Fragmentation and Transition: Understanding Perceptions of Virtual Possessions among Young Adults in Spain, South Korea and the United States

William Odom[1], John Zimmerman[1], Jodi Forlizzi[1], Ana López Higuera[2], Mauro Marchitto[2], José Cañas[2], Youn-kyung Lim[3], Tek-Jin Nam[3], Moon-Hwan Lee[3], Yeoreum Lee[3], Da-jung Kim[3], Yea-kyung Row[3], Jinmin Seok[3], Bokyung Sohn[3], Heather A. Moore[4]

[1] HCI Institute, Carnegie Mellon University, Pittsburgh, PA, USA, wodom@cs.cmu.edu

[2] Cognitive Ergonomics Group, University of Granada, Granada, Spain, delagado@ugr.es

[3] Department of Industrial Design, KAIST, Daejeon, South Korea, younlim@kaist.ac.kr

[4] Research and Development, Vodafone Group, Dusseldorf, Germany, heather.moore@vodafone.com

ABSTRACT

People worldwide are increasingly acquiring collections of *virtual possessions*. While virtual possessions have become ubiquitous, little work exists on how people value and form attachments to these things. To investigate, we conducted a study with 48 young adults from South Korea, Spain and the United States. The study probed on participants' perceived value of their virtual possessions as compared to their material things, and the comparative similarities and differences across cultures. Findings show that young adults live in unfinished spaces and that they often experience a sense of fragmentation when trying to integrate their virtual possessions into their lives. These findings point to several design opportunities, such as tools for life story-oriented archiving, and insights on better forms of Cloud storage.

Author Keywords

Virtual Possessions; Young Adults; Interactive Systems Design; Digital Things; Human-Centered Architectures

ACM Classification Keywords

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

INTRODUCTION

Many disciplines have investigated how people from different cultures modify and form attachments to their material possessions. As interactive technologies continue to become woven into the fabric of everyday life, people's practices have expanded and today they are amassing ever-larger collections of virtual possessions [18]. Virtual possessions include former material things that are increasingly becoming immaterial (e.g., books, music, photos, and tickets); things that never had a lasting material form (e.g., electronic message archives, social networking profiles, game avatars, and social networking badges); and also metadata traces that document people's interactions with digital devices and services (e.g., photo location information, music play histories, automatic and manual photo tags, and credit card purchase histories). The convergence of social, mobile, and cloud computing services has created new opportunities for people to carry, access, create and curate their virtual possessions across environments throughout the world.

In the past few years, HCI researchers have begun to explore people's practices with their virtual things [e.g., 11, 18, 20, 23, 24]. This nascent body of work has focused on both understanding and building tools to support people's values and practices surrounding their virtual archives. However, to date *virtual possessions* remain difficult to characterize. Part of this complexity owes to the fact that virtual possessions are placeless in that they can be accessed anywhere and do not take up physical space. They are infinitely reproducible, often with no distinction between an original or a copy. They are formless in that they can easily be mashed up with other things to match specific devices or applications. These qualities make virtual possessions seem less like material things, and make it difficult to obtain a sense for what they are and what they could—or should—be. Relatively little is known about how people construct value with their virtual possessions and close to no research has explored this outside of contexts in the United States (US) and United Kingdom.

To advance a more cross-cultural understanding of people's value construction with their virtual possessions, we conducted in-home interviews with 48 young adults at sites in South Korea, Spain and the US. We selected young adults because they occupy a transitional life stage; they are still engaged in exploring who they want to become [6]. They also have had the opportunity to acquire large collections of virtual possessions. Our goal was to gain insights on how virtual possessions are incorporated into young adults' everyday lives in these various cultural settings, and where similarities and differences exist.

CHI 2013, April 27–May 2, 2013, Paris, France.

Fieldwork revealed that our young adult participants typically lived in "unfinished" spaces, with many of their most precious material possessions packed away or fragmented across other geographic locations. Our participants desired to interact with their virtual possessions in terms of the activities and events that made up their life story or in terms of an important social relationship. They drew on their virtual possessions to explore life aspirations; however, the social appropriateness around these practices varied across countries. Finally, this group experienced significant fragmentation of their virtual possessions, including having their possessions spread across many Cloud services, having precious virtual things trapped on old devices, and due to the challenge of combining material and virtual things into a hybrid collection.

This paper makes two contributions. It provides one of the first cross-cultural studies exploring young adults value construction practices with virtual possessions. Second, it advances current understanding of how people construct value with their virtual possessions in the context of the HCI community and outlines several opportunity areas to guide future research and practice.

BACKGROUND AND RELATED WORK

Researchers have explored how people's possessions contribute to their evolving sense of self. In exploring this theme, the connection between the self and possessions has been characterized in numerous ways. Goffman connects possessions and identity by describing how certain things act as props that support people in managing different presentations of self [8]. Csikszentmihalyi and Rochberg-Halton describe attachment as arising from meaning making that emerges as possessions are integrated into one's life and help form idealized future goals [4]. Material culture researchers have explored how possessions shape the construction of social relationships and meaning [e.g., 16]. Here, material possessions are resources for making sense of the world, demarcating social relationships, and assigning value to things and the places that they are kept.

