Mailing Archived Emails As Postcards: Probing the Value of Virtual Collections

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ABSTRACT
People accumulate huge assortments of virtual possessions, but it is not yet clear how systems and system designers can help people make meaning from these large archives. Early research in HCI has suggested that people generally appear to value their virtual things less than their material things, but theory on material possessions does not entirely explain this difference. To investigate if changes to the form and behavior of virtual things may surface valued elements of a virtual archive, we designed a technology probe that selected snippets from old emails and mailed them as physical postcards to participating households. The probe uncovered features of emails that trigger meaningful reflection, and how contextual information can help people engage in reminiscence. Our study revealed insights about how materializing virtual possessions influences factors shaping how people draw on, understand, and value those possessions. We conclude with implication and strategies for aimed at supporting people in having more meaningful interactions and experiences with their virtual possessions.

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Virtual Possessions; Technology Probes; Self-Reflection; Design; Revisitation.

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INTRODUCTION
We live in a world in which people are accumulating large, heterogeneous archives of virtual possessions. The ongoing transition of traditionally physical artifacts (e.g., books, photographs, movies, etc.) into digital forms has produced a range of benefits, such as lower costs, more flexible access, and a smaller physical footprint. People are also acquiring growing collections of things that never had a material form, such as digital communication archives (e.g., email and SMS), video game avatars, and metadata from social networking sites (e.g., photos tags, Facebook likes, comments, etc.). Given this shift, researchers have begun to examine how the forms and affordances of virtual materials shape how people perceive their value and meaning.

Virtual possessions open up a wide range of opportunities to support meaningful experiences—from reflecting on previous life experiences to connecting with loved ones across space and time. Despite these benefits, a nascent and growing body of research has shown that people often view their digital collections as less valuable than collections of material things [e.g., 38, 45, 55]. Current theory on how people perceive and construct value with their material things fails to describe why the same value often does not accrue to the same extent for virtual things. Additionally, research from archival studies and HCI suggests a number of challenges that arise from trying to make sense of large collections of virtual things [17, 28, 54]. There are still a number of open questions regarding how people construct value with virtual possessions [3], leaving designers with little guidance to create new opportunities for people to create value and meaning with their virtual things.

Recent research speculates that changes to the form or behavior of virtual things might increase people's perceptions of value or attachment to them [37]. Yet, it is unclear (i) how designers can support meaningful engagement with archived artifacts, (ii) how interaction with those artifacts influences perceptions of the archive as a whole, and (iii) how designers can support meaningful engagement with those artifacts. To investigate this further, we designed and deployed a technology probe [18] that altered the form and presentation of potentially valuable messages within people's email archives by sending them as physical postcards. We deployed this system in eight households, sending one postcard every seven to ten days over the course of three months, and interviewed the recipients to understand the properties of messages that did and did not encourage self-reflection—a behavior

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associated with value creation [37, 40]—and to consider the meaningfulness of the items they received through the mail.

Building on existing research on designing for reminiscence [8, 14], the field study revealed that people were most likely to experience meaningful reflection on the past when the postcards represented cues from some substantial life event, a memorable social relationship, or a transformative experience. In line with prior work from archival studies and information science, the study also revealed challenges associated with making meaning from content that has been removed from its original context, a problem that results from the mutable nature of virtual content. The paper makes two main contributions. First, it provides an example of the design, implementation, and field deployment of a technology probe that alters the form and behavior of a virtual archive. Second, it offers new insights about how designers can build systems that help people to perceive the value of their virtual possessions archives as well as design strategies that ought to be avoided.

RELATED WORK

Related work spans three areas: theories of material possessions; research on virtual possessions archives; and research on designing for digitally mediated experiences of self-reflection and reminiscence.

Theories of Material Possession Attachment

Psychologists have long considered possessions to be an integral part of people's self-concept [19]. Goffman spoke of possessions as props in self-presentation [12] and Csikszenthmihalyi and Rochberg-Halton [10] noted how people invest psychic energy in the things they use, both with meaning-making activities and with self-reflection on who they were or wish to be. Belk's work in consumer behavior research [2, 3] describes how people extend their sense of self through their use of objects. People come to understand the value of a thing as they use it socially, and also as they reflect on and re-evaluate it in relation to their self. Research building on Belk's idea of self-extension has emphasized the importance of social roles and life story [1]. People grow attached to the things that connect them to the important social roles they enact, as well as to the things that play a role in the events and activities that make up their *life story*—the many stories that tell of who they were, who they are, and who they desire to be [1, 26].

Dispossession also plays a critical role, though it has been researched somewhat less [32, 44]. As people acquire new things, they often get rid of other things to make space [26, 42, 44]. The practice of dispossessing things is ongoing, but it is most easily viewed at life transitions. For example, when a person has a child, they may accumulate many new objects, such as a crib and a stroller. These all intrude into their domestic space, forcing them to reassess the value of their other possessions, to curate their collections, and to dispossess the things that are no longer reflective of who they are. Dispossession has value as a way of constructing and communicating one's identity [25], as a way of establishing an enduring life narrative [42], and as a way of highlighting significant values and relationships [42].

Research on Virtual Possessions and Archives

Research in archival studies and information science provides a foundational understanding of how people engage with large archives of virtual things. Though much of this work is focused on the practices of archivists and of people interacting with data that they did not generate, there is a limited corpus of research that has investigated how people engage with personal archives, including archives of their own information and media. With regards to our work, this research highlights that metadata and other contextual information may provide valuable insights about the significance of the information they describe or accompany [17, 22, 29]. Work in these areas also describes tensions regarding people's perceptions of the value of their virtual archives. For example, although people take steps that maintain and add to their archives [53], they are often unsure of the future value of these archives or the information they hold [20, 28].

HCI researchers have begun to investigate collections of virtual possessions. Early work examined specific types of possessions, such as music [6, 51], photos [6, 23, 42], videos [24], money [52] and, later, social media [46, 58, 59]. More recently, researchers have begun to investigate virtual possessions as a class of artifacts [36, 38].

One recurring finding has been that virtual possessions are often considered less valuable than material possessions. When investigating this issue, prior work has speculated about the nuances of virtual possessions that limit their ability to become valued objects and has suggested how we might draw from aspects of both physical and digital objects to support this type of value creation [13, 42]. Work by Brown and Sellen theorizes that the inability to display digital music collections might erode their value [6], a finding that could extend to other types of virtual possessions. Similarly, other work in this area suggests that e-cards may seem less valuable than traditional greeting cards because people perceive e-cards as a low effort alternative to physical cards [37]. This finding points to the ways in which the context of a virtual object impacts the way it is perceived.

