Understanding Everyday Experiences of Reminiscence for People Living with Blindness: Practices, Tensions and Probing New Design Possibilities

by

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Abstract

There is growing attention in the HCI community on how technology could be designed to support experiences of reminiscence on past life experiences. Yet, this research has largely overlooked people living with blindness. I present a study that aims to understand everyday experiences of reminiscence for people living with blindness. I conducted a qualitative study with 9 participants living with blindness to understand their personal routines, wishes and desires, and challenges and tensions regarding the experience of reminiscence. Findings are interpreted to discuss new possibilities that offer starting points for future design initiatives and openings for collaboration aimed at creating technology to better support the practices of capturing, sharing, and reflecting on significant memories of the past.

Keywords: Digital Memories; Reminiscence; People with Blindness; Interaction Design

Dedication

First and foremost, I have to thank my family for endless support throughout the transition to pursue my true passion. I would have never achieved this far and onward without your love.

To all of my friends and EDS members, thank you all for being there to help me academically, socially and emotionally.

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Glossary

Reminiscence	The practice of recalling memories from one's past experiences. In the context of this thesis, reminiscence includes (i) an unstructured storytelling of events and episodes, and (ii) a structured, evaluative process of reviewing past experiences to promote positive self-identity.

Chapter 1.

Introduction

People often acquire a curated set of possessions that provide a sense of who they were, who they are, and who they wish to become. For example, many people keep and cherish things like photo albums, diaries, and music collections, using them as resources to reflect on their past life experiences and contemplate the future. Researchers from a range of disciplines have investigated these practices, developing theories that help understand how people's draw on their possessions to construct their identity through acts of self-presentation, self-reflection, and social interaction.

Butler describe reminiscence as a naturally occurring mental process of returning to past experiences [16]. The author recognizes that people, regardless of their age, often review their past. Webster et al., further categorize the experience of reminiscence in three stages; (i) *Simple Reminiscence*, an "unstructured autobiographic storytelling" of relational reminiscence (e.g., at anniversaries and reunions among friends and family); (ii) *Life Review*, a structured and evaluative process that supports in "restoring positive self-identity"; and lastly, (iii) *Life-Review Therapy*, a deeper reminiscence intervention that is often applied in psychotherapeutic setting [133]. In this study, I define the term **reminiscence** as people's practices of looking back on the past life experiences within the context of *Simple Reminiscence* and *Life Review*.

Material possessions play important roles in mediating people's experiences of reminiscing on past life experiences and reflecting on the future [6, 19, 27, 134]. Over a century ago, William James described the intimate and intricate ways that people consider their possessions as part of their self and stimulate recollections of significant life events across their life [58]. As technologies have become widely adopted, people's practices have extended due in part to growing amounts of personal data archives (e.g., [34, 63, 95]). Along with these shifts, there are calls in the Human-Computer Interaction (HCI) community to develop alternative approaches that enable people to draw on their personal data as resources to support and explore different perspectives on their life experiences over time (e.g., [35, 46, 123, 125]). In parallel, an established and still

growing corpus of HCI research has revealed how re-experiencing digital data from the past (e.g., digital photos, audio recordings, social media content, online maps, etc.) can offer valuable resources for supporting experiences of reminiscence (e.g., [13, 23, 88, 96, 100, 103]).

Yet, despite its size, this body of work has largely focused on sighted populations. To date, research on personal data and digital possessions offers very little guidelines for designers to create new systems that can support valuable interactions with personal digital archives for people with disabilities based on their own situated needs and desires. Recently, there have been emerging calls in the HCI communities to develop alternative approaches that enable people to interact with their personal data in more reflective, contemplative, and curious ways (e.g., [21, 52, 90–92, 136]). Indeed, this call for more diverse approaches to engaging with personal data in everyday life is valuable and important. We believe it is necessary and incumbent on the HCI community to include more diverse people and populations.

The majority of HCI research related to people living with blindness focuses on overcoming practical challenges, such as spatial navigation (e.g., [22]) and usability (e.g., [12]). This work has made major contributions to designing technology that helps improve the lives of people living with blindness. However, limited HCI research has explored how technologies could be designed to enrich other important aspects of blind people's lives, such as experiences of reminiscence. My research aims to open up an area that has not received much attention for people who are blind to date: reminiscence.

As a first step, my thesis aims to take a modest step towards better understanding the experiences of reminiscence among people living with blindness by exploring the intersection between design-oriented field research and the situated experiences involving personal data and digital possessions. Specifically, I conducted a qualitative field study with 9 participants living with blindness (7 early blind and 2 late blind) investigating their practices of individual and social reminisce. Next, I plan to explore the experience of reminiscence for people with blindness in the context of HCI through a longer-term research program that will progressively build up to shape and span my Ph.D. program. Design opportunities based on the findings of the thesis will be

the starting points of the discussions and possible research prototypes in the next steps of my research.

My thesis makes two contributions. First, it offers a rich, in-depth understanding of participants' situated practices, cherished artifacts, social interactions, as well as perceived challenges and desires related to their experiences of reminiscence. Second, findings are synthesized and interpreted to propose a set of starting points for future design initiatives aimed at creating resources that better support people living with blindness in capturing, sharing, and reflecting on significant memories from the past.

1.1. Overview of Chapters

Below is a brief overview of the rest of the chapters in my thesis.

Chapter 2: Background and Related Work

Chapter 2 presents a literature review of relevant areas. First, the definition of visual impairment and blindness is provided. Then, I introduce key works in technologies that are designed for people living with blindness. In what follows, I present a body of research that aims to promote the inclusion of people with blindness in the process of making design decisions. Last section highlights a collection of prior works in HCI that look into the personal data and digital possessions.

Chapter 3: Methodology

Chapter 3 presents the methodological choice of the study as well as research objectives, research questions and details about study design, participant recruitment, data collection and data analysis process.

Next three chapters report the findings of the thesis. Largely, there are three emerging themes in the findings: (i) Pathways to Capturing and Remembering the Past, (ii) Possessions as Resources for Reminiscence, and (iii) Towards Future Practices of Reminiscence.

Chapter 4: Pathways to Capturing and Remembering the Past

Chapter 4 presents the first theme, *Pathways to Capturing and Remembering the Past*. This chapter reports observed practices and existing patterns of how people with blindness capture and remember the past. Within the overarching theme, findings are categorized into the following five topics, such as sensorial impressions, emotions and feelings of being in the place, conversation-based recollection, visual descriptions from others and lastly, practices of not actively capturing.

Chapter 5: Possessions as Resources for Reminiscence

Chapter 5 presents the second theme, *Possessions as Resources for Reminiscence*. This chapter introduces different types of physical and digital possessions that mediate the experience of reminiscence for people with blindness, and tensions around using their possessions. Findings are further broken down into five categories. The smaller categories cover; memento as a physical representation of memories, digital and digitalized documents, audio recordings, visual possessions and social media and embedded metadata, and finally, emergent tensions in interacting with possessions for reminiscence.

Chapter 6: Towards Future Practices of Reminiscence

Chapter 6 presents the last overarching theme, *Towards Future Practices of Reminiscence*. In this chapter, wishes, desires and speculations into the possible ways of reminiscing are described. Findings are grouped into three sections as the following: values in AI image description, inclusion and experience with tangible aesthetics, and crafting legacy to pass down.

Chapter 7: Discussion

Chapter 7 presents the analysis and possible design initiatives based on the findings. I report the discussion in four parts. The first section, *Remembering through Sound* discusses possible implications in the experience of sound, involving audio recordings and soundscapes. Next, *Remembering through Collaboratively Annotating and Retrieving Photographs and Mixed-Media* speculates design ideas that support

collaborative experiences around visual possessions, such as photographs and video clips. The third section is *Remembering through Unique Tangible Experiential Metadata*. This section reflects on the possible uses of applying technologies related to tangibility and tactile features. Lastly, in *Methodological and Ethical Concerns* section, I introduce questions, concerns and dilemmas that surfaced from conducting this study and from the discussions with fellow researchers.

Chapter 8: Conclusion

Chapter 8 concludes the thesis by providing a summary of the thesis, limitations on methodology and design approach, contributions and the future steps of my research.

Chapter 2.

Background and Related Work

There is a growing attention in research around assistive technologies to promote an independent lifestyle for people with blindness or visual impairment. Research in the HCI community has been achieved in removing barriers and enriching life experiences for people with blindness and visual impairment in diverse domains. Recently, the interest in HCI community begins to broaden the meaning of assistance to addressing the idiosyncrasies of individual well-being.

This chapter reviews prior works in four research areas. First, I give the definitions of visual impairment and blindness. Then, I provide an overview of technologies and research that are designed for people living with blindness. In what follows, I introduce a body of research that focuses on the inclusion of people with blindness in the process of making design decisions. Lastly, I highlight a collection of prior works in HCI that look into the personal data and digital possessions.

2.1. Visual Impairment and Blindness

Vision (or visual) impairment is a broad term that refers to multiple stages of vision loss from low vision to complete blindness [66]. Visual acuity is a measure of an eye's ability to distinguish shapes and details from a given distance [72]. A number on the left of the visual acuity reading represents a standard vision. 6-meter (20-feet) scale or an equivalent of 3-meter (10-feet) scale is often used. While 6/6 or 20/20 reading represents a nominal vision, 3/60 reading means a person at 3 meter can identify shapes and details that a person with nominal vision can identify at a distance of 60 meters. Blindness is defined as "presenting visual acuity worse than 3/60", according to World Health Organization (WHO) [131].

Although the prevalence of blindness in each region or country may vary with the causes of blindness, blind community is a small community within the entire vision-impaired community. Globally, about 14.5% of all vision-impaired population are blind; there are 5 million people who are living with blindness [120]. In Canada, where I

conducted the field study, the size of blind population is 10% of all low-vision population [70].

2.2. Technology for People with Blindness

People living with blindness or visual impairment are confronted with numerous that people with sight do not encounter or otherwise go unnoticed every day. There has been continuous attention given to studying the daily lives of people with blindness and, to some extent, their fluency with technology. Such research topics include mobility/navigation [3, 11, 22, 37, 38, 62, 111, 126], position/location tracking [74, 83], substitutive senses [20, 59, 64], screen reader and usability [12, 17, 36, 44], and braille conversion [55], to name a few.

Prior research has repeatedly shown that people with blindness wanted to be included and embedded in society through “maintaining independent living and contributing to society like everyone else” [82]. While some challenges could be solved by introducing physical devices like braille labels, tactile watches or white cane, technology has provided many tools for people with blindness to tackle everyday challenges in more innovative and creative ways.

Researchers and practitioners across HCI, assistive technology, and related fields have investigated the question of how technology can be designed to better assist people living with blindness or visual impairment to maintain their capacity to live independently. Hersh and Johnson [53] presented a thorough overview of assistive technologies that “enable blind and visually impaired people to live independently in their home settings” in five categories of daily living: personal care; timekeeping, alarms and alerting; food preparation and consumption; environmental control and the use of appliances; money, finance and shopping.

Mobility is one of the most actively researched areas in assistive technology. Researchers have implemented various technologies to address the needs for assistance in spatial navigation, such as ultrasonic sensors [115, 126], RFID [22, 37], image processing [38, 62] and drones [3, 4]. In other domains in everyday lives, an eyes-free text input mobile software for braille users [40] and a braille-based mobile device blind and deaf-blind people to promote public transit safely [5] are developed.

Researchers also have explored technologies for the needs and possible supports for people with blindness [106]. Similarly, Shinohara and Tenenberg investigated closely into how Sara, a congenitally blind college student, interacts with a number of different technologies in her daily life, which are implemented to provide genuine supports for practical challenges she faces in daily routines [114]. One key technology for people with blindness is the screen reader software. Although there are some limitations [12, 17], people with blindness use screen readers to use applications work on digital documents, website browsing, instant messaging and emails.

Collectively, these works represent a few of many important and valuable contributions the assistive technology and HCI community has made to creating devices that not only help address key practical issues but also promote a rich, independent living for the blind and vision impairment populations. Yet, specific research into how they capture, keep, share, and reflect on their life experiences in support of self-development and social connection has been conspicuously overlooked. Our work modestly contributes to this literature by presenting an initial look into the experiences, practices, and needs of people living with blindness around capturing, archiving and revisiting moments in their life through technology.

2.3. Designing for and with People Living with Blindness

Researchers and practitioners across HCI, assistive technology, disability studies, and related fields have investigated the question of how technology can be designed to better assist people living with visual impairment to maintain their capacity to live independently. Assistive technology often refers to supporting people with visual impairment in a world designed by and for people with sight (e.g. navigation [3, 22, 37, 38, 62, 115, 126], web browsing and usability [12, 17], and screen readers [36, 112]). Consequently, the term *assistive* has been criticized because it connotes that people with disabilities need *assistance* from an abled perspective without direct involvement and participation of people with disabilities [137]. This is a questionable proposition because every technology assists people to accomplish things in a “better” way, but it is only referred to as “assistive” when we aim to marginalize disabled people by assuming that they need assistance to take part in an abled world [24, 119].

Services and devices made from the standpoint of non-disabled persons have revealed a number of problems. The idea of "designing for disability" often introduces misunderstandings from a designer's standpoint because many designers who design for disabilities are people *without* disabilities. Lefeuvre et al. argue that devices that are “developed with sight in mind” can often be a burden for users with visual impairment to use [65]. These authors point out the critical need to consider the blind and vision-impaired population’s situated experiences and desires in the design of new technology. The consequences of not doing so can and does lead to the creation of expensive and cumbersome devices that are not adopted and lead to users with disabilities returning to their original habits and inventive workarounds that they had developed. Hersh and Johnson [53] arrive at a similar conclusion and highlighted that homemade tools and idiosyncratic workarounds developed with personal devices are more common and often work better than narrowly devised top-down technology solutions.

It is important to acknowledge that there is a growing amount of research in the HCI and design communities that advocates for moving toward focusing on designing toward the dreams, desires, and needs of people with disabilities. Researchers have emphasized that normative approaches to “practicing empathy” by mimicking being blind through using blindfolds is counterproductive at best, and often inappropriate and insulting [10]. In advocating new pathways, researchers have argued it is essential to foster rich, inclusive deep engagements with people with disabilities and populations through the design process [8, 71, 110]. Relatedly, from a universal design standpoint, a world designed with disabled users in mind would lead to better accessibility for everyone [49].

Supporting and enriching other important aspects of blind people’s lives through technologically mediated experiences would require blind people’s participation. Silverman [116] explains that a temporary roleplay increases empathy, but such short experience could lead to misleading information and, consequently, creating a gap between a design and people who actually use it. The author encourages a heuristic learning of the blind people's challenges and preferences through face-to-face and collaborative activities that promote the positive involvement of people who are designed for. Similarly, blind scholars have emphasized that it is critical to acknowledge the design capabilities of people with disability [9]. By the same token, Participatory Design is

continuously advocating to involve those into design who will be using these designs. In particular, Metatla et al. [77], have shown a number of avenues for conducting participatory design research that does not necessitate vision to partake. Muller [81] introduces a number of narrative structures in the participatory approach, such as stories, photographs, dramas, videos and games. Information regarding people's intentions and perceptions could be surfaced via various forms of interactions, such as gestures, behaviours, drawings or creative activities. HCI researchers use a variety of idiosyncratic approaches based on curiosity to communicate better with people with disabilities. Specifically, Hauser et al. [51] report on the rich, playful and intimate experiences shared among people with vision and impairment and their guide dogs. This work represents one of the only studies in HCI to date that has inquired into everyday routines of people living vision impairment from a ludic, experience-centered perspective.

Creating tangible prototypes and interactive activities are other great ways of engaging participants. Lefeuvre et al. [65] created a pair of dice with multiple input and output sensors to collaboratively speculate the experience and future applications of Internet of Things (IoT) concepts and sensors with visually-impaired and blind people. Aldridge [2] conducted an in-depth interview with people with learning disabilities in the form of photography. Albouys-Perrois et al. [1] developed a multisensory map for visually-impaired people with a mixed-system of auditory feedback from an augmented reality device and tactile tools. Lim et al., developed TouchPhoto [67], an integrated system that assists visually impaired people to take photography through speech guidance, manage photos with auditory tags and understand photos by providing tactile feedback. Yet, research focusing on the role of digital possessions and archives in supporting people’s practices of reminiscence and reflection whom live with blindness or vision impairment is conspicuously limited.

Prior research has also shown that inviting participants to offer situated reflections on their personal and everyday experiences or struggles through stories, scenarios, and through asking questions is a valuable technique. Frauenberger et al. [39] created a series of participatory activities involving "sensory interest and storytelling" for children with special needs to co-create a technologically enhanced learning environment. Briggs et al. [14] produced short movies featuring different use cases

scenarios of technology that is not explicitly shown in the film. The ambiguity of technology featured in films triggers creative imagination and elicits the dialogues with participants. The authors named this design technique as “invisible design”. Vines et al. [130] introduced “questionable concepts” to discuss new banking technologies for older adults. The authors created a set of concept cards that represent banking technology based on the initial in-depth interview. Questionable concept cards are able to “include serious and playful ideas,” and ambiguity of concepts leads to new insights that suggest what to design next and what to avoid when designing for this older population.

These prior works presented in this section make clear that engaging people living with blindness to design future technologies to better support their needs requires direct participation in the design process as well as framing future design initiatives as targeting their capabilities rather than disabilities. To date, research into how people living with blindness capture, keep, share, and reflect on their life experiences in support of reminiscence, self-reflection and social connection has been largely overlooked. My thesis contributes to this literature by presenting a rich understanding of experiences, practices, needs and desires of people living with blindness around capturing, archiving and revisiting moments in their lives through technology.

2.4. Possessions, Personal Data and Reminiscence

Butler is the first scholar who acknowledges the importance of reminiscence in successful adaptation of older adults through his experience in clinical observations [16]. While Butler recognizes the practice of reminiscence is a "naturally occurring" process for all people in all ages, he states that intensive and deeper reflection of life reviews are observed more often for older adults due to the “realization of approaching dissolution and death, and the inability to maintain one’s sense of personal invulnerability”. Recently, Webster et al. define reminiscence, in a broader term, as "the recall of personally experienced episodes from one’s past" [133]. The authors categorize the experience of reminiscence in three stages. *Simple Reminiscence* is the first type, which is mostly unstructured and involves autobiographic storytelling that often take place within a specific context, such as anniversaries and reunions with close friends and family members. *Life Review* is the second type of reminiscence that is much more structured than Simple Reminiscence. Life Review is a synthetic practice of involving

both positive and negative experiences to promote a positive self-identity, which could help people who need to "[cope] with transitions and adversities in life". Lastly, *Life Review Therapy* is often applied in a psychotherapeutic context to support people in severe depression or anxiety, conducted and assisted by specialists and counselors.

In my thesis, I define reminiscence as a practice that encloses *Simple Reminiscence* and *Life Review*. It goes beyond a fragmentary experience of recalling/remembering/recollecting past memories. In connection to personal data and digital possessions, reminiscence refers to an experience, as a whole, that encompasses not only sharing and reflecting on the past memories around the possessions, but also a dynamic, emotional reflection (both private and social) on the past life through interacting with possessions and digital data.

Material possessions play important roles as triggers for personal and shared memories; they capture and signify people's evolving life history, sense of self and social relationships with others over time. Csikszentmihalyi and Rochberg-Halton [27] articulate the complex ways material things represent the development of life goals and achievements. Belk [6] offers a framework for understanding how people extend their sense of self through their things, in part by drawing on them as resources for self-reflection on the current and past self. In parallel to Belk's theorization, McAdams characterizes identity construction as the development of a coherent *life story*—a synthesis of stories uniting events from the past and present interwoven with aspirations for the future [75]. Here, possessions play central roles in pointing back to the past, capturing a current sense of self, and projecting desired futures. In this way, possessions operate as resources for mediating people's experiences of reminiscing on past life experiences and prospectively reflecting on the future [19, 134].