Some consumer behavior research investigates how and why people develop a deep love for their things. Attachment can emerge through the process of *self-extension*, where people attribute important aspects of their self to the persons and things symbolized by their possessions [3]. The concept of *narrative* has also emerged as central to advancing theories of possession attachment [2]. Consumer behavior researchers have turned to McAdams' concept of identity construction as the development of a coherent *life story* — a synthesis of stories uniting events from the past, present, and future [14]. People gain attachment to possessions as they reinforce affiliations to groups and symbolize their self-driven actions in the past and present [12].

Relatively little is known about how theories related to material possessions can be applied to people's rapidly growing collections of virtual possessions. HCI researchers have begun to explore implications surrounding the increasing virtualization of material artifacts, such as photos [23] and music [24]. Research also describes how virtual objects function as resources for identity construction, and informs the design of embodied digital mementos [e.g., 11, 20]. Additionally, the convergence of social and Cloud computing has created new opportunities for people to move virtual possessions to online places. Several studies have illustrated how the presentation of digital content in online environments can support identity-building practices [18, 23]. Others have explored the implications of 'owning' virtual content in the Cloud, focusing on issues of loss and control [13, 19].

However, little is yet known about how people construct value with their virtual possessions, and how the placement of virtual things in and across local systems and online services might shape these practices. The majority of prior research has been conducted with participants in the US or the United Kingdom. In this work, we to address this gap and contribute a more concrete understanding of how people across Korea, Spain and the US construct value with their virtual possessions, and how this knowledge could inform design of new products and services.

FIELD STUDY METHOD

We conducted in-home, semi-structured interviews with young adults in Korea, Spain and the US. We selected these sites because they represent three large regions (Southeast Asia, Southern Europe, and North America), they have distinctly different cultures, and they have similarities in terms of technology accessibility and infrastructure. We are interested in how technologies and services get adopted into different local settings and, in particular, how these processes shape young adults' value construction practices on a rich, descriptive level. This approach has limitations; for example, it makes the results difficult to objectively generalize beyond our participants' experiences. However, considering the paucity of work on people's value construction practices with their virtual possessions, we wanted to begin with a small population in order to gain a descriptive understanding that can drive future research.

We recruited 48 participants (8 male and 8 female per country) using flyers posted in public locations, online advertisements and by word of mouth. All participants were young adults aged 25-35 years old. We chose this group for several reasons. First, they are making a transition from pre-adulthood to early adulthood (a phase that can last up to between the ages of 40-45 years old [6]). In this transition, they are beginning a more independent life, forming new family and romantic relationships, and establishing a niche in society. Throughout this process, young adults draw on their possessions while pursuing personal and professional aspirations, and to live out or bury aspects of their emerging adult self [6]. This trajectory of social change could provide valuable insights into how virtual possessions are integrated

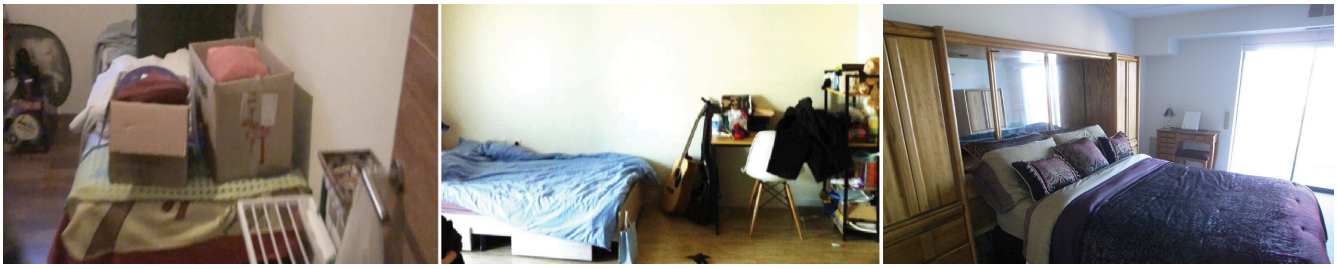

Figure 1. Examples of unfinished domestic spaces. From left to right. F3-Spain's apartment in a holding pattern, neither packed nor unpacked, F8-Korea's apartment with only a handful of material things, F2-USA's bedroom aesthetic did not reflect her personality.

into young adults life story construction practices, and comparative similarities or differences to material things.

Participants were technologically similar. All used computers relatively frequently, maintained at least two online accounts (e.g., email, Facebook), and owned smartphones. Across countries, participants exhibited a range of occupations including construction worker, actor, yoga instructor, nurse, house cleaner, lawyer, accountant, and electrical technician; none were fulltime students.

None of our participants had children. Prior research has shown that having a child can substantially alter one's growth into adulthood [17], causing a shift to family-oriented construction of identity, which is often reflected in presentations of possessions in the home [4]. We excluded parents from our study to better understand how young adults draw on virtual and physical possessions for self-growth and value construction.

We conducted semi-structured interviews in participants' homes that lasted between 1.5 to 2 hours. Interviews were conducted by local researchers who had a native understanding of the language and culture. Interviews aimed to develop an understanding of each participant's orientations toward their material possessions, locally stored virtual possessions and virtual possessions appearing in online places. We first asked participants to describe and show us their precious material things (e.g., "If your house was burning down and you could grab five material possessions you couldn't live without, what would they be?"). Next, we asked participants to describe their precious locally stored virtual possessions. This was followed by a similar tour of their things online. We asked participants to compare and contrast their material and virtual possessions, paying close attention to the language they used to describe similarities and differences. We placed a special emphasis on how participants' possessions, both virtual and material, became valued, meaningful things in their lives.