Delving deeper into the ways people use their virtual possessions, other research has observed people engaging in behaviors similar to value construction with material things [3]. This applies to virtual possessions that do and do not have a material form. Studies on teens demonstrated that valued virtual possessions are those that support self-presentation and self-reflection [37]. Other work investigating practices of young adults showed that they valued assortments of virtual possessions that represented their life stories, and that they desired to organize and access their collections in terms of relationships, events, activities, and life stages [36]. This is in line with larger narratives around how people collect and curate physical

objects as a way of constructing their identity and cultivating personal values [26].

Nonetheless, there are clear differences between the qualities of a virtual possession and material things—differences that change how these objects are perceived and used. In a synthesis of fieldwork people's uses and perceptions of virtual possessions, Odom et al. noted three paradoxical properties of virtual possessions that increase their functional value while eroding their ability to accrue deeper meaning: spacelessness, placelessness, and formlessness [38]. Because of differences like these, it is unclear how digital things can be integrated into existing practices and rituals in a way that is meaningful [41]. This process is complicated, in part, by the means through which people store and manage their virtual possessions [27]. The scale of the archives that people generate also can make it more difficult to manage those records [57].

Our work advances research on virtual possessions by examining how changes to form and behavior impact perceptions of virtual possessions. Specifically, we investigate how materializing elements within virtual archive might diminish its placeless, spaceless, and formless qualities, and provide a way for people to draw on these artifacts as resources in everyday life.

Reflection and Reminiscence

Our work investigates self-reflection and reminiscence through use of email archives. These archives present the opportunity for operating as a rich resource for reflection due to their size, message length, and temporal depth; several researchers have created systems that visualize email archives in support of reminiscence. Across systems, these visualizations often represent online social behavior and overviews of relationships [34, 47, 49, 50]. Different systems offer more or less depth in terms of archive navigation [14, 40, 50], but for the most part users found each of these systems useful for reflecting on their own patterns of behavior and reminders of past life events, and show that users find value in using these tools to engage in self-reflection.

In addition to an analysis of individual systems, our work draws from research that directly articulates how we might design systems that enable people to reflect and reminisce using virtual materials [8, 35, 56]. In particular, this work suggests that experiences of reflection can be supported through three related strategies: (i) materializing one's virtual possessions, (i) providing lightweight methods for people to select and organize meaningful records, and (iii) integrating one's records into everyday life. To better understand the process of reflection on one's virtual information, we also examined a number of existing systems and practices—such as TimeHop [48], Facebook's Year in Review, and the use of hashtags on Twitter, Instagram, and Facebook for 'throwback Thursday' posts, in which people resurface content from their past. The popularity of these systems and practices suggests that people have the desire to reflect on and share information from their virtual archives. However, none of the research work examining reflective practices online engages with questions about how this reflection and examination impacts people's perception of value for the whole of their virtual communications or archives.

Our goal is to bring these threads together to examine how people's perceptions of value with physical and virtual possessions differ. Theories of material possession attachment do not fully explain the difference, but provide a starting point. We aim to build on this foundation, while incorporating insights from prior research on virtual possessions. In advancing these ideas, we explore how materializing key elements in an email archive might shape their capacity to function as resources for reminiscence and reflection. We also seek to better understand how people construct value with their virtual things in the service of opening new opportunities for designing more meaningful interactions with virtual archives in the future.

TECHNOLOGY PROBE DESIGN

The overarching goal of our work is to investigate how changes to the form and behavior of virtual possessions shape people's perception of their value in the context of self-reflection, identity formation, and construction of one's physical environment. The concept for the probe we design was influenced by prior research that simulated a similar idea using the user enactments design research method [37]. This prior work suggested there might be value in providing people with materialized versions of their virtual possessions, but did not use participants' actual archives.

We extended this work by adopting a technology probes approach [18] that involved creating a concrete, functional system, and subsequently deploying and studying people's everyday experiences and interactions with it over time. This method is particularly beneficial in situations where there is little knowledge to guide designers in what they should make or how people might interact with a new thing. Importantly, technology probes do not aim to 'solve' a particular problem. Rather, they aim to explore the benefits (e.g., what participants enjoy), the unexpected uses, and the unintended consequences and tensions produced from people's real, lived-with experiences. In this way, it is a generative approach for researchers to develop an under-investigated area in order to identify both opportunities and areas of concern.

We chose to focus on archives of email messages because they hold long histories of social exchanges and have been shown to be valuable resources for self-reflection [40]. We initially considered SMS or social media archives, but we chose to use email instead for three reasons. First, email has no length limit, which offers the potential to support more in-depth communication than text messages, Tweets, or status updates. Second, it presents one of the oldest and most persistent virtual archives people have. Email has existed since the early 1970's [4], long before any social

networking service. Notably, Gmail, the world's largest email service [33] has encouraged archiving instead of deletion since its launch in 2004 [27]; many of its hundreds of millions of account holders have uncurated archives spanning several years. Research on email archives also demonstrates the high frequency with which people choose to hold on emails they've received [54]. Third, email is a private, directed communication medium as opposed to a broadcast medium like social media [7], making it potentially more apt to contain intimate or personal information that could be a trigger for self-reflection.

We chose to materialize email communication as postcards. As a cultural artifact, postcards are a familiar, slower communication medium, often used for personal messages such as holiday wishes and vacation updates [21]. Unlike letters, postcards are often displayed informally in the home and signify some information about the relationship between the sender and recipient. In addition, postcards are often used to share information about a particular memory or experience. As such, the form and function of a postcard aligned with the kind of engagement we hoped to foster with participants. By materializing electronic messages in the physical world as postcards, we were interested in whether participants would feel more inclined to re-examine the potential significance of each message against the backdrop of their everyday lives and to consider the value of their archives as a whole.

Message Selection

In designing the probe, we were interested in giving participants the chance to engage with their virtual archives through a discrete interaction. We tried to select emails that could reasonably be expected to trigger self-reflection as an indication of meaning making and value attachment, should such messages actually exist. Email contains rich structure: long messages within conversations or threads. However, due to space limitations, we could not tell an entire story on a single card. Instead, we printed a portion of an email (a "snippet") on each postcard with the intention of sparking a memory and triggering reflection under the assumption that people would remember the context from which the snippet was drawn.