As technologies have become widely adopted, people's practices have extended, due in part to growing amounts of personal data archives [95, 128, 132]. In part motivated by the proliferation of personal data, there have been calls in the HCI community to develop alternative approaches that enable people to draw on their personal data as resources to support and explore different perspectives on their life experiences (e.g., [21, 52, 90–92, 136]). This has led to a stream of HCI research exploring how people's practices of recollecting and reminiscing on the past could be better supported by interactive technology. A key body of work has focused on the

creation of new technologies to attach digital content to existing physical mementos (e.g., [127]) as well as to support the capture and exploration of images, video, audio recordings, and location histories [56, 76, 124].

There is a body of research that highlights the value of re-experiencing digital data from the past [13, 21, 80, 92, 94], including social media [122], emails [50, 129], online maps [100, 135], photos[96, 127] and sound files [29, 60, 103], to support experiences of reminiscence. For example, Cosley et al. present a system that supports "individual, spontaneous reminiscence" by sending memory triggers collected from social media contents [101] and reflect further on the experiences of everyday reminiscence, especially autobiographical memories for self-reflection [23, 104]. Isaacs et al. report a positive experience of life logging as well as emotional well-being through technology-mediated reflection via a custom smartphone application that records daily events [57]. Prior work is not limited to remembering and capturing of personal data, but also delves into the longevity and inheritance around the legacy of digital possessions [48]. Yet, prior research has largely focused on people without disabilities, and it is important that the HCI community make efforts to include more diverse populations. Very limited research in HCI has revealed that people living with visual impairment do actively engaging with personal data that include such as photographs and on social media platforms [7]. However, there has been no research into the ways in which people living with blindness experience reminiscence and the role of digital and non-digital possession shaping these practices.

Collectively, my research aims to contribute to the growing body of HCI research that investigates how personal data can provide rich resources for supporting experiences of reminiscence and recollection of the past. Importantly, I aim to build on and extend prior work by inquiring into the unique experiences and perspectives of people living with blindness. Beyond work that has come before, I offer new findings on how people living with blindness capture, keep, share, and reflect on their life experiences with their digital and physical possessions; and interpret these findings to present opportunities for designing technology with people's living with blindness.

Chapter 3.

Methodology

This study aims to observe how people with blindness reminisce on the past life and explores how interactive technology could support the experience by designing for their capabilities. On-site, one-on-one field study consisted of qualitative interview questions and two elicitation exercises was designed. Through this study, I hoped to learn from participant's perspectives and to understand the capabilities to make decisions together when designing interactive technology to support their experience of reminiscence.

3.1. Research Objective

The study intended to achieve the following two research objectives:

1. Provide an in-depth understanding on the experience of reminiscence for people living with blindness, including personal practices, cherished artifacts, social interactions, tensions and desires.

2. Surface design ideas and speculate possible design opportunities for interactive technology to support and enrich experience of reminiscence for people living with blindness

3.1.1. Research Questions

Research objectives were met through the following research questions:

1. What are the practices and experiences of reminiscence on the past life for people living with blindness?

2. What types of cherished possessions (e.g. tangible and intangible, physical and digital) are involved in the experience of reminiscence for people living with blindness?

3. How interactive technology could support existing patterns and practices of reminiscence to enrich the experience of reminiscence for people living with blindness?

In order to investigate the research questions, I conducted an in-person, on-site field study with qualitative interview questions and two elicitation exercises at each participant's home.

3.2. Study Design

Considering the limited knowledge in the intersection between reminiscence experience and design opportunities for interact technology for people living with blindness, I began with a smaller, but diverse group of people living with blindness to gain a rich, descriptive understanding of their practices, needs, values and desires as a whole, following the suggestion by Edmondson & McManus [32]. I took a qualitative research approach. Qualitative research provides an "interpretive, naturalistic" understanding of things, including experiences of a specific community, people's belief or phenomena, through descriptive representations, such as interviews, field notes, photography, video clips and recordings [68]. Through this approach, I intended to explore my research interest as well as to inform what might be salient research inquiries for future research.

3.2.1. Study Details

The study was designed to take place at each participant's home. The home setting would make participants more comfortable sharing personal stories and more accessible to refer to specific artifacts or places at their home. The study was consisted of two parts. The first half was a retrospective part that aimed to develop an understanding of each participant's orientations toward their possessions and experiences on existing objects related to memories. The second half was a prospective part, which intended to draw a deeper conversation on a number of different themes, such as the patterns and tensions of the current practices; desires and wishes for the feature; and aesthetics and interaction of a possible, speculative storage for capturing, archiving and revisiting memories. During the study, I collected data in forms of field

notes, photographs, audio recordings and short video clips. Participants gave consent to share photos of their homes and possessions, and personal stories to be used in academic disseminations.

Figure 3.1. On-site field study interviews with participants at their homes

The First Half – Looking Back

An introductory interview and two elicitation exercises were prepared for the first half. In the introductory semi-structured interview, a set of open-ended questions were asked to understand the participant's current practices and experience on reminiscence at a higher level. *Home Tour* and *The Storage* were two retrospective elicitation exercises.

The first activity was *Home Tour*. This activity was designed to understand meaningful possessions' types and locations, and to observe how participants would interact with them. I invited participants to give us a tour of their home. Participants were encouraged to show meaningful artifacts kept in the home and to share the stories behind them. Some interviews could not take place at participant's home. In these cases, I suggested alternative options to participants to give us a tour, such as drawing

on a piece of paper or verbally describe their home and meaningful objects as we do the sketch.

Next activity, *The Storage*, provided an opportunity to understand participants' perceptions and interactions involving various forms of memory storages, which could be commonly found and used by sighted people. Five objects were presented as examples of storages: photo frame, photo album, diary, jewelry box and smartphone. Sharing positive and negative experiences on these objects could open up prospective conversations on how participants would want to design their own memory storages to organize their memories throughout their lives.

The Second Half – Looking Ahead

The second half was intended to have a forward-looking conversation and to co-speculate on a possible memory storage that could support reminiscence experiences for participants. Participants were given a clay pot with some engravings as an example of a storage for them. Participants were guided to discuss possible features, interactions and a few use-case scenarios of a storage that they prefer or imagine. Participants were invited to share their thoughts freely, regardless of whether discussed ideas were realistic or unrealistic.

The study ended with a few wrap-up questions, giving participants an opportunity to ask questions about the study, future directions, or to elaborate more on the topics that were covered or not covered during the study.

3.3. Participant Recruitment

Participants were individuals living with blindness who reside in Canada. A relatively diverse sample of people living with blindness were recruited to elicit a wide range of rich descriptions about how they capture, archive and revisit moments in their lives and to prospectively envision how might technology better support their unique and situated practices of reminiscing on life experiences past.

A total of 9 participants were recruited (4 females and 5 males) from the Metro Vancouver area. The first round of recruitment was through visiting a local non-profit organization, Canadian National Institute for the Blind (CNIB) [18]. The next round of

recruitment was done through an online community. A recruitment script, including brief study details, was posted on Reddit's blind community [109]. As interviews were carried out, more participants were recruited using a snowball sampling approach.

Participants were screened over the phone or email to ensure we recruited a range of ages and occupations. Participants' computing practices and expertise varied; however, all participants owned personal computers and smartphones, used them frequently (the majority on a daily basis), and maintained at least one online account (e.g., email, social media, etc.). Our resulting sample represented people living with blindness at different life stages and in many different occupations. Importantly, 7 participants had been blind from birth, and 2 had become blind later in life. Although a blind community is a highly heterogeneous group, gone-blind and born-blind persons were both recruited for this exploratory study for a marginalized community.

Short descriptions and narratives for participants are shown below. Participants' names are replaced to pseudonyms.

- **Luis** (mid-30s, born blind) loves sailing, lives on a sailboat, and fluent with technology
- **Ray** (mid-30s, nearly born blind) became totally blind at age of three. He is a martial arts instructor and a counselor for people with blindness.
- **Meg** (early-20s, born blind) is a recent graduate from university and living with a lovely guide dog.
- **Carol** (late-60s, born blind) worked as a typist and in data entry for more than 20 years. She enjoys talking with her siblings (whom are also living with blindness) over the phone.
- **Carl** (mid-60s, gone blind) was a video camera operator (for films) and loves photography. He lost his sight 15 years ago, yet he still works as a passionate photographer.
- **Jessie** (late-20s, born blind) loves music and is training to become a music therapist.
- **Janet** (late-60s, born blind) worked as a special education instructor for visually impaired people for many years.
- **Frank** (early-70s, born blind) is **Carol**'s blind sibling who always liked the sound of boats and cars. He enjoys going on boat trips and listening to audio books.

- **Rob** (early-60s, gone blind) became totally blind in his 30s. He is a technology counselor for people with blindness. **Rob** loves technology and traveling.

3.4. Data Collection

The study was conducted at each participant's home in Metro Vancouver. Participant's home setting was the best place to observe their practices and learn about where and how meaningful objects are kept. Overall, each session lasted between 100-180 minutes. One or two other fellow researchers accompanied to take field notes, photos and short video clips. All sessions were fully audio-recorded. **(See Appendix for the interview protocol and questions.)**

During the introductory interview, I began by asking participants to broadly describe their current practices and experiences on reminiscence. Questions, such as what are specific triggers or cues that bring back past memories, how past memories are kept and archived, what are the interactions with archived collections, and how the current moments are captured, were asked and discussed. I also asked participants to describe the cherished material things that they possessed, and which represented their self or past life experiences.

Home Tour, the first elicitation exercise was designed to understand what kinds of meaningful objects were kept in homes, where they were located and how participants would interact with them. Four participants did a sketch of their homes, while other five gave us a physical tour. I encouraged participants to describe artifacts including both physical and digital objects. I also asked participants to describe what they perceived to be valued digital possessions of other forms, of data with emphasis on probing motivations and strategies for holding onto these things and how they are used in participants' respective practices of reflecting on past life experiences and sharing these narratives with others. Across these parts of our interviews, I asked participants to reflect on similarities and differences among their material and digital things; I paid close attention to the language participants used to categorize and describe similarities and differences. I explored their strategies for keeping these things and how they triggered reflective experiences. When necessary, I prompted them to clarify their orientations toward their various material and digital things in terms of the role they played in supporting reminiscing on the past.

The next activity was *The Storage*. Five different memory storages that are commonly used by the sighted people were presented; photo frame, photo album, diary, small accessory box and smartphone. Personal experiences, thoughts and challenges regarding each storage were discussed along with the benefits and drawbacks of interacting with each storage. I brought five storages as demonstrations. Participants touched and felt each object before I told them what it was. As they touched each object, they could easily recall similar possessions of their own, which evoked detailed memories, sentimental emotions and personal stories. The exercise surfaced rich descriptions of both positive and negative experiences in interacting with some of the existing objects related to memories, which participants briefly touched on during the *Home Tour*. For example, although I intended to conduct an individual interview, **Frank**'s wife was interested to join the study together as a couple. As we discussed through each storage, they shared different perspectives on the photo albums that **Frank** missed during the *Home Tour*. It led to a deeper conversation about how **Frank** and his wife treated and used the same albums differently. Also, possible augmentations for each storage were explored to make it fit to participant's needs and desires.

In the next phase, the clay pot acted as a symbol of storage that participants could hold on and stroke. The pot helped to evade focusing too much on intangible possibilities, such as mobile applications or online services, which allowed to touch on topics, such as aesthetic features and physical forms. Also, engravings on the surface of the pot led speculative conversations around tactility and relative technologies, such as tactile photography (**Janet**).

The wrap-up interview provided a great opportunity to explore a breadth of topics. The conversation got much more interactive as accompanying researchers joined the discussion. We were able to gain a lot of inspirations from diverse topics. Some participants invited us to see personal possessions that they missed or forgot during the study, such as homework and crafting from elementary school (**Jessie**) and braille recipes (**Carol**). Some other participants commented on existing or upcoming technologies that could be useful for their experience in reminiscence, such as image-describing AI and 3D printing (**Ray**).

3.5. Data Analysis

Analysis of the data had been an ongoing process as the interviews were proceeded. The recordings from the study produced nearly 17 hours of recordings in total. Relevant segments in the recordings were transcribed. After each interview, field notes taken during the interview were reviewed. Open coding was used to surface tentative insights were noted and grouped to identify emergent patters across the data [26, 47]. Data were then organized into themes. Data was coded in weekly meetings; overlaps and differences in interpretations of the data were discussed through Axial coding [26, 78]. Meetings were also held with lab members outside of the project to challenge our assumptions and to corroborate the themes.

Chapter 4.

Pathways to Capturing and Remembering the Past

In this chapter, I present several examples taken from field observations and interviews with participants that capture the emerging themes in three areas: how memories are sensorially captured and evoked; how physical and digital possessions mediate individual and social experiences of reminiscence as well as emergent tensions in social reminiscence; and desires for future practices of reminiscence.

Remembering and reminiscing on the past life experiences is an important part of our lives. Whether intentional or unintentional, we often recall the past in our daily lives. All participants agreed that they do reminisce regularly as many as a few times a day or at least once in every few months. Also, participants described that there are certain triggers that bring them back to the past. For example, there are the times of sharing memories with friends, family members or loved ones, or the times of encountering objects that have memorable meanings.

Although each participant had different triggers, they all have their own ways of recalling memories and have developed personal practices of facing moments from the past. Overall, participants described various perceptional and sensorial experiences that triggered reflection on past memories, which ranged from as regularly as a few times a day to at least once in every month. Next, I provide examples that help illustrate these different experiential qualities, place-based associations, and social practices of capturing memories and looking back on the past.

4.1. Sensorial Impressions: Triggering and Capturing Memories

Taste, olfactory (smell), auditory (sound) and tactile (touch) senses each were described to offer distinct and unique pathways to memories of the past. Participants described these experiences as emerging both through accidental encounters as well as purposeful recall. A pattern of feeling through other senses and relating it to a scene in the past was dominantly observed among all participants. Once recalled, the memories

came in a great detail. **Ray** said “[he] remembers through textures” as textures are a strong “gateway to the past”. He memorized textures of meaningful objects in his head that he owns for long enough time to get used to them, so that it is not necessary to feel the textures to remember them.

For **Janet**, touch evokes memories because she “[uses] it so often” that textures of things make impressions on her mind “just like the picture”. She described how she remembered memorable events through different types of textures. A “silky material with polka dots on it” reminds her of a confirmation back in her childhood and silky dresses with “puffy sleeves” reminded her of her sister’s wedding. Similarly, **Jessie** mentioned how a specific material was a direct reminder of a past memory:

> There is a material that reminds me of my grandma's house. This old blanket, the drapes in the room that she used to have. There are some materials associated with memories. (**Jessie**)

Rob shared his personal story about the experience when he touched an artwork that immediately brought him back to his childhood memory. He described an art show called “Continuous Ribbon” where an artist carves a rough stone into a smooth marble in front of the crowd. When **Rob** was experiencing the show, he had a chance to touch the stone and carved out ribbons. As soon as he touched the artwork, a wave of childhood memories and the visual images that had been forgotten for many years flooded into his mind. Especially, a memorable place where he spent many days, especially when feeling “melancholy”, back when he was a child:

> I experienced a Continuous Ribbon carved out of a Vancouver Island marble at an art show two years ago. An artist would take a big piece of rock and he'll start carving it. All you see it is a ribbon and it twirls and twines in amongst and out, but you'll never find either end of that ribbon. When they grab a piece of marble out of the ground, it's rough. Once [the artist] starts carving it, it's very smooth and over the top, it's really rough, but as he is on the outside edge of marble and then it goes back to smooth again.
>
> When I was younger in teenage years, there was a dam park near the river close to where I lived. That's where we all went swimming. … There was a great big rock, just down below, it was looking down on the rapids. This was a very fast-moving piece of water with lots of undertows. When I felt in that melancholy place, I used to go to the river sometimes early in the morning when nobody else is around, just sit on that rock and look at the water. I don't know how deep it was, 20- or 30-feet deep, but all of a sudden, the water would be clear and you could see right to

> the bottom, and then the swirl of bubbles coming through the rapids would obliterate your sight and all these bubbles were bursting at the top. The roar of the water from the rapids was right there. I was lost in that white noise and I was just mesmerized looking at the water and how it constantly changed and moved and the sound and all that stuff.
>
> The minute that I put my hand on that continuous ribbon with some really smooth and rough stone, that's the image that came back to my mind immediately, as soon as I touched that stone. (**Rob**)

Echoing **Rob**, **Luis** also emphasized that he became more sensitive to tactile, explaining how past experiences, emotions, and memories are evoked through tactile sensations. **Luis** strongly agreed that "[his] brain tends to focus on sensory inputs from other sources." He described how he could meticulously remember and envision the details of objects in his head "exactly as it feels" through tactile textures:

> I observed that often blind people tend to be more sentimental, than the average person. Because we have such a focus on memory, anything that I touch usually has a memory associated with it. Even if it's not a memento, even if I touch an edge of the boat, I remember the day that ***David*** stained that wood stain. I can remember how thrilled it was when he looked at as the product of drawing and how it nicely set it looked.
>
> It sounds silly but, even if I come across a pair of headphones or an old tape recorder that I haven't seen in 20 years, just by touching them, I remember a whole bunch of memories would come to mind of when I last used that device. I think sometimes it can be a disadvantage because if I have something that my uncle Rick gave me, and he died when I was 16, but if I find something that he gave me, it'll make me sad, and I guess if you would see it too, but I feel like it might be more. It might feel stronger just because I don't know what his face looked like. So, for me, the one audio recording I have of him or these things that he gave me mean more. (**Luis**)

As **Luis** mentioned at the end, not only tactile sense but also hearing is a major sense for remembering for people living with blindness.

Smell and sound offered different sensorial modalities that offered different pathways to the past. In describing meaningful memories of past travel abroad, **Janet** noted how "different countries have different smells in different times of the year." She noted that serendipitously encountering key smells in her everyday life could trigger vivid memories of past travel experiences of particular locations during a specific season. Similarly, **Rob** described how he captures an important life experience through by a mixture of his senses:

> For me, the smell is probably a bigger thing for me. I love walking through the forest or down by the beach. I just love all the smells even just the wind blowing across at a grass field. That come to really appreciate the different sound of trees. Just with the wind blowing in the trees, they sound different so I can identify an evergreen from a leafy tree. (**Rob**)

As our dialogue continued, **Rob** noted that his recollection of cherished memories often involved differing degrees and overlaps of olfactory, auditory, and tactile impressions. Although these types of memories were not easy to be archived as an external form, memories captured through these senses of a body last very long.

4.2. Being in the Place

Another key general theme in participants' orientations toward recollecting significant life experiences was highly associated with specific physical locations. **Janet's** statement that "Every place has its own memories" captures a sentiment that all participants shared – that simply being within a significant place could trigger the recollection of vivid memories without committing to reminisce.

I first introduce some of participants' favorite spots that revoked nostalgic memories from their past. **Frank** has always loved cars and boats. There is a used car dealership in the neighborhood that he has been known the place since 1970 through his father. The dealership became his favorite place where he enjoyed hearing engine sounds. Even today, he visits there as often as 2 or 3 times a week to hear the sound of boat engines from the past boat trips.