Our interview protocol was iteratively developed in English with participation from all three research teams. After several rounds of critique and pilot interviews, the final protocol was translated into Korean and Spanish by local teams. All interviews were audio recorded, producing 70+ hours of content. All recordings were transcribed. Researchers took field notes and documentary photographs during each interview. Field notes were reviewed immediately following each interview, and tentative insights were noted in reflective field memos [7]. We held weekly international conference calls to discuss emergent findings and general progress.

Analysis of the data was an ongoing process throughout the study. Each team individually conducted preliminary analysis, searching for emergent patterns and themes across field notes, recordings and photos to draw out underlying themes [15]. All teams then gathered for a five-day data analysis workshop. This was also a highly iterative process. Country-specific teams presented their own analysis on their countries data to each other. During this workshop, all teams also explored and analyzed the raw data documents that had been coded during preliminary analysis and translated into English. We created conceptual models and affinity diagrams to reveal unexpected connections and differences among participants. Discussion of design implications followed, with emphasis on observed similarities and differences between countries. In the following sections, we present several examples taken from field observations that help illustrate the themes. We refer to each participant by her or his sex, participant number, and country (e.g., M1-Spain stands for Male 1 from Spain).

FINDINGS

Our interviews and observations revealed a range of insights on young adults' lives. Korean participants had an average age of 30.0 (SD=1.78). They worked at least eight hours per day and had long commutes. None owned a car due to both cost and traffic. Most had experienced difficulties in finding work; many had moved away from their family (in some cases their spouses) for work. Only three lived close to family, and all reported using various devices and services to keep in touch with loved ones.

Participants in Spain had an average age of 31.2 (SD=3.32). They usually worked between six to eight hours per day, and the workday was often divided by a two-hour lunch and siesta. Nearly all had experienced trouble gaining full employment, and many were unsure with the stability of their current job. The majority lived within walking distance to family members and friends, and they would see and interact with them frequently at homes, cafes, and bars.

Figure 2. Examples of Life story-Oriented Collections. From left to right. F4-Spain's archive of annotated cinema tickets, M5-Korea's photos ranked to signify which one's 'best' captured life experiences, F4-USA's LCD snowglobe housing sentimental digital photos.

Many speculated that they might soon need to move away from their life long hometown in order to find work.

US participants had an average age of 28.5 (SD=2.4) and described working at least eight hours per day. Almost all owned a car and had been employed in their current job for over a year. Roughly half had family members within the metro area, which they visited at least once a month. The other participants, with family farther away, also frequently used devices and services to stay in touch with loved ones.

None of our participants owned their own home. US participants had larger residences and the largest amount of cherished material possessions that extended deep into their pasts. These were usually kept out of sight in drawers, under beds, or in closets. Participants in Spain and Korea tended to keep smaller collections sentimental material possessions on hand, while storing the bulk of these things at their parents' homes. Interestingly, almost every residence we observed had an unfinished aesthetic; participants had not taken total authorship of their space. Nearly all participants talked about their current residence as temporary, even though many had lived in the same place for several years. They all had uncertainty in their lives in terms of employment, intimate relationships, and/or current city of residence, and many were looking forward to a future "home" once the uncertainty subsided. Collectively, these findings match prior research on the transitional nature of young adulthood [6].

Participants engaged in value construction activities with their cherished possessions — both material and virtual — in terms of events, activities, and relationships that made up their life story. When creating collections related to a person, event, or activity, they often experienced a sense of *fragmentation* that complicated their work. This happened in a variety of ways. Virtual possessions, such as SMS messages, could get trapped on old or non-functioning devices. They also struggled to integrate virtual possessions of different types together (such as digital photos and SMS messages), and to integrate their virtual and material possessions into holistic collections around an activity or person. Finally, participants experienced anxiety over how their virtual possessions were fragmented across the different cloud services they use, and how these services could complicate their sense of ownership and control over these things.

Unfinished Aesthetics and Transitional Situations

It was evident that participants had not exerted strong authorship over their domestic environments. Participants commonly perceived they would be 'somewhere' else soon, while also grappling with, as M1-Spain put it, "*the future* [being] *totally full of uncertainties*." Participants also commonly perceived they would be 'somewhere' else soon where, as M3-USA put it, "my things and honestly my life direction will be more together again." These sentiments, in part, were manifested through a lack of decorations or possessions on display in domestic settings (see Figure 1). While participants in the US had the largest collections of material things, it was common across countries that cherished material possessions in participants' homes were packed away in *deep storage* [11], archived in boxes tucked away in closets or shoeboxes hidden under beds. For example, F2-USA, whom had lived in her current home for over two years (see Figure 1), describes her motivation for keeping cherished things out of sight: "*It's not that I don't want to see those things. They'd help me feel more settled as a whole. ...I've been living in this state of transition for a few years now. ...even to me, this place looks sterile. ...It's where I'm at right now."* The statement is exemplary of behavior witnessed across our interviews. Participants frequently characterized the unfinished, fragmented qualities of their living environments as reflections of their transitional life stage.

Nearly all participants also deeply valued the lightweight nature of their virtual possessions: "*I have my eye on the future ...and I'm going to be moving. ...I don't want to give up special things that remind me of great memories. I can't exactly lug around photo albums. ...my* [virtual] *things are significant because I can keep acquiring things that remind me of my experiences without being weighted down*" (F3-USA). In several other cases, participants explicitly valued the ability for their immaterial things to be available across geographical settings and, as F8-Korea stated, "*I can revisit them anytime without locational limitation.*"

These reflections help capture how participants valued the nature of their virtual possessions in relation to the current and anticipated future demands of their transitional situations. Young adults valued the ability to continue acquiring artifacts highly symbolic of life experiences without some of the hardships associated with material

possessions, and that their virtual archives had the capability to fluidly travel with them to their future, unknown destinations.