To select snippets, we wrote software to extract potentially meaningful segments from a person's archive based on several heuristics. We induced these heuristics from our

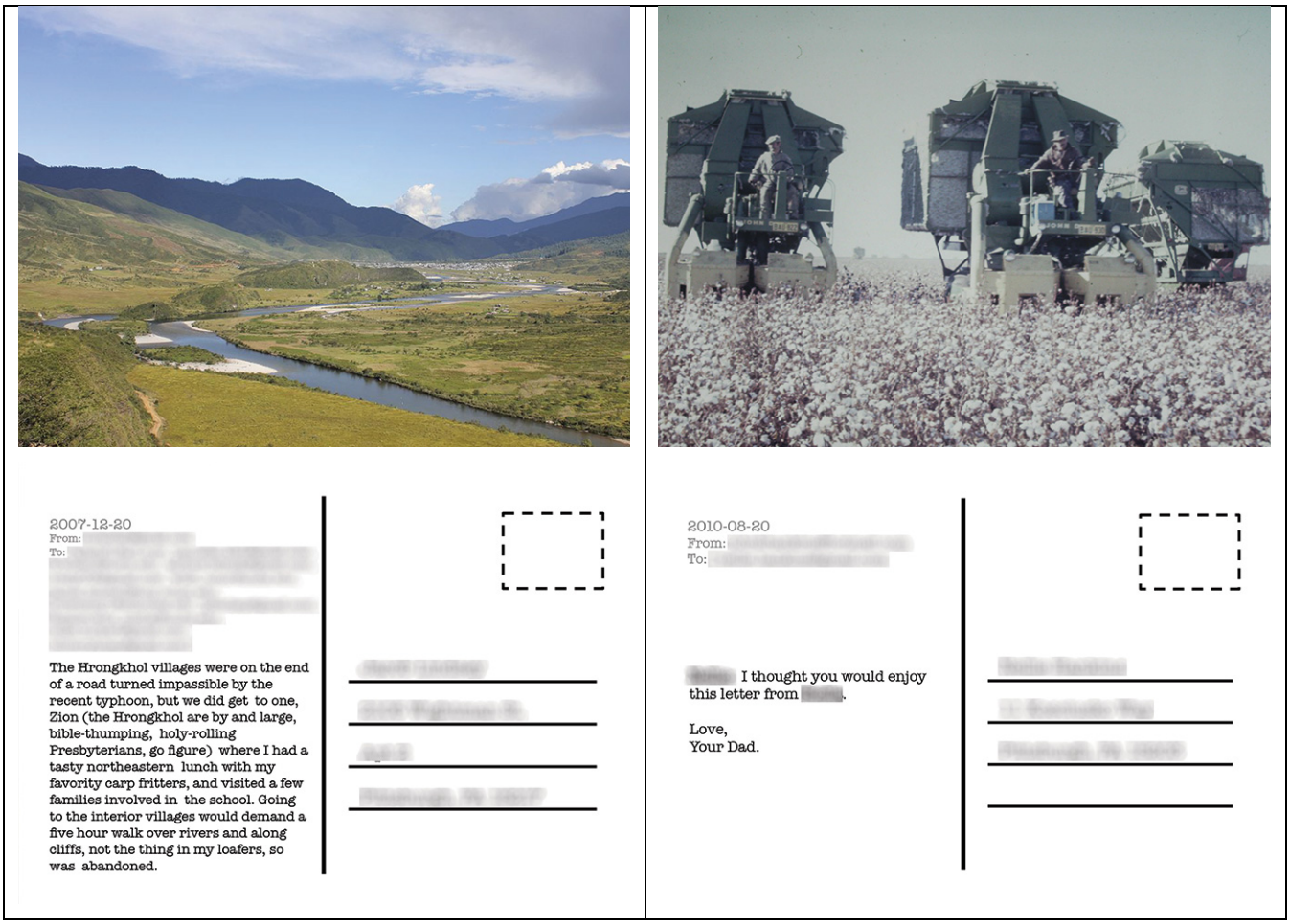

Figure 1: Examples of postcards we sent. A postcard that triggered self-reflection (left) and a postcard that was mundane and lacked context (right)

own email archives and from prior work that suggested cues for identifying meaningful messages and threads. Based on our analysis, we created the following rules to help select messages:

- High-frequency words that appear mainly in messages from a single person. For example, if a participant often discusses theology with one friend, but rarely with others, then conversations about theology with that one friend might be meaningful. We employed the TF-IDF statistic [15, 50] to determine which words were statistically improbable for each sender.
- Keywords and key emoticons, such as lol, love, I feel, xoxo, haha, :), :-). Research on the MUSE system suggests that these emotional cues may help identify significant or meaningful content [15].
- All-caps words with four or more letters, which may signal excitement within an email message. (We excluded shorter words to avoid acronyms.)

To determine which emails to mine, our software generated a list of each participant's most frequent correspondents. We then asked them to specify people from whom they did not want to receive messages (this process is described in more detail in the study design section). The software then applied the heuristics we developed to select specific sentences from the emails both to and from these topmost correspondents. After identifying a plausible sentence, the software then expanded each snippet by adding surrounding sentences from the same message until the snippet was between 400 and 500 characters—a comfortable number for a postcard. Messages less than 400 characters long were included in full. Each snippet was printed on the left of the postcard. The "To" and "From" email addresses and the date the email was originally sent were above the snippet. The participant's home address was printed on the right, as in a standard postcard (see Figure 1).

It is important to note that our approach to identify potentially interesting or meaningful messages, though based on prior work, is one of many possible approaches to this problem. Similarly, the decision to shorten long messages was made due to space considerations, but other approaches (such as summarizing content or only using messages that can be represented in full) may have elicited other reactions from participants. However, the snippets generated by the probe did yield reflections from the participants that inform our understanding of how we might increase the value associated with virtual possessions.

Image Selection

Materializing virtual artifacts introduces unintentional side effects in which some users could potentially find meaning. This was evident for us in selecting images for the front of the postcards. We were not specifically investigating the value people attach to images, and we wanted to avoid, when possible, using pictures that could significantly change the meaning people attributed to the original text. We used Google Image Search to randomize image generation for each snippet. To do so, we used the entire snippet as our input, with parameters set to large, wide-format images, with moderate safe search. If we found no results from this, we removed the last three words and searched again, taking the first image that we found. We rejected images that were only text or that were potentially upsetting (e.g., a picture taken just before the April 2013 Boston Marathon bombing). Our goal was to generate photo selections that would support, but not overtly influence, the process of reflecting on the message.

FIELD STUDY PROCEDURE AND PARTICIPANTS

Participants

Participants were recruited through Facebook, and then through word of mouth. In total, there were 8 participants (4 male, 4 female) in this study. They ranged in age between 25 and 32 years old (mean 28) and all lived in the same medium-sized city in the United States. All participants had been using their email account for at least 3 years. Despite the limited age range, the participants had a wide range of technological proficiency. The number of messages each participant had in their archive ranged from a low of approximately 800 to a high of approximately 80,000. The amount of personal correspondence each participant regularly receives varied, but each participant had some experience sending and receiving letters and postcards.

Study Design

We conducted the study over a three-month period. We sent a postcard to each participant at a random interval between 7 to 10 days so that they received each new postcard on a different day of the week across the duration of the study. This was meant to reflect the pleasantly unpredictable nature of receiving traditional postcards. We also conducted three in-home interviews with each participant that lasted from 30 minutes to 2 hours apiece. Interviews were semi-structured and each of the three served a different purpose.

