Beyond Looking Back: A Long-Term Participatory Approach to Co-Designing and Co-Speculating with People with Blindness on Reminiscence Experiences through Sound Memory

by

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Approval

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Ethics Statement

The author, whose name appears on the title page of this work, has obtained, for the research described in this work, either:

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Abstract

Reminiscence, the practice of recalling memories from one's past experiences, has long been an essential human practice. Remembering past memories is not limited to recalling information, but grounded more fundamentally in self-reflection, social connection and contemplation of the future. Today, the ways we preserve, organize, revisit and share meaningful life moments are highly mediated by digital devices and services, with the rise of new technological interventions. These technologies have enabled the creation of much larger, broader and deeper personal digital archives and digital memory traces. However, much of this work is centered on and prioritizes visual modalities, assuming their target audience is fully-abled individuals, not adequately addressing unique perspectives, values and situated lived experiences of marginalized communities, such as people with blindness.

My overarching research question is: How do people with blindness look back, reminisce, and reflect on past memories and meaningful life moments, and how can interactive technology be designed to better support their experiences and practices of reminiscing and remembering? My dissertation answers this question through a seven-year participatory research program conducted in deep, ongoing collaboration with a small group of blind individuals. Utilizing a Research through Design and Participatory Design approach, I explore the rich, under-examined design space of sound-based and non-visual reminiscence experiences, and taking a step further, looking into the future of memory technology for people with blindness.

This dissertation makes three contributions: First, empirically, I investigate the situated, everyday reminiscence experiences of people with blindness, drawing on deep qualitative. Second, practically, I deliver a set of design techniques for creating multi-layered sound memories and offers strategies for designing a biographical memory archive for people with blindness. Third, methodologically, I present a rich methodological demonstration of navigating and pivoting decisions throughout the design process, mapping a rare, seven-year longitudinal participatory design relationship with blind participants as close collaborators, describing key pivoting moments and decisions to sustain non-extractive research practice.

Keywords: Reminiscence; People with Blindness; Participatory Design; Co-Design; Co-Speculative Design; Alternative Research Outcomes

Dedication

To my loving family, for always believing in me to live, grow, and achieve to my fullest potential.

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> MinYoung Yoo, William Odom, and Arne Berger. "Understanding everyday experiences of reminiscence for people with blindness: Practices, tensions and probing new design possibilities." In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*, pp. 1-15. 2021.

For this paper, I started the research idea through iterative meetings with Dr. Odom, as part of my thesis project. I created the initial research proposal, consent forms, recruitment statements and interview protocols. Then, I conducted the data collection and analysis and wrote the paper. Dr. Odom contributed to the development of the research idea and framing, and to the iteration of interview protocols, data analysis, and the paper. Dr. Berger contributed to the refinement of the interview protocols, data analysis and the writing of the paper.

> MinYoung Yoo, Lauren Knight, William Odom, and Arne Berger. "Storywork & Reciprocity: On the Design of an Audio Documentary that Extends HCI Research back to Participants." In *Proceedings of the 2022 ACM Designing Interactive Systems Conference*, pp. 1345-1357. 2022.

For this paper, the idea emerged from discussions among Dr. Odom, Dr. Berger, and me after the previous paper. We reached out to Lauren Knight, who studies Sound Studies and is experienced in sound design. Lauren Knight contributed to the project's decolonial framing. I took the lead on the audio documentary by translating the academic jargon into plain language, simplifying the paper's themes and findings, retrieving participants' quotes from the interview recordings, and finally creating the narration and editing the audio documentary. Then, Lauren Knight added various sound components to the documentary, including dips to silence sensitive information, background music, sound effects, and pauses to create space for reflection. She also helped with the mixing and mastering of the audio documentary. For the paper writing, I wrote most of the sections, Lauren Knight contributed to the literature review and framing of the paper on decolonial theories and sound studies, and Dr. Odom and Dr. Berger helped iterate the core arguments and polish the final draft.

MinYoung Yoo, William Odom, Arne Berger, Samuel Barnett, Sadhbh Kenny, Priscilla Lo, Samein Shamsher, Gillian Russell, and Lauren Knight. "Remembering through sound: co-creating sound-based mementos together with people with blindness." In *Proceedings of the 2024 CHI Conference on Human Factors in Computing Systems*, pp. 1-19. 2024.