Life story-oriented Possessions

While the domestic settings we observed were sparsely decorated, young adults did describe a range of beloved material and virtual possessions. All participants drew on key possessions as resources to explore or re-enforce where they wanted to go in life and who they wanted to become. These possessions frequently took the form of curated collections. Examples included book collections, RSS feeds, material and virtual archives of prior academic work, and archives of material and digital images that depicted desired future situations, such as getting married. Additionally, collections of digital images depicting cities associated with their next major life change (e.g., New York and Seoul) were common among Korean and US participants. These images often occupied backgrounds of computers and mobile phones, and were changed frequently. This trend was notably less common in Spain. Here, many participants instead expressed anxiety about moving away from their childhood home to find employment. At the time of the study, Spain had an overall unemployment rate of more than twenty percent, and this was considerably higher for the age group under study.

Participants commonly described these collections of aspirational possessions as unfinished and ongoing. For example, F4-USA describes the 'aspiration board' she created, which was one of the only things on display in her living room: "*It shows a lot of things I want to accomplish in my life. …getting married, owning my own yoga studio. …it keeps me balanced, reminds me what I want to do. …I always thought when I finish it I'd save it and start a new one, but it's not done yet. …There are things I'm still trying to figure out about myself and my future.*" While this quote portrays one of the most complex examples we encountered, it is exemplary in how it captures the unfinishedness we observed across aspirational collections.

Aspirational possessions were projected through social networking sites. However, the perceived social appropriateness of this action emerged as one of the biggest differences we encountered across countries. In the US, many participants reported productive outcomes emerging from this behavior. In these cases, young adults notified people in their social networks about new progress toward, for example, completing a marathon or receiving a new professional certification. US participants commonly reported a core motivation for this behavior was to acquire comments and 'likes' from people in their social network.

Research teams from Korea and Spain noted that it was considered inappropriate to project personal aspirations to social audiences in their cultures. These conventions have different motivations. The Korean research team noted that it would be highly undesirable for young Koreans to appear explicitly ambitious among their peers. This may be due to tensions produced when values of individualism are introduced in collectivist-oriented cultures, such as Korea [9]. The Spanish research team noted that its Catholic-influenced upbringing and culture made it inappropriate for young Spaniards to express a strong desire to want more than others have. This matches findings from prior research on Roman Catholic countries (including Spain) illustrating strong trends in social values emphasizing conformity, tradition, and benevolence toward others, over self-direction and self-achievement [21]. Interestingly, in both Korea and Spain, participants maintained private collections of aspirational possessions online, whether through diary-oriented blogs or private personal homepages (e.g., via Cyworld.com) containing images, videos and text entries that could only be accessed by the owner.

All participants also reported being most deeply attached to material and virtual possessions capturing their life experiences, which helped develop their life story. Participants frequently described using these objects as resources to reflect on past experiences and construct a sense of who they are. These possessions were broad, including material collections of cinema and concert tickets personally annotated with details (see Figure 2), annotated diaries and scrapbooks containing photos and mementos from trips, large digital photo archives, and, in some cases, archives of virtual correspondences with loved ones, and snippets of significant social networking content (e.g., a Facebook wall screenshot). Archives of digital metadata also emerged across our discussions. These things included metadata related to personal interests, such as records of accomplishment logged via computer games and music playlists illustrating changes in personal taste. They also included shared metadata constructed with other people, such as comments and 'likes' attributed to social networking content and rankings of 'the best' digital photos capturing a particular experience or event (see Figure 2).

Observations and interviews with participants indicated that *fragmentation* affected their cherished material and especially virtual possessions in disruptive ways. As young adults struggled to transition to a more holistic sense of self and a more cohesive living situation, they desired a similar cohesiveness reflected in the organization of their valued possessions. Their virtual things were fragmented across devices, systems and online services. This complicated young adults' desires to adapt virtual possessions to existing value construction activities with their cherished material possessions and their work to create more holistic archives around a person, event or experience. These breakdowns prompted participants to develop innovative workarounds to better support their values and desires.

Workarounds to construct holistic archives

An overarching theme across interviews centered on participants' practices of creating holistic archives of cherished possessions, which captured life experiences,

events and close social relationships. Interestingly, few participants drew concrete distinctions between their material and virtual possession; they typically saw them as significant parts of their life story that belonged together. Moreover, participants regularly expressed how valuable cohesive archives of significant possessions were, as opposed to individual elements, would be: "*I want them to be separated from all the lesser* [meaningful] *stuff. But also, it's kind of like they're more valuable if they're together. They tell the bigger story of who you are. …Now I have so many digital things, it's not very easy to do. Can feel downright impossible*" (M2-USA).

This reflection helps capture participants' desires to collate cherished possessions to create *hybrid archives* [11], and how this process in itself could function as a value construction activity. However, the fragmentation of virtual things across obsolete and working devices and online services disrupted these kinds of activities, making it difficult to impose the same kind of structure and organization to valued virtual possessions as compared to material things.

