Curatorial Agents: How Systems Shape Our Understanding of Personal and Familial Digital Information

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ABSTRACT
As people increasingly turn to digital channels to share, store, and reflect on their lives and experiences, the processes by which they manage the diverse collection of information generated over the course of their lives are changing. These processes, once a matter of hands-on curation and personal meaning making, are now deeply rooted in interactions with digital systems. In this work, we drew from prior research from personalization, memory, and information management to create four interactive, provocative systems. Through sessions with 12 adults from Pittsburgh, PA we used a combination of these systems and interviews to examine how systems might play a role in the near and long term resurfacing of personal and familial digital information. Findings point to an opportunity to create systems that can openly mediate the curation and transmission of digital content, and ways to draw meaning from the differences between how systems and people recall and represent their experiences.

Author Keywords
Research through design; memory; digital legacy; identity; reflection; curation; metadata; personalization; agency

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION
Managing digital information is a well-documented problem; it is far easier to generate information than it is 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 [4, 25], 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 [32, 34]. However, the idiosyncratic, fragmented nature of people's digital records and their management strategies makes it difficult to develop prescriptive solutions [19, 20].

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 [26] and whether they will hold value to future generations [15]. More broadly, there may be cultural and societal value in building systems that can archive and derive meaning from multigenerational records [11]. 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.

In this paper, we explore these issues and focus on the implications of the nascent, but developing, capabilities for digital systems to analyze and make judgments about the information that they capture. We place 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 [18] and reflective design [39], we developed four interactive systems (Fig. 1) to provoke discussions with participants about the role that both systems and people play in the process of curating and deriving meaning from digital records that are diverse with regards to their source, temporal context, and meaning.

Through sessions with 12 adults from Pittsburgh, PA we utilize these systems to investigate how digital systems might make sense of unwieldy, diverse collections of digital information. In addition, this work explores the complex nature of how people feel about digital systems interpreting and making judgments using their digital information. The findings from this work expose nuances regarding the discrepancies between system and human memory, the ability for systems to act as mediators for personal digital

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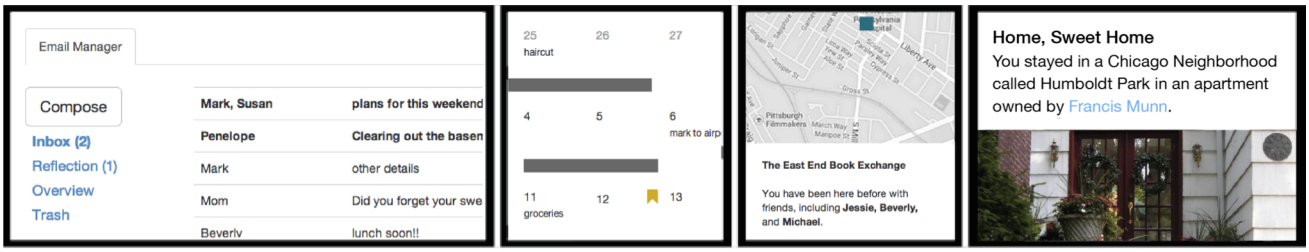

Figure 1: Images from each of the systems developed as probes for this work: *MailMem*, *Calendera*, *Locale*, and *Gather*.

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 paper contributes a collection of design recommendations for the creation of systems that enable more meaningful interactions with heterogeneous digital records.

RELATED WORK

Research on personalization systems helps to articulate the complex feelings people have about being profiled and tracked by digital systems [1]. Studies in advertising reveal that most people do not feel comfortable with personalization, and this discomfort increases with knowledge about how this process works [43]. Giving people control over how information is collected reduces concerns [42]. However, this differs for recommendations (such as those for music or media) that are not framed as advertising; in these cases transparency can positively influence how people perceive the system [40].