Luis's favorite spots on his sailboat were the cockpit and the cabin, where a lot of memories were made from a number of sailing. Just by mentioning the place, **Luis** was able to recall every specific detail from his past experience:

> Min: Where are the places that you have the most memorable moments?
>
> **Luis**: Easy. Cockpit. Because the cockpit is where on a nice sunny day, you seat at the back of the boat, my friends are sailing, or talking we're having a good conversation. I go make food, when he's steering the boat or I steer the boat, he goes and makes food. It's always the cockpit. Sometimes, it's in the cabin if it's like a rainy day and we order a pizza and we're dreaming and planning out our next cruise.

For **Meg**, the bedroom is not just a place to sleep, but a space that has many memories with her beloved guide dogs. Her current guide dog sleeps on the cushion next to **Meg** 's bed, and her first guide dog's bed was at the same place. **Meg** elaborated on the significance of her bedroom:

> [In the bedroom], it has this beautiful giant window where the breeze that comes in. Next to my bed, kind of behind it is **Milo**'s bed. I have a lot of fun memories in that area because that's where my first dog snored a lot. That's kind of this emotional area. (**Meg**)

Jessie said that the more time she spent in a place, such as kitchen or living room, the more special and meaningful it got. **Jessie** pointed out that the kitchen a place for numerous mundane but valued memories, such as when she first baked and all the rushed and lazy mornings:

> A lot of memories are made in the kitchen. This is where I first learned to bake. The first thing that I've ever baked was an absolute disaster. It was supposed to be cookies. I don't even know what I did. They were not cookies; they were sugary bits of "I don't even know". But yeah, here, lots of mornings... Gosh, I remember all the mornings, sitting at the island, something to eat before heading off to school or starting my day. There have been rushed mornings and there have been really lazy mornings. (**Jessie**)

Listening to participants' stories revealed that certain places act as a cue, which effectively brought memories back through unique atmospheres and feelings of places. Participants were often able to describe and reflect on very specific details of their past experiences within places of personal significance. These narratives revealed how the act of occupying a specific place and simply absorbing the atmospheric sounds, smells, and tactile feelings could provide powerful cues for supporting self-reflection and reminiscence.

4.3. Conversation-based Recollection

As participants were familiar with capturing and recalling through verbal descriptions, memories were frequently recalled and shared in a form of descriptive verbal depiction with others. Many participants preferred *conversation-based recollection,* triggered by various conversation starters, such as mood, place, weather, events, people and possessions. Dialogues involving a sense of reminiscence did not necessarily happen in-person nor having any possession at hand. Recalling memories

through conversation was much more flexible in space, and sometimes more accidental. **Jessie** said:

> [My family and I] would sit down and reminisce about stuff. "Remember when this happened…". It's quite conversation-based, actually. We will reminisce quite a bit about stuff that's happened in a particular place. Usually, it's coming up from nowhere. When we reminisce it's usually about a person doing something [unexpected] or something breaking. (**Jessie**)

Similarly, **Rob** also mentioned how memories from the past events were easily brought back simply by chatting about it:

> You know, if we start talking about the family reunion in 2012 back in Saskatchewan, all you have to do is mention it, and then those highlights that were there for me tend to pop up. (**Rob**)

Sentimental factors, such as mood, people and place, were major components that determined the richness of experience in the conversation-based recollection. For example, **Meg** said talking to different friends, who she hasn't seen in a while, is a good trigger for memories as they talked about things from the good old days. Often, the quality of experience was not associated to blindness or sightedness, but the emotional connection with people participating in the conversation. **Carol** and her blind brother **Frank** enjoyed talking about their memories from the past over the phone, although they did not exchange a lot of possessions at hand. They casually chatted and asked questions about different memories from their childhood or early adulthood years.

> I believe that the reminiscing that **Frank** and I do is very special and timeless. The memories we share are long lasting and always seem like the events we share happened yesterday. I don't know how this compares with memories shared with sighted people. I think the reason **Frank** and I have such long-standing reminiscences is that we shared so many activities and interchanges during our childhood. (**Carol**)

Story was a powerful trigger for participants to reminisce together with others. Stories were much more effective in creating a nostalgic atmosphere. For example, as I was going over **Jessie**'s photo albums together, she mentioned how she wanted something more interesting than organizing photos in chronological order. **Jessie** suggested grouping certain themes to make unique stories by connecting old photos:

> You can make a story with [all these photos]. Start with 'Baby pictures', 'when a child is older' or we could have a whole birthday theme to put

> everyone's birthdays. There are so many ways to make this creative. Like, making a storybook of memories. (**Jessie**)

Similarly, **Rob** did not need many souvenirs or reminders to recall his trips to Europe. Rather, he preferred to remember memories through his own story:

> I'm always gained to try whatever. We wandered to travel how many castles and churches and cathedrals all over Europe. But I don't tend to need a lot of detail about it. Just hearing the stories. I guess that's what it is for me. That just evokes for me a feeling of sensation of... nostalgia. (**Rob**)

While physical presence and tactile features carry an important meaning, **Rob** had to pay constant attention to the limited space in collecting mementos. I observed that other participants had a similar experience in being very selective when choosing what to keep. As **Rob** highlighted, story was an ideal form that is free of such space constraint, and a way to establish an intimate social relationship to share their experiences and memories.

> I've recognized in myself that I will grow to fill whatever space is available to me, so I don't want the space to be huge that I keep adding more and more. You know what, memories that we've forgotten or gone over, so much of it I carry with me.
>
> I don't have to have the physical item to remind me, although I need is the story and I can go back there. It's not that I need a lot of stuff, but I need a lot of interaction with people, with family and friends to keep those memories alive. I don't necessarily wanna keep them in the storage, I wanna keep them in the story when we gather.
>
> Wherever we gather, that's where the stories are gonna be told. (**Rob**)

4.4. Visual Descriptions from Other People

Participants reported it was common for visual details associated with significant life experiences or locations to be captured in part through **other people's descriptions**. This was most often the case when it came to experience natural phenomena, such as entangled branches of giant trees or a thousand stars in the sky or a beautiful sunset; here, capturing and recollecting such moments became a collaborative experience.

When I was interviewing **Frank**, his sighted wife **Susan** also joined the interview. She told us a story from their honeymoon, where she described a visual scene to **Frank** by making a hand gesture to make intertwined trees along the road:

> We were on our honeymoon. We went over to the island. The trees over there were huge, great big things. So how does **Frank** think about? The only thing that I could think of, because I did have some experience with blindness because of my parents, I said to him, "visualize and take your fingers and intertwine like this". That's what the trees were like on the road because the trees touched each other from one side to the other side. (**Susan**, **Frank**'s wife)

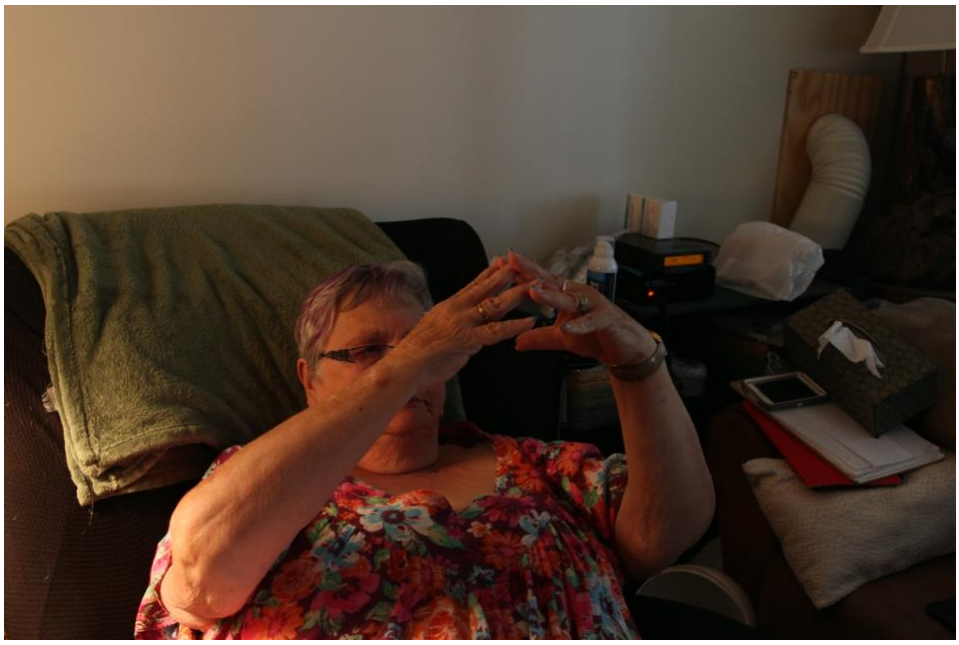

Figure 4.1. Susan, Frank's sighted wife, is showing a gesture of intertwined trees

Luis is congenitally blind. **Luis** described how he remembered scenic views as he recalled the best descriptions that others have provided to him:

> I was born totally blind, so I've never really had a problem memorizing or remembering anything. I could just go down a memory lane and pick thousands of memories. But people that lose their sight, they always tell they are really scared of eventually forgetting what a sunset looks like, what a loved one's face looks like or what a color orange is. I've never seen those things so if I would recall what they look like, I recall the best description that somebody gave me of it. I've been sailing and I recall my friend describing the stars to me in the wondrous voice.

> For me, I look through his eyes. That's how I remember the star and the sunset is; what he said, how he described those. That's really how I see the world, how I receive things myself in terms of touch and smell and taste and text and hearing. But then, whenever it's a visual concept, it's always through the eyes of somebody else. How they described it for me in word-pictures and that's really meaningful for me. I've been really fortunate that I've got to do a lot of things. I treasured those *descriptions*, but I don't really have to write them down. As we get talking about them, they just all come into my mind. (**Luis**)

As a gone-blind person who lost his sight completely in his 30s, **Rob** is in a slightly different situation from **Luis**. **Rob** described an intimate collaborative practice shared with his sighted wife when capturing memorable landscapes and vistas:

> I don't spend a lot of energy missing the things that are no longer available to me. When [my wife] and I go for a walk down by [where we live], a beautiful little bay in there and the sun setting over the backside of Vancouver Island is quite spectacular some evening. I will never ever lament the lack of access to that.
>
> When [my wife] and I go for a walk or when we and anybody else goes for a walk and they see the beautiful sunset, they start to explain what they are seeing; colors, the shapes and all that stuff. I thoroughly enjoy it while I'm there and while I'm experiencing with that person, but I never spend a minute saying "Ugh... It's so awful that I can't see those beautiful sunsets that all you guys see".
>
> I've heard blind people give a sighted person hell because they are describing this beautiful sunset and it hurts their feelings because they don't get to see it, but I don't go there. I don't think I've ever done that. I'm happy to experience the world as it shows up today in the places where I am. (**Rob**)

Collectively, these examples illustrate a diversity of ways that participants drew on sensorial capacities of their own and from others to capture and revisit significant experiences. They also highlight the importance of physical places and the role that their subtle atmospheric qualities, as well as more active verbal descriptions of them by others, can play in offering rich resources for reflecting on the past.

4.5. Not Actively Capturing

While some participants actively recorded their experiences and memories to make their own collections, other participants preferred not to put too much effort in capturing them. Making recordings or capturing memories often require a continuous

endeavor, therefore, participants shunned capturing memories. Instead, they choose to enjoy the moment as it.

For certain activities, participants got out of a habit of making memories because there was ***no easy way of doing it***. The most frequently mentioned practice was writing a diary. **Carol** and **Meg** used to keep a daily journal, but it got out of habit for both of them. **Carol** mentioned she uses a “Brailler”, which is a braille typewriter for making physical notes. However, the machine is very heavy to carry around and it is not easy to edit writings. On top of that, the interaction was far different from “writing”. Although **Carol** does realize that it gets much easier to make recordings with recent technology, **Carol** said she “got remiss”, not doing anything specific these days. Similarly, **Meg** said writing diary felt “really boring and [took very] long to keep it”. Instead, she preferred to have conversation with others by sharing stories, rather than continuing a diary.

Figure 4.2. A large brailler at a participant's home, which is used to print paper documents in braille

As feelings and emotions from personal experiences and relationships with others are particularly difficult to archive, some participants preferred to ***live in the moment***. For example, **Meg** mentioned that she was being lazy to collect all recordings, though she agreed that audio recordings mean a lot for blind people and also for her. **Meg** thought focusing too much on capturing the moments would “take away the memories that are happening”. **Rob** agreed with **Meg** that he is prone to enjoy the moment, rather than actively capturing to leave records:

> For me, it's just being there and experiencing it is what really matters. I don't tend to take pictures [or to make audio recordings]. Take what comes, go along and get along, so I'm not a huge detailed, planning kind of person. More sort of relaxed and 'let it go, let it be'. It's not a lot like a soother, I don't need them in my hand all the time. Just thinking of them takes me to those places. (**Rob**)

Accepting the forgetfulness was a good reason to get rid of a burden of making recordings. If memories get too old, they are prone to be forgotten. Even if memories are recorded, they do go away if they are not revisited for a good amount of time. **Jessie** cherished the past. However, at the same time, she was not worried about recording or remembering moments:

> I don't really write things or record things. I guess a part of it is that I'm not really concerned too much in the past. I rely more on remembering what someone's voice sounded like. But sometimes I think to myself that I should start recording. Maybe I want to remember it, but then I ask myself. "Do I want to hang on to a lot of that?" I like looking forward to the future. Yes, it's nice to have videos when **Mac** (a pet dog) was a puppy but, I don't know [if I really want to hang on to that too much]. (**Jessie**)

Echoing **Jessie**, **Meg** shared similar thought about how she deals with the past. She said, "memories hang out and surfaced when they feel like it". Just like memories come and go, she accepts and enjoys accidental encounter of past memories.

Slowness is one factor that people with sight are not accustomed to, especially when it comes to the experience of recalling memories from the past. **Carl** pointed out that slowness as a barrier that negatively influenced the habit of making memories. **Carl**, who lost his sight 15 years ago, said his practices became much slower in both capturing experiences and recollecting details and feelings from memories because he was not trained to recall through non-visual mediums.

> Blindness has stored different aspects of the experience. It [has made me] slower to match with existing memories. Slowness is not really about the decisions, but it's the process. Maybe because I have to explore more [options available to capture or recall memories]. Not just essential aspects, but all of the meanings [of adopting and implementing such options] as well. (**Carl**)

Enduring the effort of making recordings of the moments may yield a wonderful collage of collected memories, which people could later look back and reminisce. However, if the effort of keeping track of all memories and recordings interferes with the quality of

experience happening now, enjoying the emotions and experiences in the present to the fullest could be a better choice.

Next, I turn to the varied roles that physical and digital possessions played in mediating participant's practices of capturing and revisiting memories.

Chapter 5.

Possessions as Resources for Reminiscence

Participants kept cherished possessions that were closely connected to their past memories. I observed different types of possessions, including physical objects like photos, analog recordings, and mementos that were kept, often in highly personalized collections in the home. I also observed a range of digital possessions, such as audio recordings, photos, videos, electronic journals and digitalized letters—that were typically fragmented across personal devices, in social media, and cloud storage platforms.

5.1. Memento - A Physical Symbol of Memory

Mementos, physical representations of memory, were commonly observed as a cherished possession across multiple participants' homes. A tangible shape along with its physical presence was critical for participants. Often, each memento was associated with a memory of friends, family, meaningful places or events.

Ray was collecting action figures. He said the old action figures reminded him of his childhood, where he used to play with brothers and sisters. Many memories before the era of digital recorders and smartphones were not easy to capture and archive, especially childhood memories:

Figure 5.1. Ray's two action figures are on the table in the living room

> I collect mementos. A lot of time, if I know the moment is going to be incredible or I'd want to remember this, I would rather make a piece of art or buy something special for myself to keep. There two action figures on the table. They are very old; they are from 1996. I remember clearly when my mom bought them for me as a child. If you go to my bedroom, you will see that I have over 500 action figures. Pretty much every single one of them is engraved in my memory. Not every one of them is linked with a strong memory, but most of them mean something.
>
> 20 years ago, a lot of [the current technologies] were not available. I can only remember them. This is why actually sometimes I would go out of my way to track down an action figure or a piece of sculpture that I remember from my childhood. Some people ask me, "Why are you buying old action figures? Shouldn't you buy new ones?" Because I've never kept them around when I was little. So now, if I want these memories back, the only way is to track down those action figures that remind me of certain moments; with my brothers or sisters or parents. Sometimes when I buying things is almost like a memory hunt. (**Ray**)

Carol showed her collection of stuffed animals. Not only they felt soft, she also remembered very specific details associated with each stuffed animal, such as people who gave it to her, place that she went when bought it, and the experience and feeling of the moment she got each stuffed animal:

> Stuffed animals. They are my real weakness. I've got lots of them here. I treat them like real animals. I love the texture, softer the better. This is my real pride and joy. Some people from work gave him to me years ago. His name is Ralph, and he's so soft. I interact with them every day, several times a day. I'll hold them, stroke them and talk to them. I remember when I pick up Ralph (a huge teddy bear). Four people at work gave him to me. I remember the day they put him in my arm. I was so surprised. (**Carol**)

Besides stuffed animals, **Carol**'s braille recipes were definitely one of the memorable mementos shared by participants. **Carol** loves to cook, and she has been collecting all different kinds of recipes shared by others, translated to braille using her braille typewriter. She remembered who gave her recipe for each of them and would recall a strand of memories by reading recipes, probably much stronger when she actually cooks and tastes the food:

> I've got all these braille recipes in this envelope. My families have given me some family recipes, then I've written them out (in braille). Some of them, I need to re-do because, over the years, they've gotten a little bit dog-eared, but they are all on a separate sheet. Lemon squares; three-quarters of a cup of flour... There are ingredients and a little bit of instruction, some more ingredients and a bit more instruction. Those I use when I'm cooking. This lemon square recipe, my sister gave me. Lots of them over the years have come out the ones that people have given me and I've written them out (in braille). (**Carol**)

While some mementos were carefully selected and kept with care, some 'unseen' mementos that lingered in participants' homes. Spending time together made possessions more meaningful as a lot of memories are created around them over time. As a result, a possession that stayed long enough to be a part of the living environment often became a cherished possession that is loaded with memories. For example, **Jessie** played the piano since she was young, and the piano has been with her family for many houses, which now became a memento imbued with memories:

> There's a piano on the corner, that's got a lot of memories. That travelled with us from the old house to our new house. I used to play it a lot more back at our old house, I used to practice a lot more. It's been around with me for a number of years. (**Jessie**)

Figure 5.2. A piano at Jessie's home that has traveled many homes with her family

Rob had a few boxes at his home. He said the box has been around for a long period of time. Although he did not frequently think deeply about it when using it, simply having it meant a lot to him as the box reminded of someone special:

> The jewelry box was something from my two sons' grandfather. When he passed away, that was the memento that I got from him. So that jewelry box has been around for a long, long time. It's not what's in it that's important. (**Rob**)

Personal possessions and reflective moments indeed highlighted significant individual experiences, but when it became more socially meaningful, it added much more attachment and affection to people who enjoyed together. For example, **Carol** liked to display her mementos, such as an ironwood dolphin from Mexico in 1990s and other sculptures she received as a gift, nearly 50 years ago, from her housewarming party. Mementos collected from various places and trips were placed in the living room, not only for decoration but also for people to see and enjoy.

Sometimes, these possessions were private, shared only between a few individuals. **Luis** described a hidden place on his sailboat, which his close friend used to live and sail

together. There were some of his mementos from childhood, such as a bible from his dad and a teddy bear that he had since he was 3. On top of that, it was a place for **Luis** and his friend to keep a few "treasures". Although the boat now became **Luis**'s own place, he said he still reminisces through the treasures every time his friend comes over to sail.