The first interview was used to learn more about participants, explain the study, and collect the information to use for the probes. We asked participants about their living situation, occupation, their communication patterns, how they interact with their archived emails, and their relationships with sentimental objects (e.g., postcards or other mementos), as well as where such items are kept. We also described our data protection policy and downloaded their entire email archive. Participants knew before the interview that we would be requesting access to the archive.

After downloading the emails, our software output the email addresses with which the participant had exchanged the most messages. For each correspondent we collected information characterizing the relationship, and then asked the participant for permission to send postcards containing information from this person. We wanted to give participants control to avoid receiving messages from

relationships they would rather not revisit (one participant removed a correspondent for this reason). Participants sometimes chose to exclude certain email addresses as inappropriate, such as mailing lists or business associates. Most participants also had a set of emails in which they had emailed themselves information, and these were also excluded. For each participant, we settled on a selected set of 8 to 12 email addresses that corresponded to friends, family, and other personally relevant contacts.

After selecting correspondents, we generated the postcards, as described in the previous section. We then manually checked each postcard to ensure that it did not contain sensitive information, exceedingly emotionally fraught conversations, or simply automatic or business communication. If it did, we replaced it with a different snippet and image. We rejected 24% of the snippets at this stage, the vast majority of which fell into the later category of business and promotional communications, such as advertisements. It is possible that some rejected snippets could have triggered the participant to reflect on some aspect of their life. However, regarding sensitive and emotionally fraught messages, we made the decision to exclude those to protect the rights of participants and reduce the emotional risks of being involved in the study. This decision reflects findings from recent work that highlights the potential impact of systems exposing people to difficult or negative content over time [11, 16, 39].

The remaining two interviews were conducted after the participants had used the system for one month, and again then two months later (totaling three months of system use). During each interview we discussed participants' experiences receiving the postcards, what they did with them, and any further reflections on their communication or archives. We recorded the audio from each interview and took pictures to document how people display their meaningful objects and where the postcards were stored after they were received.

Data Analysis

To analyze results, we reviewed field notes taken during and immediately following an interview and employed affinity diagramming to reveal and structure salient themes. This was an ongoing and iterative process involving clustering and coding themes emerging in the data over time [31]. Throughout this process, we reviewed the recordings to resolve ambiguity in our notes, to locate particular quotes or ideas, and to better understand the data we'd collected.

FINDINGS

Our data analysis revealed a number of significant findings and themes. The first theme describes insights about value construction for virtual possessions—insights that come from the intrinsic features of messages and whether they did or did not trigger meaningful reflections. The second articulates challenges associated with deriving meaning from large virtual collections and allows us to reflect on how these challenges might be addressed through the design of the systems that capture and archive this information. The third theme explores how the technology probe and its materialized form of virtual messages caused behavioral tensions for the participants. Finally, the fourth describes participants' higher-level reflections about their virtual collections.

Value Construction Through Reflection

Not all of the 8-11 postcards sent to each participant were successful in triggering some form of reflection. Though an email account is only one of the many ways that people generate and accumulate content, it is still a large archive of content, much of which may not be all that meaningful. In this section, we describe the types of reflection that our postcards generated (or failed to generate) and we use that information to frame a discussion about how designers and developers might help people engage in value creation with heterogeneous virtual collections.

Our interviews revealed that people were primarily interested in engaging in two distinct but related types of reflection. The first type of reflection relates to events and time periods in one's life. This type of reflection often involved revisiting significant periods of one's life and thinking about how one's life had changed since that time. The second type of reflection was centered around relationships. As one would expect, different participants displayed different levels of enthusiasm for reflection in general, but within their level each engaged in narrative exposition about important people or life events. Though one type of reflection usually dominated each narrative, it was often the case that both types would be present in a single narrative. For example, it was rare for someone to reflect about a life event without it having been triggered by a memory of a specific person. In the following sections, we describe participant's experiences reflecting on the information shared on the postcard and describe how the findings could be used to inform the design of systems that help people engage with their virtual collections.

Reflection on Events and Place

When describing a memorable postcard, participants would often begin with "This was when…", framing their story around a specific event or time period in their life. This notion of 'events' was frequently tied to place; it is clear that events that reference changes of place, such as traveling, leaving a workplace, or moving to a new city, are often transformative experiences that offer a rich resource for reflection. As systems capture more information that connects to these transformational experiences in people's lives, we can begin to think about how those systems can use the data they've captured to provide more meaningful opportunities for reflection.

For P3, who described herself as someone who loved to reminisce, the two most memorable postcards triggered her to reflect on events and periods of time from her past. The first was from an old interaction with a former employer.

The message itself was mostly mundane *("It would most likely be part time or internship type work, but I'll see what I can do!"*), but P3 joyfully described how the message brought back fond memories of a time of her life and a job she had enjoyed. The second snippet was from a message that she had sent while on a trip. She was fond of this postcard because it reminded her of something she would write in a journal—that is, it brought her back to that time and allowed her to reflect on that experience.

Events were also accessible anchors for participants who described themselves as not being particularly interested in saving or holding on to things. For example, P4, who thought of keeping old cards and accomplishments as a form of "hoarding," told us that her email was mostly recipes from her mom, which she kept because of their utility, and conversations that reminded her of when she studied abroad in China. Many of P4's postcards had messages from this time that she had spent abroad. In each interview she told us that the postcards were not meaningful and that she intended to throw them out, but she continued to tell us these stories of when she was abroad and the people that were in her life at that time. Her interest in sharing these stories illustrates that the postcards—and the contents of her virtual archives—were capable of calling up important times from her life that helped construct her evolving life story.

Reflection About a Person

For several of the participants, an event referenced by a snippet was less important than the person that it reminded them of. For example, P5 described receiving a postcard that reminded him of a fondness he had held for a former high school teacher. The snippet from the card read, "*The Hrongkhol villages were on the end of a road turned impassible by the recent typhoon, but we did get to one, Zion (the Hrongkhol are by and large, bible-thumping, holy-rolling Presbyterians, go figure) where I had a tasty northeastern lunch with my favority* [sic] *carp fritters…*" P5 explained that this snippet had come from an email sent as a greeting when the teacher was on a trip to India. P5 did not go on that trip, and the details of it were not particularly important to P5, but the card functioned as a reminder of a teacher that had played an important role in his life. P7 also enjoyed a card that reminded him of a friend with whom he is no longer in touch. The postcard snippet repeated a disclosure from that friend: "*Completely clean for 6mos ish*" which reminded P7 of a transformative time for his friend, and prompted him to reflect on their relationship.

Other participants shared stories about how cards triggered reflection on important family members, friends, and even acquaintances that had left an impact on their lives. P8 spoke of a sequence of postcards that serendipitously happened to come from the same conversational thread. It started with a snippet from her grandmother: "*Have you any ideas? I last had the key ring when I drove into the driveway yesterday about noon after getting groceries and mail, so they must be here…*" The thread continued with another postcard two weeks later: "*Gma- Last I knew, the keys were on top of the pine box for wood. I looked through my purse and my pants pockets, and I couldn't find them, so I don't think I still have them. I'm sorry, I hope you find them"* [P8]. P8 shared that she was able to recognize what she described as the quintessential nature of her grandmother from these two decontextualized snippets. Although people reflected on important life stages and humorous stories throughout each of the follow-up interviews, many of the initial triggers that people mentioned were the relationships connected to messages captured by the postcards.