In spite of these breakdowns, we observed several attempts to create more holistic archives. The first, and most common, involved materializing virtual possessions. In many cases, participants made material copies. This included printing and binding volumes of sentimental email correspondences or selected collections of cherished digital photos. In the extremist case, F4-Spain described writing out by hand an archive of SMS messages that detailed the progression of her current romantic relationship, which filled four A5 format journals. However, all participants across cultures reported either dramatically slowing down these practices or abandoning them altogether. This was due to the cumbersome work required to produce material copies of virtual things, and the increasingly unmanageable size of the physical materials produced.

The second approach we observed involved the virtualizing of material possessions. This workaround was typically achieved through creating digital images (e.g., via a digital camera or scanner). Participants described this approach as a way to create virtual representations of cherished material possessions, which they were geographically separated from. We encountered several instances in which US and, especially, Spanish and Korean participants had meticulously created virtual copies of analog photos kept at other loved ones' homes. We also observed a variety of other virtualized possessions, which included personal diary entries, archives of schoolwork and awards, newspaper articles featuring the participant, large-scale artworks, and musical instruments. While most participants maintained this approach, several concerns emerged around the authenticity of a virtualized material possession within the archive. For example, M3-USA reflected on images of his guitar (currently stored at his parents' home): "*…obviously it's not the real thing. It's more a reminder of when I was in a band and how I want to keep pursuing music once I'm somewhere I can have it. …it's not just the photo, but that it's in this folder with other photos from that time in my life. …having it in there creates a collection of experiences together. That's what gives it value*" (M3-USA). This reflection highlights a perception common among several participants: a cherished material possession, when virtualized, transforms into something else that can be deemed valuable and meaningful through its relationship to other life story-oriented virtual possessions in the archive.

The final workaround we observed involved the integration of archives of virtual possessions with pre-existing archives of cherished material possessions. While this approach was the least common, it provided salient insights into how virtual things might extend to existing practices with cherished material archives. We observed participants using USB sticks and key chains, Flash memory cards, external hard drives, and in one case, a dedicated laptop, to keep collections of cherished virtual possessions with cherished life story-oriented material possessions in their homes. It was common for participants across cultures to attribute value to simply keeping these kinds of materials together, even when not in direct use. The most compelling example we observed was F4-USA's use of USB-enabled trinket and keychain-based displays to keep curated collections of digital photos with related material possessions stored in her closet (see Figure 2). These devices contained roughly 60 digital photos, each with a particular theme (e.g., images of Yoga training and past Christmases with family); they were some of her most cherished possessions which had become integrated into her weekly and annual practices: "*…the Christmas one, I keep it in a box in my closet with other things, like handwritten Christmas letters and a few decorations that've been passed down in my family. …Each year I open up that box and I get the snow globes out, put them in my house and turn them on …Like all those memories are right here* [on slow globes] *with everything else, I can hold them. I know exactly where they are.*"

Whether through a Flash memory card or a dedicated device for viewing photos, these instances illustrate how participants appropriated existing technologies to create embodied forms of cherished virtual possessions. This emerged as way to extend pre-existing practices and rituals to key collections of virtual things as they were meaningfully integrated into cherished material archives.

Fragmentation of possessions across online services: tensions over awareness, control and authenticity

All participants reported having a variety of valued virtual possessions across social networking and Cloud storage services. These things were broad, and included digital photos and metadata (e.g., comments and 'likes') on social networking services, collections of inspirational images (e.g., Pinterest.com), wish lists on shopping websites (e.g., Amazon.com), archives of personal photos, video and

documents, and information related to personal achievements in online games (e.g. World of Warcraft).

Tensions over Cloud-based possessions

Despite using these online services relatively frequently, participants across cultures conveyed concerns over their longevity. When asked to compare their online things to material and locally stored virtual possessions, participants frequently described a lack of awareness about where their virtual things were. For example, F3-USA reflects on temporarily losing access to her photos, hyperlinks and comments she has accrued on her four year old Facebook account: "*Facebook will say 'try again later', like I can only go back so far. …I put it up there so I should have it, but now it's gone. Maybe it will come back, maybe not. That's the kind of thing that can make online stuff a lot less meaningful. …it's there one minute and gone the next and you have no idea why.*" Similarly, participants in Korea and Spain were frequently skeptical over the durability of social networking services and their potential to, as M5-Korea put it, "*disappear suddenly one day*." These reflections capture the conundrum many participants struggled with: the desire to have a deeper sense of possession over their Cloud-based possessions, while having no clear way of productively achieving this goal.

We observed many participants creating workarounds in the form of physical copies or locally stored digital copies of Cloud-based possessions. These were most commonly social networking information, for example a screen shot of a Facebook photo with comments or paper printouts of Facebook wall entries during an eventful time period. Interestingly, participants nearly always expressed dissatisfaction with this workaround because it complicated the authenticity of the virtual possession itself once it was removed from the online system. For example, F8-USA reflects on her archive of Facebook data that she downloaded several months ago: "*…it became less meaningful. …People will go back and comment on a photo of mine I posted years ago. But what I downloaded doesn't have this information, so it becomes a weak substitute. Once the real thing online changed, it's like that thing on my hard drive has changed too. The real thing is what's living in the system. …I wish I could have the 'real things' on my computer instead of in Facebook's hands. Then I would feel a lot better about having them for the long term, after Facebook implodes, you know.*" We also encountered participants making material copies of online virtual possessions. For example, M3-USA compared his practice of printing locally stored digital content to printing personal content from his Facebook account: "*With a photo online, on Facebook, it's connected to time because there's always the possibility that it can change. And the fact that it can, changes the way I think about it.*"

These examples help illustrate the paradoxical nature of virtual possessions kept in social networking systems that the several participants struggled with. Young adults desire more control and awareness over these kinds of virtual possessions; however, their workarounds to support this tended to render these things into something different and less meaningful over time.