> The chart table has a lid that lifts up. Inside, you can store a few things. [My friend and I] mostly keep little stuff like radios and a lot of charts, which are like maps for the sea. But also, we have a few special things. There is the first chart that we used when we were learning to sail. Even though it's out-of-date now, we both wanted to keep it. (**Luis**)

Collectively, participants valued physical characteristics, such as shape and texture, and tangible aesthetics. Physicality and materiality of possessions played an important role in supporting attachment and reflection that pointed to a very specific time of year, people and event from the past.

5.2. Digital and Digitalized Documents

Digital document was a possession that easily accumulated from making personal notes and memos or from social interactions from friends and co-workers. Digital documents included not only documents that had specific purposes, but also mundane notes and memos, such as emails, texts, messages from online messengers or journals.

Meg valued text conversations with family members and her friends, saved on her phone and messengers. **Ray** said he occasionally write a diary as a file on his computer, and so as **Luis**. They all agreed that these pieces of digital files were a good trigger for memories.

> For many years I kept a diary or journal. Which you know that I used to record important dates and stuff like that. I think there are still be cues for the memories. When I go through [my documents folder] and I see a letter I wrote or an email message I sent to somebody or I received that helps me to recall more details. (**Luis**)

Carol shared a similar thought that old emails and files evoked memories:

> I do have some things on the computer, like old emails and old files, a packrat for that. They bring back certain things that have happened or I've done in the past. (**Carol**)

Despite all participants were collecting some forms of digital document, purposefully or without noticing, how those documents were organized varied across participants due to personal preference. **Luis** organized digital documents by date and category so that they could be easily found when necessary:

> I tend to organize everything by year. My email at work is done like this, and my email at home and my recordings. Inside a folder for the current year, I make subfolders inside that year folder. I name them as the name of the vacation that I took or where I went. "Birch bay camping 2019", something like that. Sometimes, I have descriptive file names with a half of line of, "**Luis** and **David** sailing back to Vancouver". (**Luis**)

Meanwhile, some other participants did not spend too much time to group them nicely because the structure could get too complex or simply because the important information was thoroughly memorized.

D*igitalized document* was a wishful and preferred possession. When written or braille documents were translated to the computer, they became much more accessible to people with blindness as screen readers and image describing AI could read digitalized documents. Also, digitalized documents last much longer than physical documents and take up far less space than braille documents. **Janet** talked about digitalized letters of her grandmother that she received via email:

> Someone emailed me computer versions of some letters that my grandmother wrote. She wrote them back in the early 1900s when she was first married. She was in South Africa because my grandfather was serving in the Boer War in the British Army. They're very special. (**Janet**)

Yet, as **Carl** pointed out, translating physical form into digital files required lots of time and energy, and often needed someone else's help. Therefore, I observed only a few of participants happened to own documents translated into a digital form. At the same time, however, the difficult process of translating physical document added an extra layer of attachment. I found each digitalized document was valued very much and contained a special fragment of memory in it.

5.3. Audio Recordings

Across all participants, I found that audio files emerged as the primary type of digital possession that they cherished and revisited. Participants frequently created and interacted with audio files to capture and revisit life moments. For example, **Ray** mentions that “the voice recording software [on smartphones]” enables him to “have the same luxury” of “[keeping] the memories alive” as a blind person. **Luis** noted that “audio recordings [for people with blindness] are like photographs for [people with sight]”, which “serves like a reminder” for memories as the recordings are played.

Many participants described a tradition of making audio recordings to capture significant memories well before the existence of smartphones and digital recorders. **Ray** described his practice of carrying a tape-recorder to capture memories over the years. Similarly, **Carol** showed her collection of analog cassette tapes that she had captured audio memories from her daily life and special occasions, such as a trip to Europe with choir members, from over a decade ago, which she still revisited to relive and reflect on past experiences. **Janet** also described her practice of re-listening to audio recordings; occasionally, she still “[takes] them out of the drawer and [listens]” to the recordings of her wedding from 45 years ago. Across these instances, participants exhibited unique personalized ways for keeping and organizing their tangible archives of audio recordings, typically through having key designated furniture or physical containers that were associated with particular times in their life (e.g., **Carol**), life events (e.g., **Janet**), or social relationships (e.g., **Ray**). As our study progressed, it became clear that there were two distinct types of memory-oriented audio that participants captured and revisited: *ambient* and *focused*.

Figure 5.3. Frank's digital recorder which can also play audiobooks (left); Carl's digital audio recorder (right)

5.3.1. Ambient Sound

Recordings of ambient sound were often used by participants to capture the emotional feeling and atmospheric timbre of an experience as a whole. For example, **Frank** described going on boat trips and making many recordings that capture a diversity of sounds on tour:

> When I went on a boat last Summer, I said I am recording this trip because it's like a sighted person taking pictures. I can replay this over and over and over just like a sighted person can look at a picture and say, "Oh yeah, I was there!" and get the feeling of it. (**Frank**)

Janet described a similar practice of recording ambient sounds on her travels. She revisited the past through "[ambient] sound, as opposed to visual things."

> I would do audio-recordings of some of the tours that we went on or I would talk about some of my thoughts. I do that when I travel to somewhere special. I have a recording of a boat cruise on the Thames. My son and I when we were in London and then you could hear the commentator talking and you could hear the boat. When my husband and I went on a boat trip to Gull Island in Newfoundland, you could hear the birds and the guide talking about things [in the recording]. It's sound as opposed to visual things. (**Janet**)

Ray owned a unique device for recording sounds. He had a "video glasses" that, when activated, it records video so that **Ray** was able to retrieve audio clips from the recorded video:

> These glasses I'm wearing right now is video glasses. All I have to do is to turn them on, then I can record everything that goes on. If I am fighting in a tournament, I can turn on my glasses, set it on the side,

> and keep the recording to myself so I can remember what happened during the tournament. (**Ray**)

Ambient sound recordings actively reconstructed memories of scenes, events, and experiences. Our participants noted that ambient sound recordings were more "multi-directional" and could trigger a diversity of memories and associations to emerge depending on the tonal qualities that they decided to focus on when listening to them.

5.3.2. Focused Sound

In addition to documenting the atmospheric qualities of a physical environment, participants also captured focused sounds to commemorate a close social relationship. **Meg** described the focused sounds she digitally captured of her beloved, now departed, guide dog snoring:

> I did make a few voice recordings for my last guide dog snoring. I keep listening to it when I miss her. I would say that's our alternative to pictures would be audio recordings. (**Meg**)

Similarly, **Janet** shared the powerful role that her now departed brother's voice played in triggering experiences of reminiscence and remembrance. In reflecting on listening to her brother's voice on a digital video she possessed, she said:

> Sometimes, [someone's voice] would trigger a memory. You know, we don't have photographs. We can't see photographs. My brother died in 2012 and not a long ago, my nephew put up some YouTube videos that actually has his voice. It was awesome. It really helped me remember him when I heard his voice. (**Janet**)

Carl shared his perspective in remembering memories through sound. He points out that the auditory process of evoking feelings is different in comparison to the visual, and that a voice plays an important role in the process for blind people. **Carl** described how his devices' screen reader's "synthesized" voice did not resonate well to elicit the associated memory. In contrast, he described how human voice, especially one's inner voice or a loved one's voice, can richly mediate reflective experiences.

However, across all participants, I observed that they did not have the same personalized strategies for archiving their cherished digital audio recordings as they did with their physical audio archives. Their valued digital recordings were typically distributed across online services (e.g., like **Janet's** reflection above), located on their

mobile phones in and across different recording or messaging applications, and, to a lesser extent, stored on personal computers or external hard drives. Despite being among the most valued resources for reminiscence, these digital possessions occupied a precarious place in our participants' lives—a common point of anxiety across due to not having a vision of how they would hold onto them for the long-term.

5.4. Visual Possessions and Social Media as Bearers of Metadata

Photos and videos offered more visually oriented forms of memories, and many of our participants made frequent use of these types of possessions. All participants owned at least one or more favorite photos or videos on their personal smartphones. Some of the collections they owned were recorded by them, and some were shared by others. Photos and videos were a meaningful collection in that they could be shared with most sighted peers. A key benefit of having photos and videos was the ability for them to more easily accumulate social or machine-produced metadata that, in turn, provided additional contextual details to support recollection of memories. Another benefit is that they provided forms of memories that were easily sharable with sighted loved ones. There were participants preferred a video format that is more dynamic and also is able to capture sound, but others preferred photography because videos would take up too much storage space.

5.4.1. Photography

One inspirational finding regarding photo was that a physical container, that encapsulates the content inside, acted as a tangible memento. Rather than what's shown (or could be touched), participants valued the "meaningful connections" represented by photographs. As **Meg** put it, "there is a story behind every photo". These types of possessions included a collection of printed photos, photo frames and photo albums.

While I observed some uses of self-reflection and private use of photographs, the use of photographs was much more frequently mentioned to form a close social relationship with others, especially with people with sight. **Jessie** pointed out the fact that having a collection of memories on the phone is a common practice for the most

sighted people. She said, “just because I can’t look at the picture doesn’t mean somebody else can’t”. **Jessie** liked how her family and close friends were able to describe her pictures to her, and how that led to interactions and conversations beyond the photos.

Janet kept many photos of close friends and her guide dogs, “even though [she] can’t see them”. **Janet** was thoughtfully considerate of family members and people with sight who visited her home. **Janet** put photos on the wall for others to enjoy as she also enjoyed the conversations coming out around the photos.

> People with vision, obviously, come and visit me. I asked a friend to put up the pictures in the places where they would complement the walls. You can't just have a totally non-visual house just because you don't see. Other people in your world see so they have to have something to enjoy as well.
>
> My husband has vision and my children, and my grandchildren have vision, so I do have photos around the walls. I don't remember what they are, to be honest, but I do have them around. To share with other people. (**Janet**)

Figure 5.4. Many participants enjoyed showing photos on the wall and describing memories associated with each photo to the interviewers

Echoing **Janet**, **Rob** emphasized that any photo is “a great conversation piece”. Most of the visual possessions that **Rob** owned had a special meaning for him. Rather than looking at them for reminder of memories, he concentrated on the fact that he left a record of something or somewhere important:

> I have some memorable pictures in our home. Picture of my mom and dad on there, 40th wedding anniversary. The picture of everywhere I lived goes somewhere in a prominent place. [My wife] and I have a nice picture of us done on a cruise ship. We've got pictures. I know what's in that and I know where it is in our home. They all have very prominent places. (**Rob**)

One of his treasures was a photo album that his mom made for all of his siblings that contains nostalgic photos from their childhood. Each photo acted as a gateway to the specific point in the past as **Rob** was able to recall relevant details and stories of almost all photos when described:

> At one point, after all the kids are gone and we are all raising families on our own, [my mom] sat down and went through her boxes and boxes and boxes of old pictures. She created an album for each of us. I have an album of all my pictures as a kid growing up, in the teenage years and then on into marriage and my kids. Each of us has that treasure. A photo album, even though I don't...
>
> I've seen all of the pictures that are here, most of the pictures that are in there, so somebody explains to me “Oh, that looks like you at about age 8” or if mom has a date on it, that'll take me back to those days. Those particular albums... those are a treasure. (**Rob**)

Luis reflected on a cherished photo from his trip to Thailand that was embedded in a handmade frame, which he often used as a conversation piece with friends:

> I rode the elephant and did all the river-wrap thing and hiking in Thailand. In the end of that, they offered that I could buy a photo! It was a 100 baht, which was about three dollars. I was, “Okay this would be cool to bring back to my friend”, but [the photo itself] was nothing. I didn’t care much about it, but my friends were like, “Oh **Luis**, there you are on an elephant!”
>
> For me, the bigger memory was the photo frame that it was handmade in the village. It has woven cloth and all around the edges were all the beads. So, for me, a photo frame was a much more significant memento or a keepsake than the actual photo inside. But for sighted people, that would just the consolation prize, but for me it was the [main event] and the photo was the consolation prize. I guess we have different ways of looking at it. (**Luis**)

In general, photos acted as important triggers of past significant life experiences as well as mechanisms for sharing memories with others. The enclosures photos were kept in often also held significance. For **Luis,** the handmade photo frame is the distinguishing feature of the picture. In this sense, the photo is only a proxy for the frame, which is the trigger for a “significant memento.” Here, the sensorial experiences evoked by the interwoven textures of the wood, cloth, and beads can be considered as a form of tangible, experiential metadata tying directly to the experience embodied through the photograph.

While photography and digital photography could be related to positively or seen as a valuable resource for people with blindness, it equally came with limitations. For example, some participants mentioned that the technology available for them today is not at the point where it fully includes people with blindness and support their needs. For example, **Jessie** thought rather than the level of achievement in relevant technologies regarding photography and accessibility, a more critical contributing factor to the limitation is the ***awareness*** of people who develop technology in reflecting on the perspectives from people with blindness:

> Everybody shares everything through pictures. It's frustrating when you can't see what a picture is. It makes me feel excluded, right? Instagram, Snapchat, I'm not on those platforms. I feel like I miss out. No one does it intentionally but that's the way it is because we haven't thought to the point where screen readers are able to process all [of those visual contents on social media, such as memes and screen captures with text].
>
> I am sure that we'll get there at some point. Just the technology isn't at that point yet, but I think it will get there. Right now, it's just a lot of waiting around and hoping. It's both the technology and awareness. I guess even the awareness of it more to some extent than technology because the technology could do such awesome things we have. (**Jessie**)

Jessie’s reflection makes it clear that there is still a large amount of room for improvement for technology in digital photography, assistive technology and accessibility. Along these lines, despite some limitations, participants inventively leveraged digital photos and encoded digital information into digital photos to create unique connections to photography.

Digital photography now captures a range of metadata when a photo is taken, such as timestamp, location data, and social tags representing people, to name a few.

Luis, like several other participants, mentioned that the metadata encoded in each digital photo could add additional layers of "clues" about and different perspectives on the experiences captured in cherished photos:

> When I was a kid, [photos] meant something that's boring. I don't have a single photo album but a few photos that I have taken with my friends are stored on my phone. On my phone, [photos] mean more because my phone tells me the date and time that were taken and where they were taken. … [When recollecting those experiences], I can discern a lot from just by the automatic [timestamp and geolocation] data that's captured. (**Luis**)

Overall, photos acted as a reminder of past memory or experience. Whether it is digital or physical, additional information (e.g. unique tactile container to physical photo and other metadata, such as time or location data for digital photos) could be attached to photo to make it even more meaningful reminder.

5.4.2. Videography

Video was another preferred resource for reminiscence due to its combination of visual and audio components. Participants had one or more videos saved on their personal device, often shared by others. For example, **Janet** had videos of her grandchildren that her son sent, which she enjoys by listening to them. Although participants rarely shot videos themselves, they all liked the fact that videos are not only for personal use, but also a great way to enjoy with sighted peers and family members. **Carol** described how the synchronized integration of moving images and audio created a valued way of supporting experiences of collective reflection with loved ones:

> I think the best way to have a meaningful thing for a blind person is a video. Because [a blind person] would hear the audio as well, as well as the pictures. You may hear the actual person's voice and see what they're doing. I do think that the live video thing is a very good way of bringing that together with a blind person. (**Carol**)

Despite videos are much larger in size than pictures, **Jessie** showed a strong preference for recording video to capture memories:

> My mom has some baby videos, those I love watching. It's always so much fun. Those are the memories I can't remember but for my parents, it's great and they would tell us about other things that happened. It's a great way of learning your own history.

> I think videos are honestly the coolest way of capturing. You get the sound and you get to see the movements. That's the most detailed way to record a memory. It takes a lot more space than pictures but if you really wanna record something right, I think that's the way to do it. (**Jessie**)

Rob also agreed that video was the most preferred way for him to archive memorable moments. He shared his personal story about making video of a family history of his parents. A videographer was hired to film interviews of family members from different generations, sharing memories of his parents. Not only interviews, but also every recording and pictures that his siblings owned was gathered to put together as a DVD. Going through the interviews and recordings evoked sentimental feelings and brought vivid recollections:

> For me, it would be story, would be sound or video. Not still, something dynamic and moving and described. My parents are married [for over 60 years]. Later on, we hired a videographer and we did a video of a family history of my parents. When they met and how they grew up and then all of us. We did an interview that was 4 of us [to do a video]; somebody from the older generation of the family, somebody from the middle, somebody from the young. There are all these different recollections depending on what year we were born and raised in.
>
> What we did too is that we put out the call to all of our relatives and said, "Look, if you guys have any recording from any of these family gatherings or singalongs, I need these". So, we got these VHS tapes, 8mm films and cassette recordings. All kinds of stuff and pictures from all these different events and the activities over the years. We pulled all that together and the video was in one DVD and then we put together a second DVD that has the whole bunch of these recordings and lots of pictures, categorized in different folders. Those recordings of my mom singing, her brothers and sisters used to harmonize beautifully. I do find that when I go back and listen to those, I'll be reaching for the Kleenex box. (**Rob**)

How participants interacted with videos may seem similar to how they interacted with audio, but what made the video much more desirable and valuable was being able to share the moment together with sighted peers.

> A part of what makes the [video-recorded] memory keepsakes great is not just to yourself, but you can share it with someone. Something I know that I would really love to share with someone, then I would keep it as a video format. (**Ray**)

Video had both advantages of photo and audio; participants listened to the sounds captured in videos and enjoyed the atmosphere while watching the motions with others.

5.4.3. Social Media

Making posts and sharing stories become a lot easier on social media via smartphone. In this trend, **social media** becomes an electronic version of journal where life stories are being archived. Participants widely reported using social media to capture, archive, share, and revisit cherished memories. Key features such as the digital screen reader and customized captions for annotating images for people living with visual impairment (which the screen reader can read) enabled social media to offer a valuable resource to support reminiscence on the past.

Combined with mobile technology, smartphone has yield “freedom” for our participants in many ways, including their experience of reminiscence in all stages of capturing, archiving and revisiting.