For this paper, I took the lead in working with the same participants as in the first paper to continue exploring their experiences of sound-based reminiscence, and I conducted most of the data collection, analysis, and writing of the paper. Dr. Odom, Dr. Berger, and I conducted a series of group interviews that shaped the subsequent participatory activities. Samual Barnett played a major role in data collection, setting up various recording devices to capture the participatory activities acoustically. Sadhbh Kenny, Priscilla Lo, Samein Shamsher and especially Dr. Russell helped frame and develop the participatory activities and final co-design workshop on sound memories. Samual Barnett, Sadhbh Kenny, Priscilla Lo and Samein Shamsher provided huge support in running the co-design workshop, not only facilitating and working closely with participants during workshop activities but also collecting data throughout the workshop. Lauren Knight shared valuable insights into utilizing the audio documentary from the previous paper in the group interviews, as well as sound-based activities for the workshop.

MinYoung Yoo, Sophia Ppali, William Odom, Yumeng Zhuang, Kritika Kritika, Wyatt Olson, Catherine Wieczorek, Heidi Biggs, Arne Berger, Audrey Desjardins, Ron Wakkary, Kathryn E. Ringland. "Translating HCI Research to Broader Audiences: Motivation, Inspiration, and Critical Factors on Alternative Research Outcomes." In *Proceedings of the 2025 CHI Conference on Human Factors in Computing Systems*, pp. 1-24. 2025.

This paper emerged from ongoing discussions about alternative ways of sharing research outcomes with audiences beyond the academic circle, heavily inspired by the creation and sharing of the audio documentary. For this paper, I took the lead in communicating with the co-authors, facilitating online and in-person meetings and discussions, gathering written and oral reflections from the co-authors, analyzing the reflections, conceptualizing Alternative Research Outcomes (AROs), and finally writing the paper. Sophia Ppali also took a major part in gathering and analyzing the coauthors' reflections and in iterating on the definition and core concept of AROs. Dr. Odom helped frame the theoretical positioning of AROs and our positionality as researchers working with AROs. This paper presents six case study examples. Dr. Odom, Dr. Berger, and I

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Chapter 6 consists of a full-paper submission in preparation for the ACM CHI 2027 conference. For this study, I have led the research process, including the development of speculative memory object design concepts and the design of the co-speculative design workshop, data analysis and the writing of the paper draft. Dr. Odom and Dr. Berger have provided valuable guidance and feedback in this process. I would like to acknowledge Haena Cho, Lauren Thu, and Yumeng Zhuang for iterating and piloting the workshop activities, and facilitating the workshop. Also, Haena Cho and Sam Barnett accompanied to an extra session that was conducted off-campus.

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List of Acronyms

ACM	Association for Computing Machinery
AI	Artificial Intelligence
ARO	Alternative Research Outcomes
CHI	The ACM Conference on Human Factors in Computing Systems
CSCW	The ACM Conference on Computer-Supported Cooperative Work & Social Computing
DIS	The ACM Conference on Designing Interactive Systems
DIY	Do-It-Yourself
HCI	Human-Computer Interaction
NordiCHI	Nordic Conference on Human-Computer Interaction
PD	Participatory Design
RtD	Research through Design
SFU	Simon Fraser University
TEI	The ACM Conference on Tangible, Embedded, and Embodied Interaction

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

Reminiscence and remembrance have long existed as fundamental human practices for documenting life experiences, self-reflection, social connection, and contemplation of the future [46, 478, 482]. Across history, the desire to hold onto the past, looking back on meaningful life moments or reflecting on growing identities, has been expressed, materialized, and practiced through various physical mementos, personal archives, and oral storytelling traditions. Today, people's memory practices—the ways we preserve, organize, revisit and encounter these personal and shared histories—are highly mediated by digital devices and services, with the growing interest and popularity of social media, mobile devices, and cloud computing [344, 464, 471]. These technologies have enabled the creation of much larger, broader and deeper personal digital archives and digital memory traces. As a range of digital tools and services has become ubiquitous and easily accessible in everyday life, capturing a continuous stream of personal traces, such as lifelogging [411, 486], has yielded an exponentially increased volume of autobiographical data, fundamentally structuring how human memory is encoded, captured, stored, and retrieved within modern technological infrastructures.

However, these vast and advancing technologies for reminiscence and remembrance have been implicitly catered to a sighted population, and there has been very limited work at the intersection of reminiscence experiences among people with blindness [511]. While technology has catalyzed a hyper-accelerated growth of personal data, it has simultaneously amplified existing accessibility and existential tensions, excluding people who prefer or rely on alternative (non-visual) sensory modalities from fluidly reflecting on the considerable breadth and depth of life experiences captured across their lives. For blind people, technologies have largely been oriented toward addressing practical, everyday challenges or accessibility barriers, such as mobility, navigation, and accessible tools. Yet, these are often designed with a "sighted-in-mind" perspective [271], which creates significant limitations for the Human-Computer Interaction (HCI) and design communities. Consequently, supporting non-visual,

situated, and nuanced ways of capturing, revisiting, and sharing experiences, histories, and impressions is limited in current technologies that are widely available to the general public.