Personalization has also been studied within the context of personal information management. Responding to the complexity associated with managing fragmented pieces of information, researchers have developed systems that provide users with the ability to add metadata and develop their own personal categorizations [10]. This research advances the notion that a person's subjective understanding of a digital item may be a useful mechanism for finding it later [5]. More recently, there has been a push to think of information fragmentation as a valuable aspect of personal digital information and, more broadly, as to how people understand and develop their digital identities [23].

Within human-computer interaction, researchers have developed systems aimed at enabling people to archive, reflect on, and revisit their information, memories, and media. Work in this area suggests that digital systems may be a valuable way for people to engage with the desire to communicate information about their lives to others [23], a process that is an integral part of how individuals develop a narrative about their life's experiences as they age [6]. In addition, everyday reminiscence, as embodied in digital systems, offers an opportunity for people to examine the context, meaning, and value of the parts of their lives that they choose to document [8]. Personal informatics systems, like activity trackers, offer people the ability to think broadly about how their digital information reflects their behaviors and practices [22]. Additionally, there is a large body of lifelogging work that suggests that information captured through lifelogging tools aids in the process of identity construction [30]. However, despite the potential of these systems, prior work highlights the challenges of tying the capabilities of digital media and information to existing reflection and management practices [35, 47]. In addition, this work also exposes unanswered questions about how systems can impact recalling and remembering [17].

It is also often the case that people will collaboratively manage digital information. Frequently, multiple members of a family will jointly manage the media, artifacts, and documents in a home. This is a long-standing practice; the objects in a home typically often reflect the relationships of people to whom they are connected [21]. Family members also sometimes collectively manage digital or intangible artifacts and information. For example, parents regularly take on the management of the digital photographs that reflect the lives of their family members and children [46]. This practice seems likely to increase as people become the owners of multigenerational collections of digital records. Looking beyond the family, collaborative information management is an integral part of creating repositories of cultural information. The development of these repositories represents an opportunity to understand how digital systems can reflect the needs and values of cultural groups and institutions [7].

A growing body of literature challenges the idea that computers should indiscriminately remember and safeguard digital information. With human memory, remembering is a reconstructive process that is influenced by a host of internal and external factors [3, 36]. Though they have complex implications, forgetting and misremembering can be an integral part of how people construct their identities, create life narratives, and contextualize their life experiences [2]. In recent years, technologists have integrated this understanding of human memory to reconsider how people and systems might work together to make sense of large quantities of digital information [9, 38, 47]. This is not to say that the loss of digital content is inconsequential; but rather instead, it is worth reflecting on

the idea that forgetting and subjective remembering may have a valuable place in how digital systems operate [27].

STUDY DESIGN

Provocation and Engagement Through System Design

This related work highlights an opportunity to examine how systems might help people make sense of digital records and, subsequently, how those systems will influence practices related to legacy, information management, and meaning making with digital records. Building on this research, we developed four interactive systems – *MailMem*, *Calendera, Locale*, and *Gather*. These systems took the format of focused, but low-functionality websites, each of which enabled us to explore a number of questions derived from our larger research goals. Methodologically, our approach for the development, orientation, and use of these systems draws from reflective design [39], technology probes [18], and user enactments [33]. In line with these methods, we developed the systems as a way to provoke and inspire discussion with participants about issues that might otherwise be hard to imagine or articulate.

System Dimensions and Concepts

The systems were built around four dimensions — topic, generativity, agency, and time. These dimensions were chosen based on our goals for the study and on prior work in this area [14, 15, 47], which highlighted issues and opportunities for meaningful reflection with digital information. These dimensions were also drawn from related work in personalization [1], legacy making [44], and slow technology [31]. Each system represents a variation on all four of the dimensions to some degree.

In addition, all of the systems utilize metadata as a design material. Metadata is the information that describes, annotates, or adds onto digital data [13]. Though there is a fluid relationship between what is referred to as 'data' and that which is described as 'metadata', in this work we are centrally interested in metadata as a way to examine the relationship between digital systems and the people that use them. As such, we are 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.