> A smartphone means freedom; a massive boost to independent for blind people. It means a much more portable way of recording memories, keeping them alive and sharing them. Not quite but almost in the equal playing field as our sighted co-workers. They can take pictures and we can record sounds on our phone. They can share on Facebook; we can share on Facebook too. A lot of things suddenly become a part of our social network. It is an important thing for freedom, independence and integration into society. (**Ray**)

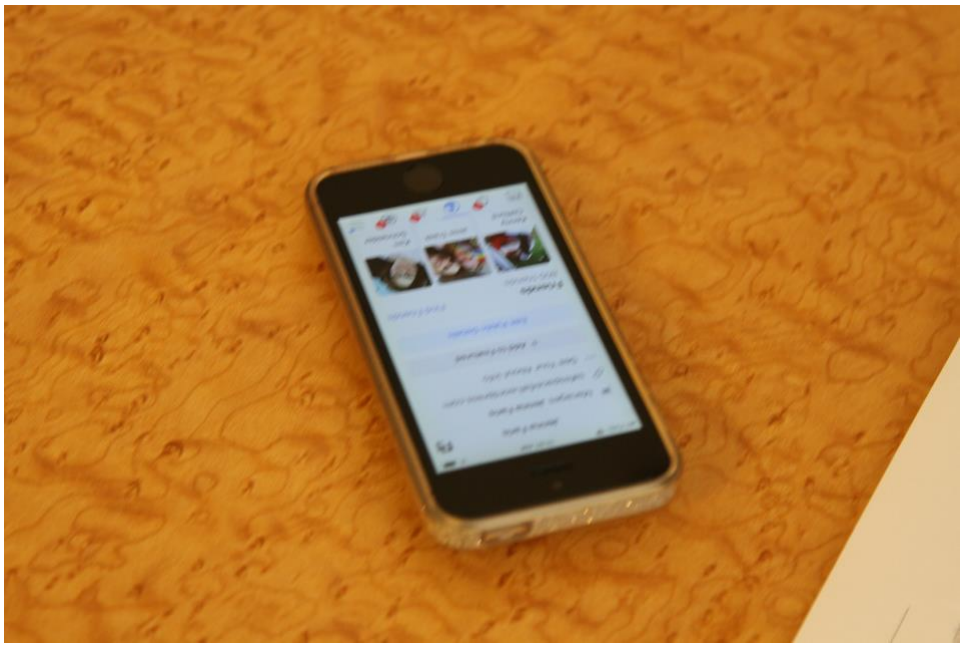

Figure 5.5. Participants frequently interacted with people around them online and were very active on social media

Meg, like many of other participants, described her practice of writing customized descriptions of photos that she shared on Facebook that were specifically tailored toward her friends that are living with blindness (and which required the use of a screen reader to access). In this way, posting digital photos to social media could act as a catalyst for mediating and capturing reflective, memory-oriented dialogue as social metadata accumulated:

> I take some [photos] and put them up on social media and photo-describe them. Interestingly on my Facebook, there is a cache of my memories I could go through if I wanted because I recently started describing these images that I put on. It helps my blind friends and also helps me in looking back. (**Meg**)

Participants also valued other qualities of social media, such as private groups and location check-ins, as these are adding further layers of metadata to audiovisual material. While traveling in Europe, **Rob** posted check-ins, notes, pictures and Wikipedia entries in a private group as he visited new places. Later, the group became a digital travelogue that **Rob** and his wife would revisit and reflect back on:

> We did a five-and-a-half-week tour through Europe last year. We did a 15-day riverboat cruise and then we did a 22-day bus tour. Before we left, we created a Facebook group; a secret and private Facebook group then we only invited close friends and family to be part of the group so that they could keep an eye on where we are, what we are doing.
>
> Whenever we were at somewhere interesting or a different place, I would go on Facebook and I would check-in and I would link to a Wikipedia or something that told us about the history of the place we are at. [My wife] who is sighted and very visual, would take pictures of our day of touring and whatever and then at the end of the day, she would upload pictures to that particular Facebook post that I had put in. Now, we can go back to that holiday, run through the Facebook group and have a look and re-read some of the experiences that we had. (**Rob**)

Similarly, **Luis** shared his experience of utilizing social media as a travel journal. Although he stopped writing any other diary or journal, **Luis** and his friend made a habit of archiving trips and sails on Instagram. He said he plan to maintain a shared "online blog" with his friend for future adventures.

From what I have observed, social media meant more than a mere personal page for participants. Social media provided a great communication channel to interact

with sighted loved ones and to share each other's memories. At the same time, it was a cherished shared and personal possession where memories are alive.

5.5. Emergent Tensions in using Possessions as Resources for Collocated Reminiscence

The use of visually-oriented possessions to mediate social, collocated experiences of reminiscence could also lead to tensions. Such tensions were rooted in the subtle differences in accustomed practices and patterns, regarding how memories were captured, archived and revisited, between participants and people with sight around them. Indeed, there were overlapping practices in reminiscing between our participants and people with sight around them, such as conversation-based recollection or enjoying videos together. However, when it came to communicate with the visual world, frictions between people with sight was inevitable. All participants reported that at some point, they felt emotionally distant when revisiting memories with others with sight, especially for the family gathering, where many past memories were shared through photo albums:

> I remember a lot of my siblings would go through photo albums. Every time they turn a page they would like "Oh~" and have some reactions but I'm like, "please, this is so annoying". Because they would describe, but there is always a few seconds delay, then the moment is already over. (**Meg**)

> [Photo albums] make me sad because a lot of people have memories of just sitting and looking through photo albums. But that's the thing that I can't do. I've sat down with my mom before, flip through photo albums but I always feel a little left out. I can't enjoy all those pictures. A picture frame is different because it's just one thing, but these are so many. I feel like I am missing out on all these pictures. (**Jessie**)

Figure 5.6. Photo albums often created tensions between participants and sighted loved ones in sharing memories

Not being able to fully participate in using photos to collectively reminisce produced feelings of frustration and anxiety for **Janet**:

> I've often thought that I am the worst person in the family because everybody else has pictures of everything and I don't have many pictures of anything. Even if I had them, I wouldn't know where to find them. So, if my sister dies tomorrow, I wouldn't be able to put together a collage of pictures about her. I do sometimes regret that. (**Janet**)

Conversely, common patterns of reminiscing for participants often did not resonate well with sighted loved ones, such as revisiting memories solely through audio recordings. For our participants, audio recordings were deeply immersive and evocative resources for reminiscence. Yet, it could be challenging for sighted loved ones to engage with these materials because of a general lack of experience or familiarity with using only audio to recollect past experiences.

Participants reported that issues with sighted loved ones commonly involved the pacing of interaction. With audio, it was necessary to listen closely and absorb segments of the recording first to establish a context for collective reminiscence, and then engage in dialogue with others that are collocated. This could lead to a sense of discomfort if the collective reminiscence process was introduced awkwardly or if loved ones began talking before the recording had finished playing. These tensions contrasted loved one's experiences with visually-oriented possessions, like photo albums, where they could comfortably view and discuss photos as they emerged, despite our participants often feeling unincluded in this process.

For example, when I asked whether **Frank** shared audio recordings of boat trips and engine sounds with his sighted wife **Susan**, he mentioned that **Susan**'s experience in listening to **Frank**'s recordings was quite different from that of **Frank**'s. As a result, **Frank** had to accept the difference in remembering memories:

> I've never thought [about sharing audio recordings] with **Susan**. She has heard some of the boat sounds, but it doesn't mean much to her. But that's fine! It's my thing, really. (**Frank**)

It became obvious, as I continued interviewing more participants, that people with blindness were prone to enjoy audio recordings more than people with sight. When **Janet** got asked a similar question of whether she tried sharing her cassette tape collections with others, she said:

> Yes, actually, it was fun because people normally really enjoy them. But an interesting thing is that blind people would enjoy it more than sighted people do because not everybody is used to be listening to stuff. But my blind friends would enjoy them. (**Janet**)

Participants and people around them put a lot of effort, paid careful attentions and constantly sought for better ways to communicate. Undergoing a lot of trial and error, participants developed their own practices to enjoy sharing memories and got used to it.

> It's basically a lot of self-advocating and letting others know what you need and working with them to find the ways of doing the same things as anyone else. (**Meg**)

Overall, despite such tensions, participants were very positive and joyful about sharing memories with others as they constantly put efforts to learn, adapt, and interact closely with others to enrich a collaborative experience in reminiscing.

Collectively, findings in this section highlight how participants drew on physical and digital possessions to capture, archive, share and revisit significant memories. They point to a diversity of ways that audio recordings, both physical and digital, could trigger evocative recollections of the past. They also show how digital photos and videos can catalyse social experiences of reminiscence; and, that their situation within social media opened up asynchronous ways for accumulating reflective accounts of valued life experiences. Yet, tensions could also emerge from a diminished sense of inclusion with visually-oriented collections for our participants and a lack of familiarity with audio-oriented content for other sighted loved ones.

Chapter 6.

Towards Future Practices of Reminiscence

I also probed with participants about their future expectations and desires for how design interventions might better support their practices of reminiscence and reflection. Participants had a desire to relieve the tension and improve inconveniences in their experience of reminiscence. I focused on possible augmentations and improvements based on their past and present experiences. In this section, I report participants' thoughts and responses on how each of the following category could be further developed to benefit their experiences of reminiscence.

6.1. Values in AI Image Description

The development of image recognition technology has been able to create connections to photo. These kinds of technology, such as image-describing AI and automatic captions, enabled people with blindness to be more independent in enjoying photos. In earlier sections, I have reported on the value and richness that participants attributed to loved one's verbal descriptions of places and life event. These actions provided participants with vivid details of a significant memory, as well as opportunity to establish an emotional connection with the person that conveyed the description. While it was not expected to be the 'same', participants reported having high expectations for recent image-describing AI applications or features. Indeed, there were several positive reflections on how AI image description could provide generate metadata that offered contextual details that made participants' overall connection to a photo more significant, such as in **Ray's** case:

> Knowing the color for me is important but it is more academic than emotional. For example, is it emotionally important to know that my mom dyed her hair red? No, not really. But knowing that would allow me to have a deeper connection with her image so that I know that my mom has red hair now. (**Ray**)

Other participants that were blind from birth described relying much less on AI image-description to 'fill in the gaps' when engaging with a digital image, and even noted complications that could arise when AI feedback was unclear and difficult to interpret.

Participants said the descriptions they get merely read or guessed visible attributes in a plain language. Therefore, it was not able to make a strong emotional connection to their memories and past experiences:

> I don't like it. It doesn't give me enough detail. It's very vague. "A woman in brown hair standing outdoors". It's very tedious but I still use [an image-describing AI]. (**Jessie**)

> There are apps that would describe photos to me. Those, I wish they can be improved because the descriptions are very brief, they don't really mean much. (**Ray**)

> But at least it gives you some idea. "A picture of person, nature, sky and outdoor". That's the kind of description that you get but at least you have some sense of what it might be. (**Janet**)

One of the expectations was a description given by AI to be more personalized and customized. For example, **Ray** mentioned how he wanted a feature or an AI that gives real-time descriptions on videos.

> If a lot of videos I take can be described to me, and those descriptions could be recorded as a part of the video, then that would definitely be the first preferred mode of memory. (**Ray**)

Overall, despite current limitations on the image-describing AI, participants were hopeful that a breakthrough in technology has been very promising. Having access to get descriptions at any time without asking for other's help was definitely a great boost to an independent lifestyle for our participants. As **Rob** said:

> The accessibility of [visual assistances in taking picture] and the artificial intelligence [that recognizes objects] is coming along so nicely. I am really excited about the upcoming technology in [image-describing AI]. It's going to allow us to more with pictures. (**Rob**)

They believed that technology will surely improve the quality to meet their expectations.

6.2. Inclusion and Experiences with Tangible Aesthetics

As technology deeply blends into everyday experience for people with blindness, many physical possessions have replaced to a digital version without a tangible form. Yet, participants valued **tangible aesthetics**, such as physical shape, tangibility, aesthetics and interactions with possessions.

Ray said touching and feeling at his fingertips would leave a much stronger impression than any other senses. The best way for **Ray** to remember things was through “textures and shapes” that he used to craft art pieces to remember special experiences. He preferred to have a “unique and special” form that would “enhance the experience”. **Ray** further explained that “unique and special” did not necessarily mean to have fancy engravings with rare materials:

> I like boxes. I have a music box in my room that brings a very strong memory of my mom. A box like this keeps whatever you need to keep, whatever a little trinket of memories safe. Boxes come in so many different shapes and forms. They are easy to remember. You will not find a box in this house that I don't know what's inside just by feeling the box. I don't even have to open it. (**Ray**)

Figure 6.1. Ray's artworks that resemble superheroes

Echoing **Ray**, **Frank** and **Jessie** had a very similar thought that he remembered though tactile feedback, much more than listening:

> I don’t mind listing to audio books and stuff. But if I really wanna remember something, I'll read it with my fingers. Because like you people reading something with your eyes and goes into your mind, this is the same with me. If a screen reader reads the word 'love', oh well…

> But when you read it with your fingers, it's like you read it with your eyes. You get the feeling. (**Frank**)

> I'd like to have physical objects that will trigger memories, rather than recordings that I would listen to. I like physical things like mementos that something I can pick up and feel. It doesn't need any explanation. I don't have to have something describe it to me. I already know what it is. (**Jessie**)

During these conversations, participants also frequently brought up the concept of tactile photography, which is a technique for adapting photography by adding tactile attributes that can be tangibly 'read' by people with blindness. Several participants were highly interested in having more opportunities to create, share, and engage with tactile photography to revisit significant memories. **Ray** said:

> I would like the ability for [photos] to feel. I don't want just to feel photos like a smooth piece of glass. I want to feel a 3D imprint of what's actually there. Something like a 3D representation of photo, something that has a texture.
>
> I remember when I was growing up, my brothers and I used to collect hockey cards, like trading cards of comic book characters. Eventually, I started to grow a small collection of my own because some of these cards are printed so that you can actually feel the design of a character, which almost like in 3D. Some calendars have a 3D element to them. I could feel the figures and design of the calendar.
>
> That is also what I would like to see done with photographs. Eventually, if there is a technology, if I take a photo to, say London Drugs, to get it developed with tactile. (**Ray**)

However, most participants had been largely unable to use tactile photography due to it having been costly to produce as each were one-of-a-kind hand-crafted pieces. Participants also noted that learning to 'read' tactile photography is a practice that requires time and attention. **Ray** described how learning to translate and then read three dimensional surfaces, shapes, and textures that were previously captured in a two-dimensional photograph is an iterative process that requires ongoing practice:

> I learned to draw in tactile when I was a teenager. In the beginning, my biggest problem was, I know what Batman feels like as an action figure, but I had no idea what a Batman should feel like on paper. If you show me a drawing of Batman, even if in 3D, I would have no idea what it is supposed to be Batman.
>
> It's a thing that blind individuals themselves actually have to get used to translating into their brains. It's something that requires us to put in

> the hard work to memorize what things feel in the real-life and how they translate so when we feel a face on paper, yes, it may be a bunch of dots and lines but in our head, it has to translate into an image.
>
> That will take us learning initially that if someone shows me a photo of my mom, then I would ask for more photos of my mom to know what it's supposed to feel like at my fingertip, so eventually, as soon as I feel it, I can recognize it. (**Ray**)

Interestingly, **Janet** had prior experience teaching children living with blindness to learn to read tactile photography from various stock photos that represented both abstract and real situations. She experienced that children who constantly practiced and exposed to tactile pictures were better at it.

> Most photos have so much detail that tactile pictures aren't practical. There are printed braille books that have tactile in them. The Education Assistants (EAs) would often make tactile diagrams and let the child know what it is. If it is a mouse where the head is, or the tail is... Some kids are better at it than I am because they've been exposed to tactile pictures that are flat. (**Janet**)

She noted that a key challenge is that while people living with blindness benefit from tactile photographs, they are also typically highly separated from the selection and production of them. **Janet** speculated that having more control over the creation of tactile photographs in terms of the tactile qualities and the content captured on the photographs could be productive in people living with blindness overcoming the learning curve. She expressed how this could open new possibilities for creating rich resources that leverage the level of detail captured in a single photo with the sensitive tactile capabilities that people living with blindness often possess.

In light of the historical challenges related to the production of tactile photographs and lack of inclusion in the design process, **Ray** actively envisioned new possibilities for 3D printing technology to be extended to people living with blindness to experiment with creating their own tactile photographs. In particular, he remarked on the potential that additive fabrication techniques offer in terms of creating custom shapes with a variety of textures, materials, and weights:

> Nowadays, a lot of people have the ability to make an object using a 3D printer. That technology is not available to the blind so far. I think that is one thing that I would love to see become accessible because then I can actually make physical memories, I can make physical things that would remind myself of things; statues of different designs or in

> different textures. Then, I can make my own storage [for memories]. (**Ray**)

As a person living with blindness, he also emphasized an importance of being more accessible to technologies that help understand visual concepts. This way, people with blindness would communicate much comfortably with the sighted world.

> I think because we live in a sighted world, the more we can understand about sight, the more we can understand our fellow human being. I think it's a two-way street. More people understand about blind people, the more they will feel comfortable with us as well. (**Ray**)

6.3. Leaving Behind – Crafting Legacy to Pass Down

We all leave footprints as we journey through our lives. Some participants reflected on their wish to leave traces of love and kindness in someone else's life. They hoped that others will be able to remember them through cherishing their possessions that will be left behind.

> I did an interesting exercise in a personal development workshop that we did some years ago. What is it that I want my life to have been about? I can't remember all the details of it, but I want to have made a difference to somebody, somewhere along the way. That was really the big, strong story that came out from me. No matter what I do, no matter where I go, I want to have been able to make a difference, have been appreciated. (**Rob**)

These conversations also led to an early and consistent theme that captures both desires and uncertainties around how our participants would craft a legacy of their life history and they would be remembered in the future. For example, **Janet** wished to live a life that can make a difference and positively influence others and hoped she would be remembered for her efforts:

> I like people to be able to remember what I did to make the world to be a better place. Somehow, those memories need to be preserved for that reason, and you know, just to help people understand what it was like at the time when I was alive compare to how different it is when they are alive.
>
> Somebody gave me a little sort of trunk and said, "you can put stuff in since your retirement". If I have gone travelling or something, then I journaled a little bit about it. I'll print it out and put it in that little box so that other people can read it when I'm not around. You know, if I'm

> gone, they'll have something to help remember the things that I did. (**Janet**)

However, as our dialogue with **Janet** continued, it became clear she was ambivalent over how her digital legacy would actually be captured and passed down. Like most of our participants, **Janet**'s archive of significant digital materials included a mixture of audio recordings, written text, photos, and videos. **Janet**, like all of our participants, remained hopeful that her digital legacy could be made into some form of a cohesive archive for others to remember her by. **Janet**'s story offers a salient insight into the added challenges that people living with blindness face when capturing and revisiting their own memories, and in creating resources for loved ones to remember them in the future. Findings in this section also highlight the willingness of our participants to engage with new technology to support their practices of capturing and looking back on the past, even when such technologies do not fully succeed.

Chapter 7.

Discussion

While there is a growing amount of HCI research on improving technology to better support experiences of reminiscence, people with disabilities have largely been overlooked; and, as a consequence, little is known about the practices and experiences of people living with blindness. A key contribution of our study is to provide a richer understanding of how people living with blindness capture, share, recollect and reminisce on past life experiences in light of their needs and desires. Findings revealed that sensorial impressions evoked from touch, smell, and sound could be powerful triggers for reminiscence. Participants mobilized various kinds of digital possessions—and, at times, their attendant metadata—as rich resources to extend their individual and social practices of reminiscence. However, these experiences were not always tension free. Various instances emerged where digital or physical possessions could disrupt reminiscence experiences for participants or for their loved ones. Next, I describe a set of design possibilities that build on themes in the findings and extend them through a generative perspective. Importantly, the aim is not to suggest that these are the 'only' opportunities for future research. Rather, they begin to give shape to a design space that future HCI research and practice initiatives can explore in the service of positively shaping the reminiscence practices of people living with blindness.

7.1. Remembering through Sound

Findings showed that participants desired to capture, revisit, and share audio that captured specific qualities of experience, and that these kinds of recordings were among participants' most cherished possessions. It was also clear that currently there is no straightforward way for participants to easily keep, explore and interact across their personal archives of digital audio recordings in a cohesive way.

Early findings and discussions for this section was presented and published at the 2020 Designing Interactive Systems (DIS) Conference [139].

7.1.1. Pairing Ambient Recordings with Additional Metadata for Individual Reminiscence

There is an opportunity to explore how digital repositories could be designed that would enable people with blindness to better safeguard these cherished possessions and, in doing so, open up new resources for supporting individual reminiscence. Revisiting sound recordings could trigger a range of reflections as participants reconstructed memories from a loved one's voice, the trail of background noise, vocal murmurs, or the tonal timbre of a recorded environment. Here, a cohesive digital repository could make it possible to combine recordings with other forms of metadata to create more socially- and environmentally-oriented ways of storing and interacting with personal audio.