Clearly, revisiting relationships was an important part of how the participants engaged in reflection and reminiscence with the probes. Many existing systems focus almost exclusively on highlighting content that they think will be relevant to the user. This is no doubt a reasonable goal. However, these insights illustrate how systems that can incorporate a broader understanding of what makes something relevant or valuable to a user may be able to surface content—like that of an old relationship or about a person that has passed away—in a way that illustrates the potential richness captured in their virtual archives.

Context and Interpretation

While a subset of postcards successfully triggered reflection or amusement, many left participants feeling bemused or disinterested because they could not place the message in context. When designing the probe, our expectation had been that people would recognize messages selected from their own archive as well as the email addresses of their most frequent correspondents. However, it turned out that many people did not recognize the addresses without their accompanying names and that the short snippets sometimes did not contain enough information to provide the context of a larger thread of messages. This is in line with prior work [17, 22], and prompts questions regarding how designers can make use of aspects of both physical and digital artifacts to support reflection and meaning-making with virtual possessions and archives.

P2 shared that reading the cards felt like looking "through a keyhole." It was difficult to make sense of what was being viewed, and in response, he suggested that a collage of messages might be a more beneficial design strategy. P3 likewise lamented a lack of context. P7 complained that in many cases he could not extract the meaning of a snippet without going back to the source email, but that the motivation from the curiosity did not outweigh the effort to find the snippet in the archive. This lack of context stands in contrast to traditional postcards, which provide contextual clues. P2, P3, P5, and P6 discussed how the image, location, event, postmarks, handwriting, and signature all add context that helps them make sense of or form an attachment to a traditional postcard, most of which was missing from or unrelated to the technology probe.

Several participants mentioned their inability to connect the randomly selected image on each card to the selected snippet. P1, P2, P5, and P6 tended to like the postcards when they could draw a connection between the picture and the text. However, for most cards, the two seemed disjointed. For example, P6 expressed a desire for the photos to come from her archive: "I don't know what the pictures are, like how those are being generated. It might be, I know I have a lot of emails that included pictures... It'd be neat if they were actual pictures that are relevant to the text." P5 thought the postcards should include photos from his photo archive, such as those saved on a local drive or on cloud services such as Flickr. P7 shared that he felt rather uncomfortable when one of the randomly selected images appeared to be someone he knew, but in fact was not. As we had anticipated, the Google Image Search images did not directly support the meaning of the accompanying text, but disconnected images may have influenced perceptions at times when they seemed to disrupt reflection on the message itself.

Though providing longer snippets or more relevant images might have mitigated some of the difficulty of making sense of decontextualized information, we believe these issues also reflects a larger set of difficulties resulting from the scale of people's virtual collections. Future systems may benefit from drawing more deeply from an analysis of the contextual information that is available about the data people generate. For example, a system might make decisions about how to present information to people based on how often it has been revisited and the people to whom it is connected. Furthermore, this points to the difficulty associated with finding appropriate physical representations for virtual content. Despite similarities between the form and function of the probe and the format and meaning of participant's emails, there were clearly ways in which the probe did not adequately capture what makes either of those meaningful or valued.

Form and Curation

One way to examine the value people placed on these materialized elements of their virtual archive was to understand how they engaged with, and made use of, the postcards. In their original form as email messages, none of the snippets were particularly important to its owner. Each of the emails represented a single message within a large, unwieldy collection of virtual information. As has been noted by previous work, it is immensely difficult to manage and derive real value from one's email archive given the scale and breadth of that archive [57].

In contrast to the activities that a person might undertake with their email archive on a daily basis, our probe reframed how a person engages with the contents of that archive. That is, the probe provided participants with an opportunity to reflect on a single, disconnected piece of their larger archive. When the snippet arrived as a material postcard, the fact that it was in their hand forced them to evaluate the message from a new perspective and to determine its next location in the world. Most participants felt uncertain about where to place a postcard after it arrived.

Although the probe took the form of a postcard, its origins and content lead people to rethink its place in their home. Participants described the place they regularly put most postcards, but in some cases did not feel as though the probe belonged in that place. For example, P6 would normally place the postcards she (infrequently) received from friends or family members on the refrigerator in the kitchen. Our postcards appeared different enough from the traditional medium that she described leaving them piled up with the other collecting mail as it migrated through the house. This pattern of postcards moving between designated spots for untreated mail repeated for several participants. P8 reported that she normally puts postcards on the refrigerator, but only one of our postcards made it to this landmark. She ended up scattering most of them across various places within her home, even using one as a bookmark because it was handy. She compared the postcards we mailed her to a photo booth image that she carries in her wallet because it has "…no other place that it belongs."

P3 regularly displays postcards by tacking them to a wall in her bedroom. The images on the cards we sent complicated this practice, however, because the pictures did not resonate with her like normal postcard photos do. She described being more connected to the text, and so she mounted them with the message facing out. P5 absentmindedly left our first postcard in the bathroom. He proceeded to place each subsequent postcard there as well, building a collection in this unexpected place. He shared that he did this because he did not know where else to put them.

A few discarded the postcards. At the end of the third interview, we observed P4 disposing of all of the cards. She had kept them only to discuss in the interviews. P7, on the other hand, kept the cards because they were reminders of having participated "in a cool study." Others, such as P1 and P2, simply discarded them over the course of the study. P1 explained that these postcards had no instrumental value, such as "save the date" cards that would normally go on the refrigerator.

Although participants viewed some of the postcards more like unfamiliar intrusions rather than treasured artifacts, this did not diminish the findings, but rather helped us to classify which messages were more or less meaningful. In this way participants' evaluations helped us determine the categories of important messages as described above.

After the Postcards

Considering the Archive

At the end of the study, a few participants spoke to us about how being a part of the study had lead them to consider changing their email archiving practices. P6 mentioned

becoming "…aware of how I see [my email archive] as sort of a burden." She talked about possibly creating a new email account and making a fresh start with building a more manageable archive. This exposes that some parts of the archive are indeed meaningful, even if all of the messages that are "worth keeping" may not be. Nevertheless, none of the participants claimed they viewed their email archive as more valuable at the end of the three months. This is not unexpected, as material possession attachment research shows changes in perception of value happen over many years and through repeated use [2].

To get a sense of the conscious value people placed on their extant archive, we asked participants if they would look through their email if the entire record was printed out in book form. Only P4 would, and she had the smallest email archive. However, if we printed out only a small subset of their personal messages, all except P1 reported that they would look at it. Similarly, P3 even considered printing out a few selected emails to save in a memory box.

