Family History
7.1	What people want to know about their family or ancestors
	Are they like me?
	What was their life like?

	How did they make decisions?
	Using this information to better understand one's own life
	How has the world changed over time?
7.2	Not interested in/has never done family history research
7.3	Is interested or has researched family history research
7.4	Obstacles to researching one's family history
	Being remembered
8.1	How a person thinks or hopes they will be remembered
	a: Traits or values, b: objects, c: stories, memories, or information, d: wealth, business, accomplishments, e: family or relationships
8.2	Things (traits, objects, etc) that a person plans to pass on or leave behind
	a: Traits or values, b: objects, c: stories, memories, or information, d: wealth, business, accomplishments, e: family or relationships
8.3	Expressing the hope you will make an impact or be remembered
8.4	How you feel about people looking back at your life through digital things
	8.4.a: You have little control over how people interpret your life after you've passed away
	8.4.b: Wishes for what will happen to your digital stuff after you pass away
8.5	Don't think you will be remembered or that you can influence how you are remembered
8.6	Want to be remembered the same way by different groups
8.7	Plan to pass on something you inherited
	Legacy
9.1	What does legacy mean to you?
	9.1.a: Legacy is something that important people have
	9.1.b: Legacy means being remembered
	9.1.c: Legacy means making an impact
	9.1.d: Legacy means having a family
	9.1.e: Legacy mostly matters to the person that makes it
9.2	Your understanding of your life or legacy changes over time
9.3	Sacrifices people make for the things they value
9.4	How you've been impacted by the life or legacy of others

	What is captured by digital systems
10.1	Examples of important things that are represented digitally
10.2	Examples of important things that are not represented digitally
10.3	Desire to capture or know more information about some aspect of your life
10.4	Using metadata features
	10.4.a: What motivates you
	10.4.b: How you subvert expectations or norms
10.5	Why you do not use certain types of metadata or features online