Complications and workarounds with Cloud storage services

Loss of control over cherished virtual possessions also extended to Cloud-based storage services. Unexpectedly, most participants viewed Cloud storage services as temporary platforms to move valued virtual possessions between geographically separated computers. They expressed distrust of these services, questioned their longevity, and were apprehensive about what happened to their cherished virtual possessions in storage: "*It is not pleasant to keep my private data on a server which belongs to one company. So, I do not use the* [Ndrive] *Cloud service*" (M6-Korea). When probed on underlying issues shaping this perception, several participants conveyed concerns over whether online services replicated their personal files in alternate locations they did not have access to, causing further undesired fragmentation and loss of control. In some cases, participants migrated their practices of sharing digital content with loved ones from Cloud-based storage services back to email services, which were perceived to be more secure. In Korea and Spain in particular, young adults adopted the strategy of maintaining a Cloud storage account and opting to share their account login information with loved ones. Family members could then individually download photos by using the account information before deleting them online to minimize the potential for copies to be made out of their control.

Participants across cultures also opted to maintain Internet-enabled external storage devices in their homes, which were used to back up cherished virtual possessions and to periodically share these things through remotely accessible folders. Participants valued having an increased amount of control over who had access to their virtual possessions, and awareness over where they were at any given time. However, the biggest and most common concern this approach raised was the vulnerability that a single point of storage introduced to their valued archives and the susceptibility to lose years worth of memories.

Interestingly, in Spain and the US, we encountered a handful of cases in which participants stored redundant copies of their archives across a select set of networked computers that were owned by family or friends. For example, M1-Spain described storing cherished virtual possessions on his own computer as well as on a shared folder of a close friend's computer. He perceived this approach as a safer and more private way to ensure the safety of both peoples' cherished virtual archives. In another case, M8-USA described the significance of creating shared remote folders on his brother and sister's computers in their respective households: "*I wasn't thinking too deeply about it when I did it, but over time I have really come to value it. …there's significance in storing important*

things in places I trust, with people I trust. ...I'm doing the same for them, looking over their things too. It's a different way of knowing your things are safe. Something we could never do with our physical stuff." M2-USA similarly described maintaining a remote folder on a computer in his parents' home in which he keeps cherished photos, email messages from a departed friend, and videos of his college graduation: "*...it's not just about the things themselves, but also where and how they're kept. ...it makes sense to keep them in my parents' home right now. It's a safe place. ...they watch over a lot of things from my past already.*"

It is important to note these are sophisticated workarounds that were developed by some of our most technically proficient participants who were employed in technology-related fields. However, they provide insights into the significance of the social context surrounding where remote storage drives were located. Similar to their treasured material things, participants desired their virtual archives to be kept in socially appropriate settings. In this way, participants had a higher level of awareness and control over their virtual archives and, subsequently, more value.

DESIGN OPPORTUNITIES AND ISSUES

Our findings show that virtual possessions play significant roles in young adults' lives across Korea, Spain and the US. They provide valued resources for young adults to reflect on their past and present self, and to speculate on the future. While there were some differences, we encountered significantly more similarity across cultures than expected. This similarity could arise from the fact that interactive technologies and services are often designed for the global marketplace, and impose a universal structure that impacts people regardless of their region.

We found virtual possessions often defied organizational structures. Similar to their value construction practices with material possessions, participants wanted to create cohesive collections of meaningful experiences and social relationships. Young adults desired a stronger sense of possession over their virtual things. They wanted to more fluidly draw on these things as resources for reflection, and to keep them in places socially signified for cherished possessions.

Interactive systems fragmented young adults' virtual possessions across devices or services. Several coping strategies emerged: materializing virtual possessions; creating digital copies of material possessions; storing virtual possessions within archives of material possessions; and creating remote storage on locations on loved ones' computers. These findings suggest many possible new forms and behaviors for virtual possessions and new interactive systems. They also raise a range of considerations when designing new products and services. Through repeated discussion and modeling sessions, we identified three specific opportunities areas to guide future research and practice in the HCI community: (i) Supporting life story-centered archiving, (ii) Improving Cloud archiving, and (iii) Prototyping "Home". We also note several potentially unintended consequences that should be considered when working in this emerging space.

Supporting Life Story-Centered Archiving

Our findings highlighted how young adults struggled to create holistic archives of virtual possessions symbolic of valued life experiences and relationships. In particular, young adults wrestled with an inability to integrate related material and virtual possessions. This suggests a large design opportunity for moving away from current system structures that keep similar file types together, and moving towards organization shaped by experience-based or relationship-based metrics. This could enable cherished virtual possessions to be more easily and artfully combined into meaningful collections. For example, experience-oriented metadata — either constructed by a machine as a byproduct of use or by a human through a reflective annotation—could play an important role in bringing together various kinds of virtual possessions related to a particular event (e.g., photos, video, social media comments, people present, ticket purchase information, weather report, calendar events, coordination emails and SMS, etc.). This new form of infrastructure could lead to the creation of experience-oriented assemblies of virtual possessions in more valuable ways. There is an opportunity to create new services providing rich APIs to enable mashups of virtual possessions based on these new kinds of organizational structures. This could enable young adults to re-imagine the forms and behaviors of their experience-oriented archives, while retaining control over the process.