We also saw that our participants were quite unaware of the contents of their email archives. On reflection, P5 noted that his archived contained things he had forgotten since high school. P7 was surprised by how much of his archive was of little value. In the beginning of the study, P4 was sure that the majority of her email archive was saved recipes and messages from when she was traveling. By the end of the study, she decided those two categories of messages must have taken up only a third of her archive, and that nearly half of it must have been nothing more than bills, receipts, bank statements, and saved contact information. In addition, many were surprised by the list of frequent correspondents, especially by how many of those correspondents were mailing lists or otherwise not humans. Although the probe may not have changed how our participants considered the value of their email archives, these findings indicate that it would be worthwhile to explore how materializing aspects of one's virtual archives may change how people interact with those materials.

Privacy Concerns

Although not a formal area of research for the current study, we anticipated participants would have concerns with the privacy of their emails, particularly since we planned to select snippets without their input and send them as a postcard that could be read by many before reaching their hand. We assured them that we would check each postcard before sending it, to avoid sending out credit card numbers or other sensitive information. We were surprised that we encountered no resistance save one participant who expressed mild discomfort in the first interview. This might be a selection effect; people who are more concerned about privacy might not have signed up to participate. However, it might indicate that participants either do not know what is in their archives or do not feel their archives hold things of private value that need to be protected.

DISCUSSION

Interaction designers bring together elements, resources, and interactions meant to trigger personally meaningful experiences, and sometimes they do this by mining a user's collection of virtual possessions. Prior research indicates that people can see their virtual possessions as being less valuable than their material possessions. The spaceless, placeless, and formless aspects of these immaterial things provide new utility while paradoxically undermining lasting value [38]. By not being present in the physical world, virtual artifacts provide fewer opportunities to encounter, curate, and reflect on the meaning of the individual items or the entire collection [20]. We examined how manifesting an archived email snippet as a postcard might enable people to re-experience their virtual collections. This physical artifact invited people to engage with their virtual archives in a new way and allowed users to talk about their virtual possessions in a more critical light.

Our findings also indicate that people have strong positive regard for materialized possessions when those artifacts have specific features: they carry a context, they remind people of cherished moments or relationships, or they remind people of transformative experiences in their life. Requiring people to curate these materialized emails provided a new way for participants to view and assess the relative value captured in their personal virtual archive. Moving forward, creating meaningful virtual objects may rely on designs that leverage contextual data in order to create a coherent connection to people's personal histories.

Struggle to Trigger Meaningful Reflection

The probe succeeded in engaging participants to discuss the meaningfulness of their email archive, however participants did not feel that the postcards shifted their sense of value for this archive. Given our goal to investigate how changes in form and behavior of virtual possessions can increase perceptions of value, in this section we reflect on this design issue and how our experience with the probes has shaped our understanding of how to engage with this issue.

The postcards we sent to participants often lacked enough context of any previous relationship, event, activity, or life stage to trigger meaningful reflection. This is in line with research from the archival sciences [17, 29], but here it suggests avenues for future research. For example, this evokes questions regarding how system designers can discover critical aspects of context within an archive and how designs can more effectively communicate this to users. Similarly, it highlights the need for systems designers to be judicious about where context should and should not be included. It allows us to reflect on the ways in which people are unresponsive when prompted to reflect. Additionally, when considered in contrast to prior work in this area [35], this work emphasizes the importance of the form of the physical representation of some virtual possession. In this study, information was materialized as postcards. For the most part, participants did not treasure

these postcards and did not integrate them into areas of their home where valued objects were kept or displayed. Despite the analogy one could make between an email and a letter or postcard, it is clear that this functional similarity did not serve the goal of fostering value creation. Given that, future research could investigate how best to adapt physical artifacts to represent and foster attachment to particular types of digital information.

Regarding directions for future research, this work articulates a number of considerations regarding the design of the physical object and the information selected or contained within the resulting artifact. The materialized items must have clear connections to time, place, relationship, event, or life stage. In addition, researchers need to acknowledge the originating media from which the data is extracted. Features of the materialized artifact should be individually considered as either direct representations of the individual's life, or else signposts that orient the individual toward the type of experience the material represents. For example, postcard senders select specific images for people and often connect the image to the meaning of the message they share. Our probe could have avoided disorienting participants by better selecting images that support the intention of the sent email message.

Features of Common, Meaningful Virtual Possessions

At the beginning of the study, several participants expressed the belief that their email archive held little value. Some participants, such as P6, were overwhelmed to discover the amount of messages in their archive, many of which she did not find valuable. She was ready to abandon the archive in order to start fresh with a new email account to better curate her meaningful emails. This arguably drastic response indicates that the email archive could be seen as valuable if its meaningful messages were more salient. In our results, we found that it is not as easy as just pulling archived messages from important people to the forefront. People want to see messages that remind them of an important relationship, a memorable life stage, or a transformative event. However, these features are not sufficient for providing value to the user. In failing to provide enough context, our probe demonstrated that users must be able to reconstruct the story which surrounds individual elements of the archive.

Email, like many virtual archives, can swell in size in nearly undetectable or unnoticeable ways. Often only those items that have utility on the day they arrive stand out as valuable. All messages, no matter what their expected future value is, are stored in the same place. Future research might attempt to draw from these findings to support the saliency of uniquely personal messages as they arrive, i.e., those that carry the potential for future value. As these more significant messages accumulate, and eventually reappear as tools for reflection, the challenge would then be to provide sufficient context. This process may involve finding the meaningful aspects of a person's virtual archive, or even creating new content that carries the same types of features. To add value to a virtual collection, it may be necessary to better facilitate the personal processes through which people attach meaning to their possessions.

Providing Value Through Curating Virtual Collections

Dispossession is a critical process for value construction with material things. People must continually reevaluate an item's worth when they acquire new material things. However, the spaceless quality of virtual things makes it easy to never engage in dispossession and, thus, to never reevaluate an item's worth. We suspect that this repeated reengagement and reevaluation of things may be a critical activity in constructing value for things, and the fact that this so rarely happens with virtual possessions may be a major factor reducing their ability to accrue value.

In addition to the spaceless quality of virtual possessions not catalyzing reevaluation, curation, and dispossession, the interaction design of most digital communication systems tends to guide people away from these kinds of activities. In other words, that these systems often direct people to advance to the next new message reinforces passive archiving of mundane content. Our postcards interrupted this practice by placing a proxy of an email into a participant's hand, forcing them to decide, even temporarily, where to place this thing. These interrelated aspects of large quantities of mundane content and lack of reevaluation may individually or even collectively contribute to people's current beliefs that their virtual possessions are less valuable. There is a clear opportunity to investigate designing interactive systems that actively subvert this process by reversing those capabilities and requiring users to take a more active role in the organization of their virtual collections.