Topic

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

Generativity

The second dimension was generativity, or the extent to which the system generated novel presentations using existing data and metadata. Though each of the probes generates new representations of content to some degree, we were interested in exploring how users perceive the differences between systems that generate new ways of looking at existing digital information and those that more faithfully represent a user's digital content.

Agency

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

Time

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

System Building

The systems were low-functionality websites, a format that reflects how these services would be used if they were real, working systems. Each was pre-populated with specific information that related to a scenario we developed. 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 [33].

Protocol

Study sessions took place in a lab on our campus 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, we introduced the participants to the systems one at a time. Participants were asked to think of their interaction with the systems as thought exercises. We made it clear that we did not intend to develop these systems further and that we were 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, we 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. We then provided them with as much time as they wanted to explore each system. Afterwards, we 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.

SYSTEM DESCRIPTIONS

MailMem

MailMem is an email system that identifies meaningful email threads and then presents them to users in their inbox (Fig. 2). Participants were asked to imagine that the system was capable of selecting conversations that it had assessed as being meaningful or unusual. 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. We described how *MailMem* would unpredictably and periodically unearth these conversations and present them to the owner of the inbox, which allowed us to experiment with both time and agency.

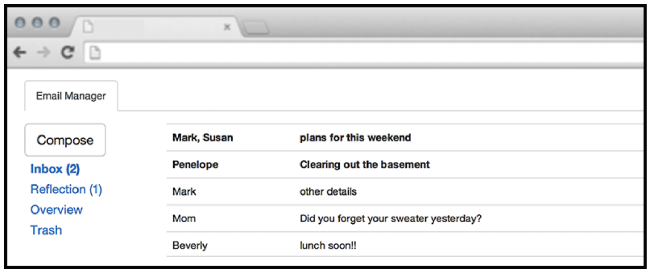

Figure 2: The inbox for *MailMem*.

For the study, participants were presented with a set of conversations marking the end of a relationship, shown in Figure 3. The graph is scaled to reflect the volume of communication between two people and the red lines indicate particular emails being highlighted by the system.

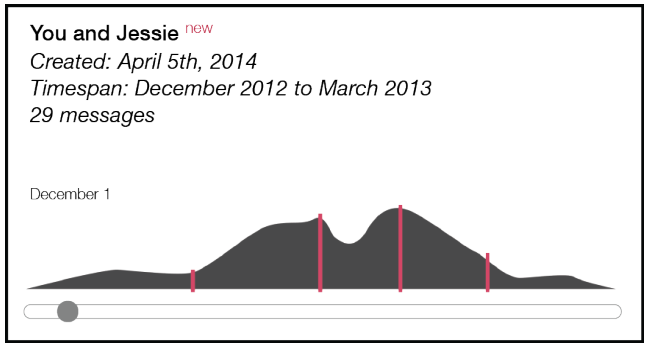

Figure 3: A thread selected by *MailMem*.

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 [28]. 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 [16, 45]. 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. We chose to frame this system around an emotionally charged topic in order to talk with participants about how predictive and adaptive systems might operate given the deeply personal information sometimes held in digital systems.

Calendera

Calendera is a calendar that integrates 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 are signaled using a golden bookmark, pictured in Figure 4. *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 are 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.

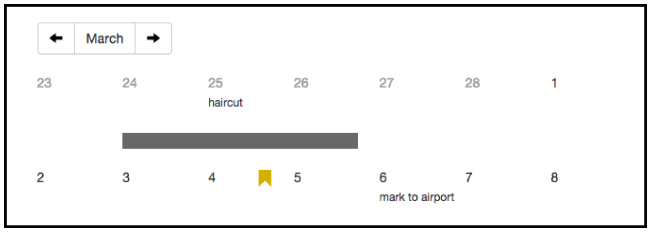

Figure 4: *Calendera* with a bookmark showing that there is information available about the owner's family.