These initiatives could enable new ways of capturing, organizing, and retrieving audio recordings as well as the ability to surface and explore potentially intriguing forgotten or yet unknown themes and patterns in snippets of recordings across the archive (e.g., by location, people's voices that were socially present, or particular atmospheric timbre, all of which encompassing qualities that were valuable to participants). These efforts could also contribute to higher-level calls in the design and HCI communities to diversifying the populations that we engage to understand and design the digital domestic soundscape [29, 30, 99, 103]. Following the possibilities outlined above, a personal soundscape could be augmented by attaching different types of metadata. Building on prior work showing the value of geolocative reminiscence (e.g., [31, 76, 107]), location history data could be integrated with audio to allow people to explore ambient sound recordings based on their geographical location. For example, re-combining and blending sound recordings that were captured around the same geographical area, across different times in the life of a person living with blindness could be one possible direction. Additionally, building on prior research proposing interactive sonic jewellery [85], future research could explore how sound archives of focused voices or ambient soundscapes alike could be embedded in a handheld ornaments or objects to explore what kinds of tangible interaction qualities are preferred by people with blindness when living with hybrid physical-digital possessions.

Collectively, these proposals represent a diversity of design proposals that could be explored individually or through varied combinations. They offer a set of generative

possibilities that can be used to frame future participatory research initiatives with people with blindness to probe on their potential value and how new co-envisioned concepts could be refined and be attuned to each participants' unique practices of engaging with memory-oriented audio recordings. Future work in this area offers promise to extend the pre-existing rich individual practices of audio-based reminiscence that we observed, while opening new opportunities for rich interaction and for better safeguarding these cherished archives.

7.1.2. Exploring the Potential of Asynchronous Audio Sharing Systems to Mitigate Tensions

While participants were highly adept at revisiting audio to personally recollect cherished memories, engaging in these practices in a social setting with sighted loved ones was not as easy and tensions frequently emerged. Participants could deeply connect with longer-form audio recordings in rich and evocative ways, while their sighted loved ones struggled to appreciate their nuances and maintain attention. This finding connects with Dib et al. [29] and Oleksik et al.'s [99] earlier research on sonic mementos, where family members desired to distill meaningful clips from longer recordings as brief catalysts to trigger event-based social reminiscence. Yet, these studies were conducted with sighted family members and our participants faced additional challenges that stemmed from their attachment to a more diverse set of audio recordings (e.g., atmospheric, vocal murmurs) that could feel unfamiliar to sighted loved ones.

I believe there is an opportunity to explore how sighted and blind loved ones might develop a stronger sensibility for collectively engaging with memory-oriented audio recordings. Recent work [54, 61, 69, 98] has revealed the value of asynchronous audio-based storytelling to support intimacy and reinforce close-tie relationships. A similar strategy could be extended to enable the capture and asynchronous sharing of memory-oriented audio snippets groups of sighted and blind loved ones. This direction could probe on the potential value in enabling the person recording memory-oriented audio snippets to also record, attribute, and layer annotations as a form of audio metadata to memory snippets. This could provide the necessary space to guide the listener(s) on what to listen to within a recording and their significance; and, in turn, nurture other loved

ones in cultivating their own sensibility for engaging with audio-based reminiscence and attributing their own audio annotations in response.

Over time, a system like this may encourage sighted loved ones to begin capturing, annotating, and sharing their own recordings, potentially leading to the emergence of a shared archive of audio memories. This asynchronous approach could enable sighted people to learn how to produce and exchange ‘audio postcards’ with their blind loved ones, while supporting and respecting each other’s individual pace. Future research exploring these possibilities would clearly need to be handled carefully and collaboratively. An iterative participatory design process as well as the resulting final design could collectively lead to a heightened understanding for sighted loved ones of how their blind family members or friends are sensorially-oriented to sound in the environments they inhabit and the significance it holds for their practices of recollecting the past.

7.2. Remembering through Collaboratively Annotating and Retrieving Photographs and Mixed-Media

Findings also build on recent work that dispels a misconception that people living with blindness are not interested in or engage with digital photos and visually-oriented dynamic media [7]. Although the participant pool for my research was diverse in terms of life stages and personal backgrounds, all reported that photo-centric media played significant roles on individual and social levels. Clear tensions also emerged from a lack of inclusion in collocated, photo-oriented practices of reminiscence.

7.2.1. Supporting Collocated Remembering

Prior HCI research has shown the value of pairing descriptive audio with photographs [43, 73] to create more evocative media assemblages. In parallel, there is a growing body of research showing that slowing down interaction with photos and with audio can be productive in creating time for re-visitation of the past and social interaction [42, 54, 89, 92, 97, 105, 124, 125]. In efforts to alleviate the tensions noted above, future research could bring together these strands of work to explore how new digital audio-photographic applications could be collectively envisioned that emphasize the social contemplation and discussion of photos in through a slower interaction pacing.

For example, an application or tangible device could present a digital photo of a significant life event and then prompt one (or several) family members to verbally describe the image and their memories bound up in it. This design possibility could lead to a more inclusive pathway for engaging family members living with blindness and inviting them to contribute their own narratives. This approach would support many of our participants' attachments to mixed forms of media (e.g., **Rob's** DVD archive of shared life events) as well as the highly valued practice of mentally reconstructing memories through the verbal description of loved ones. Building on the earlier opportunity of a memory-oriented audio archive, other audio snippets from within temporal proximity to a photo's timestamp, for example, could be surfaced and explored as these open-ended social sessions unfolded. Indeed, the audio recordings from these collocated interactions themselves could also be captured and archived within shared memory-oriented *audio-photographic* [43] archives over time.

This part of the design space could be further explored through initiatives that probe into the potential for different interaction design strategies to generate new kinds of resources for collocated reminiscence. For example, the FM.Radio project [103] demonstrated that parsing audio-based memories into different categories (e.g., time, voices, favorites) paired with tangible interactions for moving in and across recordings was highly productive in supporting familial reminiscence. More recently, the Olo Radio project [90, 94] has shown the value in interconnecting memory-oriented data with different temporal modalities as novel resources for supporting both serendipitous and planned experiences of reminiscence. Future research can investigate the desirability of these design qualities directly in participation with people living with blindness and their loved ones. This could lead to unique sets of preferred audio-photographic classifications and interaction design strategies that can applied and refined in the co-design of future interactive systems for collective reminiscence.

7.3. Remembering through Unique Tangible Experiential Metadata

Advances in additive and subtractive manufacturing (e.g., 3D printing, Computer Numerical Control (CNC) milling) are beginning to make the production of custom objects more accessible and flexible. This offers the potential to support people with

blindness through creating their own unique memory collections. Physical features of cherished possessions were found to be a key catalyst for participants to recollect memories. In some instances, a unique photo frame, and not the photo itself, was a significant memento. In other cases, tactile photos offered an evocative, yet under-realized resources for reflection. Across all instances, it was clear that texture, shape, material and weight came together as qualities that evoked past life experiences that participants associated with cherished tangible objects. Building off of these accounts, there is an opportunity for future research to explore the role (and limits) of tactile objects in making connections to memories in twofold; 1) translating visual memories in 2D to 3D, and 2) creating and enhancing a physical representation of memory with tangible metadata.

7.3.1. Translating Visual Memories to Tactile Photos

Tactile photos could act as a resource for connecting people living with blindness with photography in supporting reminiscence. Recent research in digital fabrication around the advent of new manufacturing techniques has enabled tactile photos to be much more accessible at high fidelity and lower cost [77, 84, 86]. On a social and collective level, systems could be designed that offer translations of significant visual photos into tactile photos. Such systems could open the possibility for both blind and sighted loved ones to create and share tactile photos.

Indeed, this area would need to be approached with caution. Currently, learning to read tactile photos is not an easy process and requires considerable training and practice. Nonetheless, as **Janet** and **Ray** reflected, if people with blindness are trained to read images through tactile information, a new opportunity for reminiscence could be explored by designing special images with unique patterns and depths on the surface of an object. Future research can combine recent technical innovation that has made tactile photos more accessible with new participatory efforts that better include people with blindness in exploring, questioning, and envisioning the role that increased access to tactile photos might play within their practices of reminiscence and their everyday lives more generally.

7.3.2. Crafting Physical Representation of Memories

Computer-Aided Design (CAD) software used in conjunction with additive and subtractive manufacturing provides people with substantial flexibility in reproducing, copying, resizing, modifying and sharing objects with a range of textures and dimensions. This generates new design possibilities for enable people with blindness to make and share their own personalized bespoke memory-oriented objects that come in different shapes, textures and weights [80, 86, 102]. While 3D modeling software is becoming increasingly accessible to novice end users, creating precise 3D forms is still not an easy task and consists of highly visual software [117]. One direction that could help alleviate some of these barriers is through leveraging existing communities, such as See3D [121], which actively brings together sighted people and people with blindness to collaboratively design, make, manufacture, and share 3D printed objects. However, translating conceptual ideas into a three-dimensional model itself comes with inherent contingencies; and, this complexity is compounded by digital fabrication processes that have narrow tolerances and are prone to material failure. Such initiatives would likely not work ‘perfectly’ or be ‘error-free’ at their inception.

However, there may be new possibilities in these challenges. Recent work has shown that frictions emerging in translating personally meaningful experiences into physical form through such digital fabrication itself can be an important meaning-making process [28, 41, 86]. This iterative, collaborative practice offers the potential to valuably connect participatory digital fabrication with the creation of unique memory-oriented reminiscence objects as an ongoing situated social process. Through direct involvement in the design process, this opens an opportunity for people living with blindness to create other forms of digitally fabricated mementos and memory objects [13, 86, 87, 113]. Likewise, this is a broader opportunity for inclusion, taking the form of either online communities or in-person maker spaces, where people with disabilities and people with sight can mingle and benefit from the unique capabilities and perspectives of each other.

7.4. Methodological and Ethical Concerns

In this section, I share questions and emergent dilemmas that I have faced and discussed throughout the research process in engaging people living with blindness. The

goal of this short section is to reflect on the concerns and dilemmas when conducting research with different and potentially marginalized or sensitive populations. I am reporting questions surfaced throughout multiple stages in my master's program. These questions first emerged from my personal experiences in conducting this research. Secondly, through ongoing discussions among my committee members who motivated me to co-author a workshop paper for the Research through Design (RtD) workshop at the 2020 Designing Interactive Systems (DIS) conference [138]. Lastly, through discussion and reflection among the broader community of design researchers at the RtD workshop. Through a synthesis of these insights and experiences, I present the following three areas; participation, ownership and equitable conclusions. Because these questions are developed through engaging with many other researchers, I use the first-person plural pronoun, *we*. Also, these questions could be also applied to other sensitive populations, I use the term *people with disabilities*, rather than limiting the domain only to people with blindness.

7.4.1. Participation

Many design techniques and methods are used to encourage engagement from end user population via design-oriented approaches (e.g., Cultural Probes [45], Speculative Enactments [33], Experience Prototyping [15], Participatory Design [81]). Some researchers have created a novel approach to evaluate experiences of interacting with technology for autistic children [118]. Yet, it is not clear that how we should best adapt these techniques for to engage with different abled populations in ways that are sensitive, appropriate, and generative. As design researchers, how do we design appropriate settings, activities and questions? How do we effectively reach the right level of 'appropriateness' for a given person or population in this context? Is it possible to adopt protocols, designed for other target groups with different kinds of communities for people with disabilities? In our view, these questions lead to the larger question of design research that intends to encourage participation of and with different abled people.

7.4.2. Ownership

Recognizing and appreciating participants is also an important part of the research process. Yet, published academic work is often intended for an academic audience and is not well setup to be directly translatable to research participants. Additionally, some participants may find the academic findings and publications are challenging to access. In order to achieve a broader distribution and impact, what are appropriate approaches to adopt in the research process to ensure that research participants with disabilities receive some form of direct value or benefit for their participation? What is a proper way of *giving it back* to the participants?

7.4.3. Equitable Conclusions

To date, there is limited work in the HCI community has conducted longer-term field research to uncover and design for experiences and desires for people with disabilities through process. If a research prototype has offered a notable difference in participants' everyday lives or in their experience in a specific context, how do we equitably conclude the project when it inevitably comes to an end? How would or should deployed research prototypes be collected back? Removing a design artifact from participants lives may lead negative experiences or consequences. Prototypes and products created through the research process are uniquely designed for participants and rarely have a replacement that would offer a similar experience. Alternatively, if participants end up keeping a design artifact, how should ongoing maintenance be handled during and long after the deployment field study?

Lastly, we discussed on the potential impact of research in this context. Disability is not a characteristic that uniquely defines a participant group or a single research participant. Research participants' backgrounds, personal experiences, challenges and desires are not the same. Considering this matter, would outcomes from field study artifacts be scalable and generalizable?

It is my desire to discuss one or several of these topics and to explore potential intersections across research interests and experiences of fellow researchers as I proceed to next steps in my research. Certainly, these concerns are hard to answer. Yet, I believe that discussion would enable the community of practitioners to explore ethical

and methodological issues that are and will continue to be of growing concern in the fields of HCI and design.

Chapter 8.

Conclusion

In this thesis, I have explored how people living with blindness engage in practices of individual and collective reminiscence on the past. A key goal of the study is to better understand our participants' experiences in order to establish an informed foundation for critically considering how technologies can be designed to support people living with blindness based on their own practices, needs and desires. Findings revealed novel ways that participants drew on their sensorial capabilities, their possessions, and other people's verbal translations of memorable experiences as rich resources for reminiscence. Several tensions also emerged that complicated reminiscence practices for both blind and sighted loved ones. Based on these findings, I proposed several opportunities for future research to inquire into how technology to better support people with blindness in capturing, sharing, and reminiscing on significant memories bound up in their past.

8.1. Limitations

As an exploratory study towards a nascent topic of experiences of reminiscence for people with blindness there are limitations in my thesis. In this section, I identify limitations in two-folds: methodological limitation and limitations on the design approach.

8.1.1. Methodological Limitation

First of all, methodologically, a field study approach of maximum 120-minute interview would not surface participants' complex, nuanced and situated personal experiences and practices. As an alternative approach, ethnography could have been possible. Ethnography is designed to understand and interpret a shared patterns of values, behaviors, beliefs and languages within a specific "culture-sharing" group [26]. However, as Creswell noted, time spent to collect data is extensive, as a researcher becomes an observer that would be immersed in the daily lives of the group of people, while continuously interviewing them. For a master's level thesis project, I was unable to

devote a prolonged time for ethnographic approach. Ethnography could have also been helpful by building trustful relationship with participants over time that may have drawn a deeper conversation of their experience. While conducting an interview, I tried to build trust through not only receiving ongoing consent to respect confidentiality and privacy when collecting data (e.g. audio recordings, pictures and video clips), but also designing interview questions carefully to form a comfortable and suitable atmosphere for participants to share their personal stories, which leads to the second limitation.

Another limitation of the study is the how the study was designed. Although I was paying a close attention to the wording, subtle nuances and the atmosphere, created by the set of interview questions and elicitation activities are presented, there was no strong evidence or proof that these questions and activities were effective to draw in-depth dialogues with participants. Also, the sample size of less than 10 individuals does not represent the experiences of the blind community as a whole. Blindness is not an outstanding trait that could categorize people in the same group. Within the blind community, there exists a wide range of diversity, including but not limited to gender, age, socio-economic status and race. Therefore, generalizing the results of this study to a broader blind population is not ideal.

8.1.2. Researcher Bias and Design Limitations

An inevitable bias due to my own positionality is present in the study, especially in the design opportunities suggested in the discussion. Earlier in the thesis, I emphasized the importance of including participants in the design process. Although these design directions are not final, I, as a researcher, took the initiative in developing design ideas based on the findings. I have never been blind nor have a close family member or a friend who is congenitally blind or acquired blindness later in life. Despite I read lots of literature, watched interviews, listened to podcasts hosted by people with blindness, it was not sufficient to fully understand the perspective of people with blindness. Much better inclusion could have done to schedule follow-up interviews to discuss about the result of the findings or proposed design ideas with participants.

Design intervention is not always a good approach in supporting the existing practices for participants. Of course, there are promising, yet under-explored domains that new design interventions could work well, such as sound (section 5.3), touch

(section 5.1) and digital possessions (section 5.3 and 5.4). However, I acknowledge that a few themes among our findings are better in its current state. Largely, there are two reasons. First, some key components, such as smell (section 4.1.), atmospheric timbre (section 4.2.) or emotions (section 4.5), are very challenging to be captured and stored. Replicating these components for re-experiencing is nearly impossible since the current technology is not capable of "saving" or "loading" such qualities. Even if we do have the ability to do so, a number of ethical issues, that need to be carefully discussed over time, may arise. Next, some participants did not want to accept new intervention for their existing practices. In section 4.5, **Meg** and **Jessie** did not put a lot of effort in recording their memories. Although they did have a device to make memories with a few taps, they preferred to "live in the moment" while accepting the forgetfulness, which is a natural characteristic as human. As a design researcher who aims to "support" and "enrich" experience for participants, who am I to suggest new interventions for areas that they already enjoy, and accept as a human nature?

8.2. Contributions and Future Directions

There are two major contributions from my thesis:

1. Offer a rich, in-depth understanding of situated practices, cherished artifacts, social interactions, as well as perceived challenges and desires related to the experiences of reminiscence of people living with blindness.

2. Synthesize and interpret our study findings to offer a set of starting points for future design initiatives aimed at creating resources that better support people living with blindness in capturing, sharing, and reflecting on significant memories from the past.

For next steps in my research, I see each of the areas of possible design direction as generative opportunities to directly engage people living with blindness in co-design activities to further develop design interventions and to question what kind of futures are desirable (and undesirable). I aim to work collaboratively with participants to evaluate research prototypes that will be developed as a result of co-design activities. Next, using design ethnography [25], I will conduct evaluative field studies of the prototypes that are produced from the three opportunity areas. I will carefully recruit a

small subset of diverse blind individuals, considering age, gender and culture, to aim for a rich, descriptive understanding of insights. In previous literature, design ethnography has revealed interesting insights and inspirations as people live with a particular artifact over time [91, 93, 108]. Following prior research on field deployment studies [94], field studies are estimated to be conducted for 3-6 months. Monthly semi-structured interviews and final in-depth interviews will be conducted to explore participants' perceptions and experiences of living with the prototype. Collected data will be in forms of photos, audio/video clips and field notes. Respecting diversity, data will be qualitatively analyzed through an ongoing iterative process to find underlying themes and merge with the overarching themes [79].

Through the process of conducting this study, I found that nearly all of the participants expressed the realization that they themselves wished to find out more about the reminiscence experiences of people living with blindness and, in several cases, desired to meet other study participants. I will distribute the digital manuscript of the thesis or other outcomes of this study (e.g., conference papers) to participants as well as a digital booklet of vignettes and anecdotes distilled from the interviews. The aim is to use this opportunity to facilitate further discussion and debate among participants and progressively work towards developing co-design workshops to critically explore this emerging design space directly with individuals and communities of people with blindness. Ultimately, I hope this study inspires future research into how technology design can be more inclusive of people with different abilities and generate valuable resources for reminiscence on cherished memories—a vital practice for people that are blind as it is for any of us.

References

[1] Albouys-Perrois, J., Laviole, J., Briant, C. and Brock, A.M. 2018. Towards a Multisensory Augmented Reality Map for Blind and Low Vision People: a Participatory Design Approach. *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems - CHI '18* (Montreal QC, Canada, 2018), 1–14.

[2] Aldridge, J. 2007. Picture this: the use of participatory photographic research methods with people with learning disabilities. *Disability & Society*. 22, 1 (Jan. 2007), 1–17. DOI:https://doi.org/10.1080/09687590601056006.

[3] Avila, M., Funk, M. and Henze, N. 2015. DroneNavigator: Using Drones for Navigating Visually Impaired Persons. *Proceedings of the 17th International ACM SIGACCESS Conference on Computers & Accessibility* (New York, NY, USA, 2015), 327–328.

[4] Avila Soto, M., Funk, M., Hoppe, M., Boldt, R., Wolf, K. and Henze, N. 2017. DroneNavigator: Using Leashed and Free-Floating Quadcopters to Navigate Visually Impaired Travelers. *Proceedings of the 19th International ACM SIGACCESS Conference on Computers and Accessibility - ASSETS '17* (Baltimore, Maryland, USA, 2017), 300–304.