CONCLUSION

In this study, we designed, implemented, and deployed a technology probe to better understand what people value in virtual archives. In the process of rendering email snippets as postcards and mailing them to people, we discovered that people most often like to reflect on important people, events, and humor. However, virtual possessions can easily be experienced out of context, which obscures their value. Findings also revealed how people fail to continually reengage with and reevaluate their virtual things, which can lead to meaningful messages being "lost." Based on these findings, we proposed that encouraging archive curation and the compilation of virtual possessions of different types into unique new assemblies could open up new value construction activities. In this way, designers could take advantage of virtual possessions' spacelessness, placelessness, and formlessness, while still enabling meaningful, unique, and self-determined experiences as people's life stories evolve and virtual archives evolve, over time and into the future.

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REFERENCES

1. Aaron D. Ahuvia. 2005. Beyond the extended self: Loved objects and consumers' identity narratives. *Journal of Consumer Research* 32, 1: 171 – 184.
2. Russell Belk. 1998. *Possessions and Self*. John Wiley & Sons, Ltd.
3. Russell W. Belk. 2013. Extended self in a digital world. *Journal of Consumer Research* 40, 3: 477 – 500.
4. Abhay Bhushan, Ken Pogran, Ray Tomlinson, and Jim White. 1973. RFC #561: Standardizing Network Mail Headers. Retrieved from https://tools.ietf.org/html/rfc733
5. Kirsten Boehner, Janet Vertesi, Phoebe Sengers, and Paul Dourish. 2007. How HCI interprets the probes. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '07). ACM, New York, NY, USA, 1077 – 1086.
6. Barry Brown and Abigail Sellen. 2006. Sharing and listening to music. In *Consuming music together: social and collaborative aspects of music*. K. O'Hara and B. Brown (eds.), Springer Netherlands, 37 – 56.
7. Moira Burke, Robert Kraut, and Cameron Marlow. 2011. Social capital on Facebook: differentiating uses and users. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '11). ACM, New York, NY, USA, 571 – 580.
8. Dan Cosley, Victoria Schwanda Sosik, Jonathan Schultz, S. Tejaswi Peesapati, and Soyoung Lee. 2012. Experiences with designing tools for everyday reminiscing. *Journal of Human-Computer Interaction,* 27, 1-2: 175 – 198.
9. Andy Crabtree, Tom Rodden, Terry Hemmings, and Steve Benford. 2003. Finding a place for UbiComp in the home. In *Proceedings of the 5th International Conference on Ubiquitous Computing,* 208 – 226.
10. Mihaly Csikszenthmihalyi and Eugene Rochberg-Halton. 1981. *The Meaning of Things: Domestic Symbols and the Self.* Cambridge University Press.
11. Doménique van Gennip, Elise van den Hoven, and Panos Markopoulos. 2015. Things that make us reminisce: Everyday memory cues as opportunities for interaction design. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems.* ACM, New York, NY, USA, 3443 – 3452.
12. Erving Goffman. 1959. *The presentation of self in everyday life*. Anchor Books.
13. Connie Golsteijn, Elise van den Hoven, David Frohlich, and Abigail Sellen. 2012. Towards a more cherishable digital object. In *Proceedings of the 2012 Conference on Designing Interactive Systems* (DIS '12). ACM, New York, NY, USA, 655– 664.
14. Lars Hallnäs and Johan Redström. 2001. Slow technology – Designing for reflection. In *Proceedings of the 2001 ACM International Conference on Personal and Ubiquitous Computing.* ACM, New York, NY, USA, 201 – 212.
15. Sudheendra Hangal, Monica S. Lam, and Jeffrey Heer. 2011. MUSE: Reviving memories using email archives. In *Proceedings of the 24th annual ACM symposium on User Interface Software and Technology* (UIST '11). ACM, New York, NY, USA, 75 – 84.
16. Daniel Hawkins, Carman Neustaedter, and Jason Procyk. 2015. Postulater: the design and evaluation of a time-delayed media sharing system. In *Proceedings of the 41st Graphics Interface Conference*. Canadian Information Processing Society, Toronto, Ont., Canada, Canada, 249 – 256.
17. Catherine Hobbs. 2001. The character of personal archives: Reflections on the value of records of individuals. Archivaria 52: 126 – 135.
18. Hilary Hutchinson, Wendy Mackay, Bo Westerlund, Benjamin B. Bederson, Allison Druin, Catherine Plaisant, Michel Beaudouin-Lafon, Stéphane Conversy, Helen Evans, Heiko Hansen, Nicolas Roussel, and Björn Eiderbäck. 2003. Technology probes: inspiring design for and with families. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '03). ACM, New York, NY, USA, 17 – 24.
19. William James. 1890. *The Principles of Psychology.* Henry Holt, New York.
20. William Jones. 2007. Personal information management. In *Annual Review of Information Science and Technology* 41, 1, 453 – 504.
21. Chris Kennedy. 2005. 'Just perfect!': The pragmatics of evaluation in holiday postcards. In *Discource, communication, and tourism*. A. Jaworski and A. Pritchard (eds.), Channel View Publications, 223 – 246.
22. Liadh Kelly, Yi Chen, Marguerite Fuller, and Gareth J.F. Jones. 2008. A study of remembered context for information access from personal digital archives. In *Proceedings of the Second International Symposium on Information Interaction in Context,* 44 – 50.
23. David Kirk, Abigail Sellen, Carsten Rother, and Ken Wood. 2006. Understanding photowork. In *Proceedings of the ACM Conference on Human Factors in Computing Systems*, Rebecca Grinter, Thomas Rodden, Paul Aoki, Ed Cutrell, Robin Jeffries, and Gary Olson (eds.). ACM, New York, NY, USA, 761 – 770.
24. David Kirk, Abigail Sellen, Richard Harper, and Ken Wood. 2007. Understanding videowork. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '07). ACM, New York, NY, USA, 61 – 70.
25. Robert E. Kleine and Susan Schultz Kleine. 2000. Consumption and self-schema changes throughout the

identity project life cycle. *Advances in Consumer Research,* 27, 279 – 285.