During study sessions, participants were asked to imagine that *Calendera* had access to generations of digital records from which it could pull out pieces of information that it identified as interesting or meaningful. For our study, we created three micro-remembrances (Fig. 5): 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.

Extending work on everyday reminiscence [8], our 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* explores how, in the future, digital systems might make use of extant digital content from one's family members.

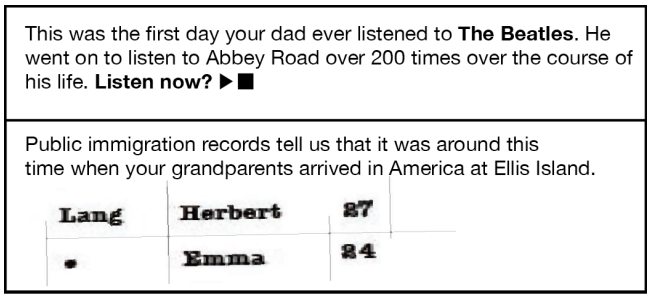

Figure 5: Two micro-remembrances for *Calendera*.

Locale

Locale explores how systems might incorporate contextual information into a person's digital records. It is a map-based system that combines information about where a person has been with information captured from his or her own records and from external, publicly available sources such as Twitter and Facebook. *Locale* (Fig. 6) displays a map on which particular locations have been highlighted. If a location is clicked, it displays information about that location, the user's history at that location and, in some cases, external information about that place.

Figure 6: 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, we provided them with time to explore the map and each of the pieces of information embedded therein.

Though *Locale* displays location data, it was not created to explore location-based records and reminiscence. These topics have been explored by prior work [24, 41]. 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, we wanted to investigate how people felt about systems acting on their behalf to provide additional context to their experiences and records.

Gather

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

We asked participants to explore an assemblage generated for a trip to Chicago. As seen in Figure 7, 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, we 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* allows users to add notes to the system-generated representations.

Figure 7: An assemblage from *Gather*.

Building on existing work that explores how digital information and collage can be used for storytelling [12, 48], 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.

PARTICIPANTS

We 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 our 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 engaged with digital systems.

DATA ANALYSIS

Study sessions were captured using a voice recorder and were transcribed by the researchers. Those transcripts were then coded using an iterative, open-coding scheme. When completed, the coding scheme contained 63 codes distributed across seven broader categories.

FINDINGS

Our findings 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, we outline four themes that emerged from our findings: 1) the influence of digital systems on the process of remembering one's life; 2) perceptions of how systems will act as mediators of personal information across time and generations; 3) the ways in which personalization systems act as a lens through which people can better understand how and when digital systems capture information about them; and 4) the role that metadata might play in helping people engage with the deliberate and automatic accumulation of digital information.

Memory and Recollection

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

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

This is in line with previous work that suggests that given the scale of the archives we generate, system-selected content has the possibility of being just as meaningful as that which we select ourselves [37]. 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 [29]. Instead, we can rework that idea to account for adaptive, analytical systems like these, that are being understood and utilized by users in a way that is productive but that may differ from the designer's goal.

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

Systems as Multigenerational Mediators

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

Seven of our participants felt as though there was value in a system that could capture and make use of multigenerational information. P1, one of our 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 of our participants noted that there is some inherent strangeness associated with utilizing digital systems to communicate information between loved ones. Several of our participants felt uncomfortable with the idea that any system would engage in unsolicited curation of information related to their family life. P5, projecting into the future, described his reservations: "*I guess I would want to tell my kid [things] that I would want them to know. I wouldn't want the computer to like slurp something out of my email, you know. But I would want to say – 'Oh, hey, this was something important…' I want to share that, I want to make sure it's this family lore that exists, but I would want to consent to that*." These issues are interesting when they are considered in the broader context of how systems are already being integrated into existing practices around reflection, remembrance, and legacy making. Extending those ideas, this finding inspires speculation into how people might react to the need for more sophisticated means of passing down information as a part of a personal legacy.