[5] Azenkot, S., Prasain, S., Borning, A., Fortuna, E., Ladner, R.E. and Wobbrock, J.O. 2011. Enhancing Independence and Safety for Blind and Deaf-blind Public Transit Riders. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (New York, NY, USA, 2011), 3247–3256.

[6] Belk, R. 2010. Possessions and Self. *Wiley International Encyclopedia of Marketing*. American Cancer Society.

[7] Bennett, C.L., E, J., Mott, M.E., Cutrell, E. and Morris, M.R. 2018. How Teens with Visual Impairments Take, Edit, and Share Photos on Social Media. *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems - CHI '18* (Montreal QC, Canada, 2018), 1–12.

[8] Bennett, C.L., Peil, B. and Rosner, D.K. 2019. Biographical Prototypes: Reimagining Recognition and Disability in Design. *Proceedings of the 2019 on Designing Interactive Systems Conference* (New York, NY, USA, Jun. 2019), 35–47.

[9] Bennett, C.L., Peil, B. and Rosner, D.K. 2019. Biographical Prototypes: Reimagining Recognition and Disability in Design. *Proceedings of the 2019 on Designing Interactive Systems Conference - DIS '19* (San Diego, CA, USA, 2019), 35–47.

[10] Bennett, C.L. and Rosner, D.K. 2019. The Promise of Empathy: Design, Disability, and Knowing the “Other.” *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems - CHI ’19* (Glasgow, Scotland Uk, 2019), 1–13.

[11] Borenstein, J. The NavBelt - A Computerized Multi-Sensor Travel Aid for Active Guidance of the Blind. 9.

[12] Borodin, Y., Bigham, J.P., Dausch, G. and Ramakrishnan, I.V. 2010. More Than Meets the Eye: A Survey of Screen-reader Browsing Strategies. *Proceedings of the 2010 International Cross Disciplinary Conference on Web Accessibility (W4A)* (New York, NY, USA, 2010), 13:1–13:10.

[13] Bowen, S. and Petrelli, D. 2011. Remembering today tomorrow: Exploring the human-centred design of digital mementos. *International Journal of Human-Computer Studies*. 69, 5 (May 2011), 324–337. DOI:https://doi.org/10.1016/j.ijhcs.2010.12.005.

[14] Briggs, P., Olivier, P., Blythe, M., Vines, J., Lindsay, S., Dunphy, P., Nicholson, J., Green, D., Kitson, J. and Monk, A. 2012. Invisible design: exploring insights and ideas through ambiguous film scenarios. *Proceedings of the Designing Interactive Systems Conference on - DIS ’12* (Newcastle Upon Tyne, United Kingdom, 2012), 534.

[15] Buchenau, M. and Suri, J.F. 2000. Experience Prototyping. *Proceedings of the 3rd Conference on Designing Interactive Systems: Processes, Practices, Methods, and Techniques* (New York, NY, USA, 2000), 424–433.

[16] Butler, R.N. 1963. The life review: An interpretation of reminiscence in the aged. *Psychiatry*. 26, 1 (1963), 65–76.

[17] Buzzi, M.C., Buzzi, M., Leporini, B., Mori, G. and Penichet, V.M.R. 2010. Accessing Google Docs via Screen Reader. *Computers Helping People with Special Needs* (Berlin, Heidelberg, 2010), 92–99.

[18] Canadian National Institute for the Blind: 2015. *https://www.vancouverfoundation.ca/give/donate/agency/canadian-national-institute-blind*. Accessed: 2019-02-14.

[19] Casey, E.S. 2009. *Remembering: A phenomenological study*. Indiana University Press.

[20] Chebat, D.-R., Harrar, V., Kupers, R., Maidenbaum, S., Amedi, A. and Ptito, M. 2018. Sensory Substitution and the Neural Correlates of Navigation in Blindness. *Mobility of Visually Impaired People: Fundamentals and ICT Assistive Technologies*. E. Pissaloux and R. Velazquez, eds. Springer International Publishing. 167–200.

[21] Chen, A.Y.S., Odom, W., Zhong, C., Lin, H. and Amram, T. 2019. Chronoscope: Designing Temporally Diverse Interactions with Personal Digital Photo Collections. *Proceedings of the 2019 on Designing Interactive Systems Conference - DIS '19* (San Diego, CA, USA, 2019), 799–812.

[22] Chumkamon, S., Tuvaphanthaphiphat, P. and Keeratiwintakorn, P. 2008. A blind navigation system using RFID for indoor environments. *2008 5th International Conference on Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology* (May 2008), 765–768.

[23] Cosley, D., Sosik, V.S., Schultz, J., Peesapati, S.T. and Lee, S. 2012. Experiences With Designing Tools for Everyday Reminiscing. *Human–Computer Interaction*. 27, 1–2 (Apr. 2012), 175–198. DOI:https://doi.org/10.1080/07370024.2012.656047.

[24] Costanza-Chock, S. 2020. *Design Justice: Community-Led Practices to Build the Worlds We Need*. MIT Press.

[25] Crabtree, A., Rouncefield, M. and Tolmie, P. 2012. *Doing design ethnography*. Springer.

[26] Creswell, J.W. 2007. Five qualitative approaches to inquiry. *Qualitative Inquiry and Research Design: Choosing Among Five Approaches*. 53–80.

[27] Csikszentmihalyi, M. and Rochberg-Halton, E. 1981. *The Meaning of Things: Domestic Symbols and the Self*. Cambridge University Press.

[28] Desjardins, A. and Tihanyi, T. 2019. ListeningCups: A Case of Data Tactility and Data Stories. *Proceedings of the 2019 on Designing Interactive Systems Conference* (New York, NY, USA, Jun. 2019), 147–160.

[29] Dib, L., Petrelli, D. and Whittaker, S. 2010. Sonic souvenirs: exploring the paradoxes of recorded sound for family remembering. *Proceedings of the 2010 ACM conference on Computer supported cooperative work - CSCW '10* (Savannah, Georgia, USA, 2010), 391.

[30] Dong, T., Ackerman, M.S. and Newman, M.W. 2014. "If these walls could talk": designing with memories of places. *Proceedings of the 2014 conference on Designing interactive systems* (New York, NY, USA, Jun. 2014), 63–72.

[31] Duel, T., Frohlich, D.M., Kroos, C., Xu, Y., Jackson, P.J.B. and Plumbley, M.D. 2018. Supporting Audiography: Design of a System for Sentimental Sound Recording, Classification and Playback. *HCI International 2018 – Posters' Extended Abstracts* (Cham, 2018), 24–31.

[32] Edmondson, A.C. and Mcmanus, S.E. 2007. Methodological fit in management field research. *Academy of Management Review*. 32, 4 (Oct. 2007), 1246–1264. DOI:https://doi.org/10.5465/amr.2007.26586086.

[33] Elsden, C., Chatting, D., Durrant, A.C., Garbett, A., Nissen, B., Vines, J. and Kirk, D.S. 2017. On Speculative Enactments. *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, 2017), 5386–5399.

[34] Elsden, C., Kirk, D.S. and Durrant, A.C. 2016. A Quantified Past: Toward Design for Remembering With Personal Informatics. *Human–Computer Interaction*. 31, 6 (Nov. 2016), 518–557. DOI:https://doi.org/10.1080/07370024.2015.1093422.

[35] Elsden, C., Selby, M., Durrant, A. and Kirk, D. 2016. Fitter, happier, more productive: what to ask of a data-driven life. *Interactions*. 23, 5 (Aug. 2016), 45. DOI:https://doi.org/10.1145/2975388.

[36] Evans, G. and Blenkhorn, P. 2008. Screen Readers and Screen Magnifiers. *Assistive Technology for Visually Impaired and Blind People*. M.A. Hersh and M.A. Johnson, eds. Springer London. 449–495.

[37] Faria, J., Lopes, S., Fernandes, H., Martins, P. and Barroso, J. 2010. Electronic white cane for blind people navigation assistance. *2010 World Automation Congress* (Sep. 2010), 1–7.

[38] Filipe, V., Fernandes, F., Fernandes, H., Sousa, A., Paredes, H. and Barroso, J. 2012. Blind Navigation Support System based on Microsoft Kinect. *Procedia Computer Science*. 14, (Jan. 2012), 94–101. DOI:https://doi.org/10.1016/j.procs.2012.10.011.

[39] Frauenberger, C., Good, J. and Keay-Bright, W. 2011. Designing technology for children with special needs: bridging perspectives through participatory design. *CoDesign*. 7, 1 (Mar. 2011), 1–28. DOI:https://doi.org/10.1080/15710882.2011.587013.

[40] Frey, B., Southern, C. and Romero, M. 2011. BrailleTouch: Mobile Texting for the Visually Impaired. *Universal Access in Human-Computer Interaction. Context Diversity* (Berlin, Heidelberg, 2011), 19–25.

[41] Friske, M., Wirfs-Brock, J. and Devendorf, L. 2020. Entangling the Roles of Maker and Interpreter in Interpersonal Data Narratives: Explorations in Yarn and Sound. *Proceedings of the 2020 ACM Designing Interactive Systems Conference* (New York, NY, USA, Jul. 2020), 297–310.

[42] Frohlich, D. and Murphy, R. 2000. The Memory Box. *Personal Technologies*. 4, 4 (Dec. 2000), 238–240. DOI:https://doi.org/10.1007/BF02391566.

[43] Frohlich, D.M. 2004. *Audiophotography: Bringing Photos to Life with Sounds*. Springer Science & Business Media.

[44] Fruchterman, J. 2008. Accessing Books and Documents. *Assistive Technology for Visually Impaired and Blind People*. M.A. Hersh and M.A. Johnson, eds. Springer London. 555–580.

[45] Gaver, B., Dunne, T. and Pacenti, E. 1999. Design: Cultural probes. *interactions*. 6, 1 (Jan. 1999), 21–29. DOI:https://doi.org/10.1145/291224.291235.

[46] Gaver, W., Boucher, A., Bowers, J., Blythe, M., Jarvis, N., Cameron, D., Kerridge, T., Wilkie, A., Phillips, R. and Wright, P. 2011. The photostroller: supporting diverse care home residents in engaging with the world. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (New York, NY, USA, May 2011), 1757–1766.

[47] Glaser, B.G. and Strauss, A.L. 2017. *Discovery of Grounded Theory: Strategies for Qualitative Research*. Routledge.

[48] Gulotta, R., Odom, W., Forlizzi, J. and Faste, H. 2013. Digital artifacts as legacy: exploring the lifespan and value of digital data. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2013), 1813–1822.

[49] Hamraie, A. 2017. *Building Access: Universal Design and the Politics of Disability*. U of Minnesota Press.

[50] Hangal, S., Lam, M.S. and Heer, J. 2011. MUSE: reviving memories using email archives. *Proceedings of the 24th annual ACM symposium on User interface software and technology* (New York, NY, USA, Oct. 2011), 75–84.

[51] Hauser, S., Wakkary, R. and Neustaedter, C. 2014. Understanding guide dog team interactions: design opportunities to support work and play. *Proceedings of the 2014 conference on Designing interactive systems* (New York, NY, USA, Jun. 2014), 295–304.

[52] Herron, D., Moncur, W. and van den Hoven, E. 2016. Digital Possessions After a Romantic Break Up. *Proceedings of the 9th Nordic Conference on Human-Computer Interaction - NordiCHI '16* (Gothenburg, Sweden, 2016), 1–10.

[53] Hersh, M.A. and Johnson, M.A. 2008. Assistive Technology for Daily Living. *Assistive Technology for Visually Impaired and Blind People*. M.A. Hersh and M.A. Johnson, eds. Springer London. 615–657.

[54] Heshmat, Y., Neustaedter, C., McCaffrey, K., Odom, W., Wakkary, R. and Yang, Z. 2020. FamilyStories: Asynchronous Audio Storytelling for Family Members Across Time Zones. *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems* (Honolulu HI USA, Apr. 2020), 1–14.

[55] Hoffmann, R. 2008. Speech, Text and Braille Conversion Technology. *Assistive Technology for Visually Impaired and Blind People*. M.A. Hersh and M.A. Johnson, eds. Springer London. 497–554.

[56] Hsieh, P.-C., Chen, H.-C. and Liang, R.-H. 2011. SoundCapsule: The study of reminiscence triggered by utilizing sound media and technology. *Proceedings of the 4th World Conference on Design Research* (2011), 10.

[57] Isaacs, E., Konrad, A., Walendowski, A., Lennig, T., Hollis, V. and Whittaker, S. 2013. Echoes from the past: how technology mediated reflection improves well-being. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2013), 1071–1080.

[58] James, W. 1890. *The Principles of Psychology*. Henry Holt and Company.

[59] Jansson, G. 2008. Haptics as a Substitute for Vision. *Assistive Technology for Visually Impaired and Blind People*. M.A. Hersh and M.A. Johnson, eds. Springer London. 135–166.

[60] Jayaratne, K. 2016. The Memory Tree: Using Sound to Support Reminiscence. (2016), 6.

[61] Jones, J., Merritt, D. and Ackerman, M.S. 2017. KidKeeper: Design for Capturing Audio Mementos of Everyday Life for Parents of Young Children. *Proceedings of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing* (New York, NY, USA, Feb. 2017), 1864–1875.

[62] José, J., Farrajota, M., Rodrigues, J.M. and Du Buf, J.H. 2011. The SmartVision local navigation aid for blind and visually impaired persons. *International Journal of Digital Content Technology and its Applications*. 5, 5 (May 2011), 362–375. DOI:https://doi.org/10.4156/jdcta.vol5.issue5.40.

[63] Kirk, D.S. and Sellen, A. 2010. On human remains: Values and practice in the home archiving of cherished objects. *ACM Transactions on Computer-Human Interaction (TOCHI)*. 17, 3 (2010), 10.

[64] Kristjánsson, Á., Moldoveanu, A., Jóhannesson, Ó.I., Balan, O., Spagnol, S., Valgeirsdóttir, V.V. and Unnthorsson, R. Designing sensory-substitution devices: Principles, pitfalls and potential1. *Restorative Neurology and Neuroscience*. 34, 5, 769–787. DOI:https://doi.org/10.3233/RNN-160647.

[65] Lefeuvre, K., Totzauer, S., Bischof, A., Kurze, A., Storz, M., Ullmann, L. and Berger, A. 2016. Loaded Dice: Exploring the Design Space of Connected Devices with Blind and Visually Impaired People. *Proceedings of the 9th Nordic Conference on Human-Computer Interaction* (New York, NY, USA, 2016), 31:1–31:10.

[66] Levesque, R.J.R. 2011. Blindness and Visual Impairment. *Encyclopedia of Adolescence*. R.J.R. Levesque, ed. Springer New York. 307–309.

[67] Lim, J., Yoo, Y., Cho, H. and Choi, S. 2019. TouchPhoto: Enabling Independent Picture Taking and Understanding for Visually-Impaired Users. *2019 International Conference on Multimodal Interaction* (New York, NY, USA, 2019), 124–134.

[68] LIncoln, N.K. and Denzin, Y.S. 2005. *Handbook of Qualitative Research*. Sage.

[69] Lottridge, D., Masson, N. and Mackay, W. 2009. Sharing empty moments: design for remote couples. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2009), 2329–2338.

[70] Maberley, D. a. L., Hollands, H., Chuo, J., Tam, G., Konkal, J., Roesch, M., Veselinovic, A., Witzigmann, M. and Bassett, K. 2006. The prevalence of low vision and blindness in Canada. *Eye*. 20, 3 (Mar. 2006), 341–346. DOI:https://doi.org/10.1038/sj.eye.6701879.

[71] Mankoff, J., Hayes, G.R. and Kasnitz, D. 2010. Disability studies as a source of critical inquiry for the field of assistive technology. *Proceedings of the 12th international ACM SIGACCESS conference on Computers and accessibility - ASSETS '10* (Orlando, Florida, USA, 2010), 3.

[72] Marsden, J., Stevens, S. and Ebri, A. 2014. How to measure distance visual acuity. *Community Eye Health*. 27, 85 (2014), 16.

[73] Martin, H. and Gaver, B. 2000. Beyond the snapshot from speculation to prototypes in audiophotography. *Proceedings of the 3rd conference on Designing interactive systems: processes, practices, methods, and techniques* (New York, NY, USA, Aug. 2000), 55–65.

[74] Maulana, P., Darusalam, U. and Nathasia, N.D. 2020. Road Guides and Special Location Monitoring for Blind People Using Ultrasonic Sensors and Microcontroller-Based GPS Modules. *Jurnal Mantik*. 3, 4, Feb (Feb. 2020), 444–450.

[75] McAdams, D.P. 2003. Identity and the Life Story. *Autobiographical Memory and the Construction of A Narrative Self: Developmental and Cultural Perspectives*. Psychology Press. 187–207.

[76] McGookin, D. 2019. Reveal: Investigating Proactive Location-Based Reminiscing with Personal Digital Photo Repositories. *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, May 2019), 1–14.

[77] Metatla, O., Bryan-Kinns, N., Stockman, T. and Martin, F. 2015. Designing with and for people living with visual impairments: audio-tactile mock-ups, audio diaries and participatory prototyping. *CoDesign*. 11, 1 (Jan. 2015), 35–48. DOI:https://doi.org/10.1080/15710882.2015.1007877.

[78] Miles, M.B. and Huberman, A.M. 1994. *Qualitative Data Analysis: An Expanded Sourcebook*. SAGE.

[79] Miles, M.B. and Huberman, A.M. 1994. *Qualitative Data Analysis: An Expanded Sourcebook - Matthew B. Miles, A. Michael Huberman, Michael A. Huberman, Prof Michael Huberman - Google Books*. Sage: London.

[80] Mosher, M. 2017. If These Walls Could Speak: Tangible Memories. (2017), 4.

[81] Muller, M.J. 2009. PARTICIPATORY DESIGN: THE THIRD SPACE IN HCI. *Human-Computer Interaction*. CRC press. 181–202.

[82] Muller, M.J., Wharton, C., McIver, W.J., Jr. and Laux, L. 1997. Toward an HCI Research and Practice Agenda Based on Human Needs and Social Responsibility. *Proceedings of the ACM SIGCHI Conference on Human Factors in Computing Systems* (New York, NY, USA, 1997), 155–161.

[83] Mutiara, G.A., Hapsari, G.I. and Periyadi 2017. Performance comparison of communication module againts detection location for blind cane. *2017 11th International Conference on Telecommunication Systems Services and Applications (TSSA)* (Oct. 2017), 1–6.

[84] Neumüller, M. and Reichinger, A. From Stereoscopy to Tactile Photography. 5.

[85] Niemantsverdriet, K. and Versteeg, M. 2016. Interactive Jewellery as Memory Cue: Designing a Sound Locket for Individual Reminiscence. *Proceedings of the TEI '16: Tenth International Conference on Tangible, Embedded, and Embodied Interaction - TEI '16* (Eindhoven, Netherlands, 2016), 532–538.

[86] Nissen, B. and Bowers, J. 2015. Data-Things: Digital Fabrication Situated within Participatory Data Translation Activities. *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems - CHI '15* (Seoul, Republic of Korea, 2015), 2467–2476.

[87] Nissen, B., Bowers, J., Wright, P.C., Hook, J.D. and Newell, C. 2014. Volvelles, Domes and Wristbands : Embedding Digital Fabrication Within a Visitor's Trajectory of Engagement. (2014), 11.

[88] Odom, W. 2015. Understanding long-term interactions with a slow technology: An investigation of experiences with FutureMe. *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems* (2015), 575–584.