We also found it was common for participants to create and accumulate digital copies of cherished material possessions they were often geographically separated from. Beyond this, our study highlighted how young adults perceived digital copies of material possessions to gain value through their connection to other related virtual possessions collectively capturing a particular period in one's life story. This suggests a design opportunity for developing easier techniques for people to create rich virtual versions of their material things. Recent advances in integrating 3D scanning into domestic artifacts and surfaces could be leveraged in the service of this direction [10].

Finally, we observed instances in which participants embodied curated collections of sentimental virtual possessions on physical storage media and attributed significant value to keeping these things with archives of cherished material possessions. This suggests an opportunity for new physically embodied forms of virtual possessions that can be more aesthetically integrated into the material collections. This design direction could support and extend recent emerging works exploring opportunities in designing embodied, smaller scale storage systems for sentimental digital content [e.g., 20].

Improving Cloud Archiving

Cloud computing services often complicate fundamental notions of what it means to 'own' or 'possess' virtual things [13, 19]. This represents a growing issue for the HCI community. Our study provides new insights into several opportunity areas. First, we found young adults wanted to know where their virtual possessions were in the Cloud, and if or when they had changed. In the context of social networking, we observed participants making material copies of virtual possessions and saving local copies of these Cloud items on their hard drive. Across cultures, these workarounds were perceived as inadequate. Participants described how taking social networking content out of the service complicated the authenticity of these artifacts. If new attributions of metadata were made online, then the printed or locally saved copies were no longer the 'real' thing. Ultimately, young adults wanted to be able to create holistic archives whether they were kept locally or online, while retaining the ability to have virtual possessions continue to 'live' in social networking services.

In the context of Cloud-based possessions, this suggests a large design opportunity in reconsidering how social networking-based service offerings are presented. Virtual proxies of social networking-based possessions could be leveraged to help young adults integrate things into their cherished archives, while retaining social networking content's innate ability to continue to be transformed through human and machine-produced metadata. These proxies could open a space for creating more holistic archives without having to compromise the additional value construction activities of social networking services.

Additionally, we observed a strong distrust of Cloud services designed to support online storage of virtual possessions. There were concerns about the longevity of the services as well as possible actions that participants could not control. Ultimately, placing one's most treasured virtual possessions under the guardianship of a third party service conflicted with young adults' desires for their things to be treated with safety and care. Interestingly, in Spain and the US, we observed a few young adults who had created remote folders distributed across geographically separated computers. Participants used remote folders to mirror their cherished virtual archives across multiple locations, ensuring these collections would endure and be accessible by others. These examples highlighted how not only were participants' virtual possessions safely backed up on their own terms, but also how meaning was attributed to the remote social contexts in which their things were stored. These behaviors made virtual collections even more valued. This suggests an opportunity for creating new services that would more easily enable, for example, family members to create networked folders on each other's computers. There could also be new, embodied forms of these networked archives, which could communicate the safety and status of the owners' and their loved ones' virtual archives. This opportunity area could expand ongoing research exploring the design of family services [5] and, more generally, the design of technologies to mediate intimacy among loved ones [24].

Prototyping "Home"

Our participants had not exerted strong authorship over their domestic environments and had not constructed a strong sense of "home". Cherished material things were packed away in storage, waiting for a future home. However, our participants continued acquiring possessions, and they valued how virtual possessions could support this goal without material burdens. This suggests an opportunity for designing interactive systems to explore how the presence of virtual possessions might be amplified in people's homes. This could be achieved through relatively lightweight strategies. One strategy could involve building on recent technical advances [22] and repurposing the many digital screens, large and small, in the home. These screens could support dynamic representations of curated collections of virtual possessions without adding any new technological or material objects. However, this direction would need to be approached with caution. Our findings highlighted differences across countries in terms of the social appropriateness of disclosing personal aspirations and ambitions, which would need to be taken into account.

We observed a resistance to acquiring new material possessions across cultures, which connected strongly to the lack of authorship over domestic spaces. Young adults were in a holding pattern, waiting for more certainty before committing to a home aesthetic. While this situation did not appear desirable for participants, there appeared to be no viable alternative. This suggests an opportunity for exploring the creation of new tools that support young adults in exploring different possible aesthetic and spatial layouts, which on a broader level might enable them rapidly prototype many different ideas of 'home' they might desire. The virtual materials produced from such systems could become valued imprints of a young adult's life, and could support creative explorations into more heterogeneous conceptions of what home could be [1].

Considering Potential Unintended Consequences

While there are many ways to advance the form of virtual possessions to increase their perceived value, it is necessary to critically reflect on possible unintended outcomes. It is important to consider how complications could emerge around virtualizing life story-oriented materials.

While young adults clearly valued the lightweight nature of their virtual possessions, it remains unclear whether explicitly supporting this trend is desirable. For example, keeping sentimental possessions in their parents' home(s) prior to entering older adulthood may play an important role in fostering meaningful interactions among parents and children later in life. Designing new systems to virtualize people's cherished material things could disrupt these practices. Creating systems that enable young adults to have

more virtual possessions could also potentially prolong a state of unfinishedness. At the same time, it is possible that young adults may need unfinished aesthetics as a way of speculating on who they want to become and how they wish to imbue their space with a sense of home. Designing new technologies to automate these processes or make them more efficient could subvert the work people need to do to reflect on their life and explore their goals and aspirations. These issues should be considered as the HCI community moves forward in developing systems that support value construction activities with virtual possessions.