Systems as Mirrors

Conversations with participants revealed that existing commercial personalization systems provide an opportunity for people to consider what information is being collected and how it is being used. Several of our 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, we are 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 our 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 we build systems designed to make sense of large collections of information, it is important to consider how the representations produced by systems may influence personal wellbeing and the ways in which people define their identities.

Metadata as a Gateway

Reflecting on the use of metadata as a design material, our findings also highlight how we 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 [23], these types of systems may be an entry point for users to think about what information holds value to them and could also function as a starting point for discussions with family members about how best to treat digital records in the context of one's legacy. In addition, this finding illustrates the potential for metadata and personalization systems to help people curate records in a way that is personally meaningful.

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

DISCUSSION

These findings highlight a number of issues regarding the ways in which digital systems are becoming a part of how people generate, organize, and revisit digital information. In this section, we 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 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 we consider 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.

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.

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. However, it seems important to note that, in this work, the strength of this method was a result of using those systems in conjunction with a flexible protocol that allowed for the participants and the researchers to imagine what the future of this technology might look like and how those ideas might impact our own notions of family and history.

DESIGN OPPORTUNITIES

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

Exposing System Interpretations

Prior work [2, 27] has suggested that we might reintroduce aspects of human memory and forgetting into the creation of digital systems in order to shift thinking about how information is used and reflected upon. On a practical level, outside of specific systems (like Snapchat), this is a provocative idea that might be difficult to encourage because it represents a direct challenge to a common understanding of how computers are supposed to work. As we examine the role that forgetting may play in digital systems, it is worthwhile to consider an intermediate step: providing people with information about how their actions are being interpreted by systems with the goal of fostering more productive relationships with digital systems. In addition, there may be a complementary opportunity for systems to learn from how people respond to system interpretations of their information.

Using Time as a Contextual Variable

An opportunity exists to build systems that help situate digital information in a time in a person's life when it would be most evocative, meaningful, or relevant. Participants discussed how time impacts the meaning, representation, and interpretation of digital information. This phenomenon extends well beyond digital data and artifacts, but is particularly interesting in the digital world given the

possibility of automating the process of stewarding and passing on digital content. For example, one can imagine an application that allows people to set aside content that will later be unlocked once the recipient or inheritor has reached some milestone or part of their life. Though this form of information management would impact the way in which its owner understands that information, it offers both the curator and the receiver an opportunity to reflect on that process.

Closing the Gap in Multigenerational Records

An opportunity exists to expose meaningful threads present in collections of digital content. Participants consistently expressed interest in passing on records to future generations and in reflecting on records from those who have passed away. However, this presents a number of challenges related to helping people make use of content, such as that which you might inherit, some of which might not be directly relevant to one's life. That is, can we leverage existing or future technologies to make sense of and draw out themes from familial archives? This work might include the creation of a system that identifies particular shared experiences across different members of one's family, like battling with depression or taking trips across the country. In the absence of technology that can automatically identify and reveal these shared life experiences, there is an opportunity to help people assemble shared representations of their experiences or craft personalized recollections of their own experiences.

LIMITATIONS

A limitation of this work is that we had a 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 our participants were citizens of other countries, we did not explicitly explore how western values may have shaped the information captured through our interviews and provocative systems. In both cases, these limitations expose rich areas for future work: (a) understanding how stage of life and other aspects of one's life influences legacy making with digital data and (b) exploring how cultural differences around technology use and remembrance may intersect to augment existing practices.

CONCLUSION

This paper draws from prior research from personalization, memory, and information management to create four interactive, provocative systems that were used to understand people's perceptions regarding access to and management of personal and familial digital information. We found 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. Our future work will explore how digital information and systems might be designed to support these important life processes.

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