[89] Odom, W., Banks, R., Kirk, D., Harper, R., Lindley, S. and Sellen, A. 2012. Technology heirlooms?: considerations for passing down and inheriting digital materials. *Proceedings of the 2012 ACM annual conference on Human Factors in Computing Systems - CHI '12* (Austin, Texas, USA, 2012), 337.

[90] Odom, W. and Duel, T. 2018. On the Design of OLO Radio: Investigating Metadata as a Design Material. *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems - CHI '18* (Montreal QC, Canada, 2018), 1–9.

[91] Odom, W., Selby, M., Sellen, A., Kirk, D., Banks, R. and Regan, T. 2012. Photobox: On the Design of a Slow Technology. *Proceedings of the Designing Interactive Systems Conference* (New York, NY, USA, 2012), 665–668.

[92] Odom, W., Wakkary, R., Hol, J., Naus, B., Verburg, P., Amram, T. and Chen, A.Y.S. 2019. Investigating Slowness As a Frame to Design Longer-Term Experiences with Personal Data: A Field Study of Olly. *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, 2019), 34:1–34:16.

[93] Odom, W., Wakkary, R., Hol, J., Naus, B., Verburg, P., Amram, T., Chen, A.Y.S. and University, S.F. 2019. Investigating Slowness as a Frame to Design Longer-Term Experiences with Personal Data: A Field Study of Olly. (2019), 16.

[94] Odom, W., Yoo, M., Lin, H., Duel, T., Amram, T. and Chen, A.Y.S. 2020. Exploring the Reflective Potentialities of Personal Data with Different Temporal Modalities: A Field Study of Olo Radio. *Proceedings of the 2020 ACM on Designing Interactive Systems Conference* (Eindhoven, Netherlands, Jul. 2020), 283–295.

[95] Odom, W., Zimmerman, J. and Forlizzi, J. 2014. Placelessness, spacelessness, and formlessness: experiential qualities of virtual possessions. *Proceedings of the 2014 conference on Designing interactive systems - DIS '14* (Vancouver, BC, Canada, 2014), 985–994.

[96] Odom, W.T., Sellen, A.J., Banks, R., Kirk, D.S., Regan, T., Selby, M., Forlizzi, J.L. and Zimmerman, J. 2014. Designing for Slowness, Anticipation and Re-visitation: A Long Term Field Study of the Photobox. *Proceedings of the 32Nd Annual ACM Conference on Human Factors in Computing Systems* (New York, NY, USA, 2014), 1961–1970.

[97] Odom, W.T., Sellen, A.J., Banks, R., Kirk, D.S., Regan, T., Selby, M., Forlizzi, J.L. and Zimmerman, J. 2014. Designing for Slowness, Anticipation and Re-visitation: A Long Term Field Study of the Photobox. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (New York, NY, USA, 2014), 1961–1970.

[98] Oleksik, G. and Brown, L.M. 2008. Sonic gems: exploring the potential of audio recording as a form of sentimental memory capture. *Proceedings of the 22nd British HCI Group Annual Conference on People and Computers: Culture, Creativity, Interaction - Volume 1* (Swindon, GBR, Sep. 2008), 163–172.

[99] Oleksik, G., Frohlich, D., Brown, L.M. and Sellen, A. 2008. Sonic interventions: understanding and extending the domestic soundscape. *Proceeding of the twenty-sixth annual CHI conference on Human factors in computing systems - CHI '08* (Florence, Italy, 2008), 1419.

[100] Peesapati, S.T., Schwanda, V., Schultz, J. and Cosley, D. 2010. Triggering memories with online maps. *Proceedings of the 73rd ASIS&T Annual Meeting on Navigating Streams in an Information Ecosystem - Volume 47* (USA, Oct. 2010), 1–4.

[101] Peesapati, S.T., Schwanda, V., Schultz, J., Lepage, M., Jeong, S. and Cosley, D. 2010. Pensieve: supporting everyday reminiscence. *Proceedings of the 28th international conference on Human factors in computing systems - CHI '10* (Atlanta, Georgia, USA, 2010), 2027.

[102] Petrelli, D., Marshall, M.T., O'brien, S., Mcentaggart, P. and Gwilt, I. 2017. Tangible data souvenirs as a bridge between a physical museum visit and online digital experience. *Personal and Ubiquitous Computing*. 21, 2 (Apr. 2017), 281–295. DOI:https://doi.org/10.1007/s00779-016-0993-x.

[103] Petrelli, D., Villar, N., Kalnikaite, V., Dib, L. and Whittaker, S. 2010. FM radio: family interplay with sonic mementos. *Proceedings of the 28th international conference on Human factors in computing systems - CHI '10* (Atlanta, Georgia, USA, 2010), 2371.

[104] Petrelli, D., Whittaker, S. and Brockmeier, J. 2008. AutoTopography: what can physical mementos tell us about digital memories? *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (2008), 53–62.

[105] Pierce, J. and Paulos, E. 2013. Electric materialities and interactive technology. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2013), 119–128.

[106] Presley, I. and D'Andrea, F.M. 2009. *Assistive Technology for Students who are Blind Or Visually Impaired: A Guide to Assessment*. American Foundation for the Blind.

[107] Procyk, J. and Neustaedter, C. 2014. GEMS: the design and evaluation of a location-based storytelling game. *Proceedings of the 17th ACM conference on Computer supported cooperative work & social computing* (New York, NY, USA, Feb. 2014), 1156–1166.

[108] Pschetz, L. and Banks, R. 2013. Long living chair. *CHI '13 Extended Abstracts on Human Factors in Computing Systems on - CHI EA '13* (Paris, France, 2013), 2983.

[109] Reddit's Blind Community: *https://www.reddit.com/r/Blind/*. Accessed: 2019-04-12.

[110] Saha, A. and Piper, A.M. 2020. Understanding Audio Production Practices of People with Vision Impairments. *ASSETS '20: The 22nd International ACM SIGACCESS Conference on Computers and Accessibility* (2020), 13.

[111] Sánchez, J., Sáenz, M., Pascual-Leone, A. and Merabet, L. 2010. Navigation for the Blind Through Audio-based Virtual Environments. *CHI '10 Extended Abstracts on Human Factors in Computing Systems* (New York, NY, USA, 2010), 3409–3414.

[112] Screen Readers | American Foundation for the Blind: *https://www.afb.org/blindness-and-low-vision/using-technology/assistive-technology-products/screen-readers*. Accessed: 2019-12-17.

[113] Selby, M. 2017. *Experiential manufacturing: designing meaningful relationships between people, data and things*. University of Nottingham.

[114] Shinohara, K. and Tenenberg, J. 2009. A blind person's interactions with technology. *Communications of the ACM*. 52, 8 (Aug. 2009), 58. DOI:https://doi.org/10.1145/1536616.1536636.

[115] Shoval, S., Borenstein, J. and Koren, Y. 1998. Auditory guidance with the Navbelt-a computerized travel aid for the blind. *IEEE Transactions on Systems, Man, and Cybernetics, Part C (Applications and Reviews)*. 28, 3 (Aug. 1998), 459–467. DOI:https://doi.org/10.1109/5326.704589.

[116] Silverman, A.M. 2015. The Perils of Playing Blind: Problems with Blindness Simulation and a Better Way to Teach about Blindness. *The Journal of Blindness Innovation and Research*. 5, 2 (2015).

[117] Siu, A.F., Kim, S., Miele, J.A. and Follmer, S. 2019. shapeCAD: An Accessible 3D Modelling Workflow for the Blind and Visually-Impaired Via 2.5D Shape Displays. *The 21st International ACM SIGACCESS Conference on Computers and Accessibility* (Pittsburgh PA USA, Oct. 2019), 342–354.

[118] Spiel, K., Frauenberger, C., Hornecker, E. and Fitzpatrick, G. 2017. When Empathy Is Not Enough: Assessing the Experiences of Autistic Children with Technologies. *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems* (Denver Colorado USA, May 2017), 2853–2864.

[119] Spiel, K., Gerling, K., Bennett, C.L., Brulé, E., Williams, R.M., Rode, J. and Mankoff, J. 2020. Nothing About Us Without Us: Investigating the Role of Critical Disability Studies in HCI. *Extended Abstracts of the 2020 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2020), 1–8.

[120] Stevens, G.A., White, R.A., Flaxman, S.R., Price, H., Jonas, J.B., Keeffe, J., Leasher, J., Naidoo, K., Pesudovs, K., Resnikoff, S., Taylor, H. and Bourne, R.R.A. 2013. Global Prevalence of Vision Impairment and Blindness: Magnitude and Temporal Trends, 1990–2010. *Ophthalmology*. 120, 12 (Dec. 2013), 2377–2384. DOI:https://doi.org/10.1016/j.ophtha.2013.05.025.

[121] The Ohio State University and Karbowski, C. 2020. See3D: 3D Printing for People Who Are Blind. *Journal of Science Education for Students with Disabilities*. 23, 1 (Feb. 2020). DOI:https://doi.org/10.14448/jsesd.12.0006.

[122] Thomas, L. and Briggs, P. 2016. Reminiscence through the Lens of Social Media. *Frontiers in Psychology*. 7, (2016). DOI:https://doi.org/10.3389/fpsyg.2016.00870.

[123] Thomas, L., Farrow, E., Aylett, M. and Briggs, P. 2018. A life story in three parts: the use of triptychs to make sense of personal digital data. *Personal and Ubiquitous Computing*. 22, 4 (Aug. 2018), 691–705. DOI:https://doi.org/10.1007/s00779-018-1110-0.

[124] Tsai, W.-C. and Chen, A.Y.S. CrescendoMessage: Interacting with Slow Messaging. 18.

[125] Tsai, W.-C., Wang, P.-H., Lee, H.-C., Liang, R.-H. and Hsu, J. 2014. The reflexive printer: toward making sense of perceived drawbacks in technology-mediated reminiscence. *Proceedings of the 2014 conference on Designing interactive systems* (New York, NY, USA, Jun. 2014), 995–1004.

[126] Ulrich, I. and Borenstein, J. 2001. The GuideCane-applying mobile robot technologies to assist the visually impaired. *IEEE Transactions on Systems, Man, and Cybernetics - Part A: Systems and Humans*. 31, 2 (Mar. 2001), 131–136. DOI:https://doi.org/10.1109/3468.911370.

[127] Uriu, D., Odom, W., Lai, M.-K., Taoka, S. and Inami, M. 2018. SenseCenser: an Interactive Device for Sensing Incense Smoke & Supporting Memorialization Rituals in Japan. *Proceedings of the 19th International ACM SIGACCESS Conference on Computers and Accessibility - DIS '18* (Hong Kong, China, 2018), 315–318.

[128] Van Kleek, M. and OHara, K. 2014. The Future of Social Is Personal: The Potential of the Personal Data Store. *Social Collective Intelligence*. Springer. 125–158.

[129] Viégas, F.B., Golder, S. and Donath, J. 2006. Visualizing email content: portraying relationships from conversational histories. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2006), 979–988.

[130] Vines, J., Blythe, M., Lindsay, S., Dunphy, P., Monk, A. and Olivier, P. 2012. Questionable concepts: critique as resource for designing with eighty somethings. *Proceedings of the 2012 ACM annual conference on Human Factors in Computing Systems - CHI '12* (Austin, Texas, USA, 2012), 1169.

[131] Vision impairment and blindness: *https://www.who.int/news-room/fact-sheets/detail/blindness-and-visual-impairment*. Accessed: 2019-12-07.

[132] Vitale, F., Odom, W. and McGrenere, J. 2019. Keeping and Discarding Personal Data: Exploring a Design Space. *Proceedings of the 2019 on Designing Interactive Systems Conference* (San Diego, CA, USA, Jun. 2019), 1463–1477.

[133] Webster, J.D., Bohlmeijer, E.T. and Westerhof, G.J. 2010. Mapping the Future of Reminiscence: A Conceptual Guide for Research and Practice. *Research on Aging*. 32, 4 (Jul. 2010), 527–564. DOI:https://doi.org/10.1177/0164027510364122.

[134] Webster, J.D. and McCall, M.E. 1999. Reminiscence Functions Across Adulthood: A Replication and Extension. *Journal of Adult Development*. 6, 1 (Jan. 1999), 73–85. DOI:https://doi.org/10.1023/A:1021628525902.

[135] White, J., Odom, W. and Brand, N. 2020. Exploring Location Histories as a Design Material for Reflection with Memory Compass & Memory Tracer. *Companion Publication of the 2020 ACM Designing Interactive Systems Conference* (New York, NY, USA, Jul. 2020), 221–226.

[136] Williamson, J. and Brown, L.M. 2008. Flutter: directed random browsing of photo collections with a tangible interface. *Proceedings of the 7th ACM conference on Designing interactive systems - DIS '08* (Cape Town, South Africa, 2008), 147–155.

[137] Ymous, A., Spiel, K., Keyes, O., Williams, R.M., Good, J., Hornecker, E. and Bennett, C.L. 2020. "I am just terrified of my future"—Epistemic Violence in Disability Related Technology Research. *Extended Abstracts of the 2020 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2020), 1–16.

[138] Yoo, M., Odom, W. and Berger, A. 2020. Research Through Design with Differently Abled People: Participation, Ownership and Equitable Conclusions. *Workshop proceedings of RtD in Situ: Discussing the Domains and Impact of Design Research* (Jul. 2020), 4.

[139] Yoo, M., Odom, W. and Berger, A. 2020. Understanding How Audio Mediates Experiences of Reminiscence for People Living with Blindness. *Companion Publication of the 2020 on Designing Interactive Systems Conference* (Eindhoven, Netherlands, Jul. 2020), 6.

Appendix

Interview Protocol

Checklist

☐ Go over and sign the consent form

☐ Start the voice recorder

☐ Take photos and field notes

☐ Provide remuneration and sign the remuneration form at the end

Introduction (*timestamp* **)**

Thank you for participating in the study. I am a researcher from Everyday Design Studio (EDS) at Simon Fraser University (SFU). Today, I am conducting an interview to understand the practices of remembering life moments from the past for people with blindness.

The interview may involve your physical artifacts or digital devices. You may be asked to share personal photos, videos or stories involving such objects. The interview will take place in the everyday home setting at your home to observe your practices and experiences at the most comfortable setting for yourself.

The interview will last approximately 90 minutes. Your response and interaction will be recorded in a few different forms. The audio will be recorded throughout the interview session, and I will be taking few notes as we proceed. Photos and short clips of video may be taken to capture interactions that you may perform during the interview, only if you give a consent to do so.

We will be reviewing a consent form that you have received earlier. You can ask any questions or concerns regarding to the study and the interview while reviewing the form.

If you agree with the interview and data collection procedures indicated in the consent form, you are asked to give an oral consent to the interviewer while reviewing the consent form. Please keep in mind that you can stop at any point during the interview and have a right not to answer or skip a question

Introductory Interview (*timestamp* **)**

Background

Many sighted people think that being blind could be very difficult in some situations, such as navigating in an unknown place. However, I would like to focus on your capabilities and strengths as a blind person. Let me ask first few questions to get to know you better.

- Could you tell me about your blindness? **(gone / born)**

- Are you a future-looking person or a person who often looks back on the past?

- Do you have your own ways to develop your own ways of using everyday objects?

- Have you used Siri, Amazon Alexa or Google Home? What was your experience of using them? (What makes the voice more meaningful?)

- ***(for gone blindness)*** What do you miss the most as you lost the sight?

- ***(for gone blindness)*** What was your experience in learning Braille?

- ***(for gone blindness)*** What are the things that you embrace more as you became blind?

- What do you think you are more confident than sighted population? (i.e. Things/tasks that sighted people cannot easily do, but you are very confident in doing it.)

For next set of questions, we will talk about your practices and experiences of reminiscence.

Current Practices/Experiences

- What are some triggers or cues that bring you back to the past?

- How do you keep the record of your past moments?

- What things do you record? What types of recordings do you have?

- How frequently do you look back on the past using the recordings?

- How do you interact with those recordings? (Choosing strategy? Random selection? Physical Interaction?)

- How do you capture important moments in life?

- How would you like to do? Is there anything else you would like to record?

- What are your strategies of organizing and remembering captured moments?

- Have you ever lost a collection of memories? Why? How did you feel? How did you overcome?

Activities (*timestamp* **)**

1. Home Tour

The first activity is the *Home Tour*. This activity aims to explore objects and places which involve memories. For this activity, I would like to ask you to walk me through your home. You could do in any way that's most comfortable for you. If you are more comfortable with describing in words, please feel free to do so. If you are comfortable with drawing, you can freely draw and describe details of your home on the paper in front of you. Or, you can take us to a physical tour of your home.

(Drawing) I may write down short notes on the same paper while you are drawing.

(Verbal tour) Okay, I will do a quick sketch of your home as you walk me though.

During the tour, please indicate and describe objects and spaces that are meaningful to you at your home, which may be associated with memorable moments. **(You are welcome to take me to the object or the place and describe how you interact with them.)**

- Is there a space or a place that you tell stories to people?

- What does this place/artifact/object remind you of?

- Why is this place/artifact/object meaningful to you?

- What do you like about this place/artifact/object?

- How often do you interact this place/object/artifact to recall stories and memories?

- Do you share this place/artifact/object with others?

- What do you like and don't like to revisit memories through this place/artifact/object?

2. The Storage (*timestamp* **)**

The next activity is called *The Storage*. This is a forward-looking activity, which we are going to talk about an ideal memory storage that you would like to have.

First, I would like to ask:

- Is there a device that you currently have for keeping information?

Now, I am going to introduce **five** objects that are commonly used by sighted people. We are going to talk about each one of them. **(Share interviewer's personal stories for each object)**

1. Photo Frame
2. Photo Album
3. Diary
4. Accessory Box
5. Smartphone

- What does this mean for you?

- What do you like & don't like about [storage name]?

- Is [storage name] private/personal or social/sharable?
- If it's sharable, how do you build or enrich social relationship through [storage name]?

- How would you make your own version of [storage name]?

- If it exists, what would you like to record?

- If you could change its property, such as physical form, texture, material, smell, sound or “digitally-enhance” that you would like, how would you change this storage?

Thank you for sharing your thoughts. Now I am going to give you a clay pot as a symbol of a storage that you would like to have. Please keep in mind that the object itself should not limit your imagination as the storage could have different form, size, features, texture, material or smell. Please feel free to share your thoughts regardless of whether an idea is realistic or unrealistic.

- What kind of memories or meaningful objects would you wish to keep in this storage?

- How would you like your memory to be kept? (i.e. dynamic; moving, snapshot, keyword or tag, symbol..)

- How would you interact with the storage?

- Would you like to share the storage to other people?

- If so, how would the storage affect or change your social relationship?

- Would you like the storage to be easily accessible or would you like to make an effort to preserve stored memory?

- Would you like the storage to have a physical form?

- If so, how big do you like to be? In what form and what texture?

- Would you wish the storage to be changed over time?

Concluding Script and Wrap-Up Questions (*timestamp* **)**

I would like to ask few more questions before we conclude the interview.

- Do you have any questions for me?

- Is there anything else you would like to tell me?

- Are there other questions that I should have asked to understand you better?

Thank you very much for sharing stories and for your valuable insight throughout the interview session. Your feedback is invaluable to our research on understanding how blind people remember the past, and how technology could support blind people's practices of reminiscence.

Please let me know if at any point in the future if you would like to be provided with academic publications that result from your participation in this study.

Also, please do not hesitate to contact me in the future if you have any additional questions, concerns or feedback. All personal information will not be disclosed to anyone and will be anonymized for future publications.

Again, I really appreciate you for your time and participating in my study.

[Provide remuneration and sign the remuneration form]