CONCLUSION AND FUTURE WORK

We have explored how young adults across Spain, South Korea and the US form attachments to their growing collections of virtual possessions. A goal of our paper is to identify findings and design opportunities about young adults' relationships with their virtual things. We can then critically consider potential benefits and dangers of designing new technologies in this emerging design space. Our fieldwork presented complications young adults faced when interacting with their virtual possessions, as well as practices developed to workaround these tensions. Based on these findings we proposed *supporting life story-oriented archiving*, *improving cloud archiving* and *prototyping 'home'* as opportunity areas to guide future HCI research.

While our study contributes a cross-cultural exploration of people's value construction practices with their virtual possessions, it was nonetheless conducted in only Southern Europe, South East Asia, and North America. Future research can investigate how different groups from outside of these geographical areas construct value with their virtual things, and how this varies for different cultures, ages and economic backgrounds. Such future studies could also help construct a more concrete understanding of fundamental similarities and differences between the perceived qualities of material and virtual possessions. Ultimately, we hope this study inspires future research into how technologies could be designed to create more valuable and values-oriented virtual possessions for people around the world and across the many life stages they experience.

ACKNOWLEDGMENTS

This work is supported by Vodafone, Google, and NSF grant IIS-1017429. We thank R. Andrews, K. Betermier, R. Gaikwad, C. Mele, M. Nagda, B. Nimmons, and S. Sugarman for their assistance in data collection in the US.

REFERENCES

1. Aipperspach, R., Hooker, B., Woodruff, A. 2008. The Heterogenous Home. *Proc. of Ubicomp '08*, 222-231.
2. Ahuvia, A. C. 2005. Beyond the Extended Self: Loved Objects and Consumers' Identity Narratives. *Journal of Consumer Research*, 32, 1, 171-185.
3. Belk, R. 1988. Possessions and the Extended Self. *Journal of Consumer Research*, 15, 2, 139-168.
4. Csikszenthmihalyi, M., Rochberg-Halton, E. 1981. *The Meaning of Things: Domestic Symbols and the Self.* Cambridge University Press.
5. Egelman, S., Bernheim Brush, A. J., Inkpen, K. 2008. Family Accounts: A new paradigm for user accounts in the home environment. *Proc. of CSCW '08*, 669-678.
6. Erikson, E. 1980. *Identity and the Life Cycle*. Norton Press.
7. Glaser, B., Strauss, A. 1967. *Discovery of grounded theory: strategies for qualitative research.* Sociology press.
8. Goffman, E. 1959. *The Presentation of Self in Everyday Llife.* Double Day Press.
9. Hofstede, G. 1980. *Culture's Consequences: International Differences in Work-Related Values*. Sage.
10. Kirk, D., Izadi, S., Hilliges, O., Sellen, A., Banks, R. 2012. At Home with Surface Computing? *Proc. of CHI '12.*
11. Kirk, D., Sellen, A. 2010. On human remains: Values and practice in home archiving of cherished objects. *ACM TOCHI.*
12. Kleine, S., Baker, S. 2004. An Integrative Review of Material Possession Attachment. *Academy of Marketing Science Review, 1-39.*
13. Marshall, C., Shipman, F. 2011. Social media ownership: using twitter as a window onto current attitudes and beliefs. *Proc. of CHI '11,* 1081-1090.
14. McAdams, D. 2001. The psychology of life stories. *Review of General Psychology,* 5(2), 100-122.
15. Miles, M. B., Huberman, A., M. 1994. *Qualitative Data Analysis*. Thousand Oaks, CA: Sage.
16. Miller, D. 1987. *Material Culture and Mass Consumption,* New York: Blackwell.
17. Nomaguchi, K., Milkie, M. 2003. Costs and Rewards of Children: The Effects of Becoming a Parent on Adults' Lives. *Journal of Marriage and Family*, 65, 2, 356-374.
18. Odom, W. Zimmerman, J., Forlizzi, J. 2011. Teenagers and Their Virtual Possessions: Design Opportunities and Issues. *Proc. of CHI '11,* 1491-1500.
19. Odom, W. Sellen, A., Harper, R., Thereska, E. 2012. Lost in Translation: Understanding the Possession of Digital Things in the Cloud. *Proc. of CHI '12*, 781-790.
20. Petrelli, D., Villar, N., et al. 2010. FM Radio: Family Interplay with Sonic Mementos. *Proc. of CHI '10*, 2371-2380.
21. Roccas, S., Schwartz, S. 1997. Church-State Relations and the Association of Religiosity With Values: A Study of Catholics in Six Countries. *Cross-Cultural Research*, 31, 4.
22. Schwarz, J., Klionsky, D., Harrison, C., Wilson, A. 2012. Phone as a pixel: enabling ad-hoc, large-scale displays using mobile devices. *Proc. of CHI '12*, 2235-2238.
23. Van House, N. 2009. Collocated photo sharing, storytelling, and the performance of self. *Int. J. Hum.- Comput. Stud. 67,* 12, 1073-1086.
24. Vetere, F., Gibbs, M., Kjeldskov, J., Howard, S., Mueller, F., et al. 2005. Mediating intimacy: designing technologies to support strong-tie relationships. *Proc. of CHI '05,* 471-480.
25. Voida, A., Grinter, R., et al. 2005. Listening in: practices surrounding iTunes music sharing. *Proc. of CHI '05*, 191-200.