26. Susan Schultz Kleine and Stacey Menzel Baker. 2004. An integrative review of material possession attachment. *Academy of Marketing Science Review* 1, 1: 1 – 39.
27. Siân E. Lindley, Catherine C. Marshall, Richard Banks, Abigail Sellen, and Tim Regan. 2013. Rethinking the web as a personal archive. In *Proceedings of the 22nd International Conference on World Wide Web,* 749 – 760.
28. Catherine C. Marshall. 2007. How people manage personal information over a lifetime. *Personal Information Management,* 57 – 75.
29. Catherine C. Marshall and Frank M. Shipman. 2014. An argument for archiving Facebook as a heterogeneous personal store. In *Proceedings of the 14th ACM/IEEE-CS Joint Conference on Digital Libraries,* 11 – 20.
30. Kathryn McGarr. 9 Reasons to Archive. 2008. Retrieved from: http://gmailblog.blogspot.com/2008/04/9-reasons-to-archive.html
31. Matthew B. Miles, A. Michael Huberman, and Johnny Saldaña. 2013. *Qualitative data analysis: A methods sourcebook*. SAGE Publications, Incorporated.
32. Daniel Miller and Fiona Parrott. 2009. Loss and material culture. *Journal of the Royal Anthropological Institute* 15, 3: 502 – 519.
33. Rani Molla. Gmail finally beats Hotmail, according to third-party data. 2012. Retrieved from: http://gigaom.com/2012/10/31/gmail-finally-beats-hotmail-according-to-third-party-data-chart/
34. Tiffany Ng, Ou Jie Zhao, and Dan Cosley. 2011. pieTime: Visualizing Communication Patterns. In *Proceedings of Privacy, Security, Risk and Trust*, 720 – 723.
35. William Odom, Abigail J. Sellen, Richard Banks, David S. Kirk, Tim Regan, Mark Selby, Jodi L. Forlizzi, and John Zimmerman. 2014. Designing for slowness, anticipation and re-visitation: a long term field study of the photobox. In *Proceedings of the 32nd annual ACM Conference on Human Factors in Computing Systems* (CHI '14). ACM, New York, NY, USA, 1961 – 1970.
36. William Odom, John Zimmerman, and Jodi Forlizzi. 2011. Teenagers and their virtual possessions: Design opportunities and issues. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '11). ACM, New York, NY, USA, 1491 – 1500.
37. William Odom, John Zimmerman, Jodi Forlizzi, Hajin Choi, Stephanie Meier, and Angela Park. 2012. Investigating the presence, form and behavior of virtual possessions in the context of a teen bedroom. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '12). ACM, New York, NY, USA, 327 – 336.
38. William Odom, John Zimmerman, and Jodi Forlizzi. 2014. Placelessness, spacelessness, and formlessness: Experiential qualities of virtual possessions. In *Proceedings of the 2014 Conference on Designing Interactive Systems* (DIS '14). ACM, New York, NY, USA, 985 – 994.
39. William Odom. 2015. Understanding long-term interactions with a slow technology: An investigation of experiences with FutureMe. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems* (CHI '15). ACM, New York, NY, USA, 575-584.
40. S. Tejaswi Peesapati, Victoria Schwanda, Johnathon Schultz, Matt Lepage, So-yae Jeong, and Dan Cosley. 2010. Pensieve: Supporting everyday reminiscence. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '10). ACM, New York, NY, USA, 2027 – 2036.
41. Daniela Petrelli, Simon Bowen, Nick Dulake, and Ann Light. 2012. Digital Christmas: An exploration of festive technology. In *Proceedings of Designing Interactive System Conference* (DIS '12). ACM, New York, NY, USA, 348 – 357.
42. Daniela Petrelli and Steve Whittaker. 2010. Family memories in the home: Contrasting physical and digital mementos. *Personal and Ubiquitous Computing* 14, 2: 153 – 169.
43. Linda L. Price, Eric J. Arnould, and Carolyn Folkman Curasi. 2000. Older consumers' disposition of special possessions. *Journal of Consumer Research* 27, 179 – 201.
44. Catherine A. Roster. 2001. Letting go: The process and meaning of dispossession in the lives of consumers. *Advances in Consumer Research* 28, 425 – 430.
45. Abigail J. Sellen, Andrew Fogg, Mike Aitken, Steve Hodges, Carsten Rother, and Ken Wood. 2007. Do life-logging technologies support memory for the past?: an experimental study using sensecam. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '07). ACM, New York, NY, USA, 81 – 90.
46. Victoria Schwanda Sosik, Xuan Zhao, and Dan Cosley. 2012. See friendship, sort of: how conversation and digital traces might support reflection on friendships. In *Proceedings of the ACM 2012 Conference on Computer Support Cooperative Work* (CSCW '12). ACM, New York, NY, USA, 1145 – 1154.
47. Daniel Smilkov, Deepak Jagdish, and César Hidalgo. Immersion: a people-centric view of your email life. 2013. Retrieved from: https://immersion.media.mit.edu/
48. Timehop Application. Retrieved from: http://timehop.com/
49. Fernanda B. Viégas, danah boyd, David H. Nguyen, Jeffrey Potter, and Judith Donath. 2004. Digital artifacts for remembering and storytelling: posthistory and social

network fragments. In *Proceedings of the Hawaii International Conference on System Sciences,* 1 – 10.

50. Fernanda B. Viégas, Scott Golder, and Judith Donath. 2006. Visualizing email content: portraying relationships from conversational histories. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '06). ACM, New York, NY, USA, 979 – 988.
51. Amy Voida, Rebecca E. Grinter, Nicolas Ducheneaut, W. Keith Edwards, and Mark W. Newman. 2005. Listening in: practices surrounding iTunes music sharing. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '05). ACM, New York, NY, USA, 191 – 200.
52. Yang Wang and Scott D. Mainwaring. 2008. Human-currency interaction: learning from virtual currency use in China. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '08). ACM, New York, NY, USA, 81 – 90.
53. Peter Williams, Jeremy Leighton, and John Ian Rowland. 2009. The personal curation of digital objects. In *Aslib Proceedings* 61, 4: 340 – 363.
54. Steve Whittaker. 2011. Personal information management: From information consumption to curation. *Annual Review of Information Science and Technology* 45, 1.
55. Steve Whittaker, Ofer Bergman, and Paul Clough. 2010. Easy on that trigger dad: a study of long term family photo retrieval. In *Proceedings of the 2010 ACM International Conference on Personal and Ubiquitous Computing.* ACM, New York, NY, USA, 31 – 43.
56. Steve Whittaker, Vaiva Kalnikaite, Daniella Petrelli, Abigail Sellen, Nicolas Villar, Ofer Bergman, Paul Clough, and Jens Brockmeier. 2012. Socio-technical lifelogging: Deriving design principles for a future proof digital past. *Journal of Human-Computer Interaction* 27, 1 – 2: 37 – 62.
57. Steve Whittaker, and Candace Sidener. 1996. Email overload: Exploring personal information management of email. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '96). ACM, New York, NY, USA, 276 – 283.
58. Xuan Zhao, Niloufar Salehi, Sasha Naranjit, Sara Alwaalan, Stephen Voida, and Dan Cosley. 2013. The many faces of Facebook: Experiencing social media as performance, exhibition, and personal archive. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (CHI '13). ACM, New York, NY, USA, 1 – 10.
59. Xuan Zhao and Siân Lindley 2014. Curation through use: Understanding the personal value of social media. In *Proceedings of the 32nd annual Conference on Human Factors in Computing Systems* (CHI '14). ACM, New York, NY, USA, 2431 – 2440.