This gap highlights a critical need to move away from the sighted-in-mind, solutionist assumptions by exploring the unique, situated perspectives and lived experiences of people with blindness. To deeply understand such nuanced memory practices, my work adapts design research methods that facilitate close communication that sustains long-term collaboration with people with blindness, rather than treating them as passive research subjects for short-term experiments. Through this close and relational engagement throughout my research program, sound emerges as a deeply preferred and frequently used medium among our blind collaborators for capturing the emotional timbre and atmosphere of the past. Yet, within the HCI community, empirical examples illustrating how personal reminiscence can be meaningfully mediated through the co-creation and longitudinal study of sound-based design artifacts remain sparse.

To address this space, my approach takes a blend of Research through Design (RtD) [172, 515, 516] and Participatory Design (PD) [130, 191, 314], particularly using Co-design [402, 470] and Co-speculative design as central methodological and theoretical strategies that can be applied and extended. Furthermore, moving away from treating their participation as a simply extractive process of using their lived experiences as user data, this collaborative orientation builds on an ethical commitment to reciprocity in research by shifting attention toward how knowledge and design outcomes are generated and meaningfully returned to the research participants and the involved community through alternative formats. Concurrently, a co-speculation approach that brings speculative design and design fiction serves as a vital extension of this participatory relationship, supporting our collaborators to inquire into co-imagining new possibilities that build directly on their situated and nuanced lived experiences to perceive, consider, and critically challenge future technological trajectories for reminiscence and remembrance for people with blindness.

This dissertation contributes specifically to the intersection of two actively researched domains in HCI—**Blindness** and **Reminiscence**—by investigating three key research objectives that ultimately yield distinct empirical, practical, and methodological contributions. First, empirically, my work investigates the situated, everyday

reminiscence experiences of people with blindness, drawing on deep qualitative insights into not only nuanced sensorial practices but also the personal and social tensions around reminiscing and remembering. These insights build a foundational understanding of non-visual reminiscence and memory practices and long-term legacy curation for people with blindness. Second, practically, grounded in the lived experiences learned from an ongoing small-scale collaboration, my work delivers a set of design techniques for creating multi-layered sound memories and offers strategies for designing a biographical memory archive for people with blindness that advocates for the narrative agency required for long-term reflection and posthumous curation, which can possibly scale to both blind and sighted populations. Third, methodologically, my work presents a rich methodological demonstration of navigating and pivoting decisions throughout the design process, mapping a rare, seven-year longitudinal participatory design relationship with blind participants as close collaborators, describing key pivoting moments and decisions to sustain non-extractive research practice. This commitment formalizes a conceptual framework for Alternative Research Outcomes (AROs) that aims to create alternative, accessible research outcomes that translate academic knowledge to the involved communities and beyond. Together, these empirical, practical, and methodological contributions establish a holistic understanding of non-visual, long-term memory curation and reciprocal design practices. In the following section, I have developed and summarized how my research questions are developed through the specific research questions and methodological approaches.

1.1. Research Questions and Approaches

The overarching research question of my thesis is:

How do people with blindness revisit, reminisce, and reflect on past memories and meaningful life moments, and how can interactive technology be designed to better support their experiences and practices of reminiscing and remembering?

To investigate this question, I adopted a *Research through Design (RtD)* [172, 515, 516] methodology as the primary approach, combined with a *Participatory Design (PD)* [130, 191, 314] lens and *Co-design* [402, 470] practices.

RtD is a widely used methodology in HCI research, which brings design practices into the research process. It is often used with qualitative research methods to investigate research questions through designerly ways of knowing [100] that involve visual, tactile, material, and spatial mediums, such as sketches, models, prototypes, artifacts and diagrams, to explore “What could be”, rather than “What it is” [107, 513]. Such epistemic practices of RtD – exploring ‘what could be’ – are essential because there is an important reciprocal relationship in this research. While traditional qualitative methods effectively articulate situated, lived experiences, RtD plays a critical role in moving beyond qualitative research to establish a close connection between blind people’s lived experiences and the form-giving aspects of co-design sessions. In the context of this research, the ongoing, iterative process of creating and speculating with non-visual (mostly sound-based) reminiscence enabled our participants to actively generate, understand, and contribute to their alternative practices and preferred futures.

Another important pillar of my methodological approach is PD and Co-design. Historically rooted in the Scandinavian tradition, PD actively involves stakeholders, especially end-users, citizens, and employees, in the design process to ensure the final outcome meets their needs and expectations, positioning their situated, lived experiences as central to generating knowledge. Epistemologically, this fundamentally shifted the knowledge creation practice in my research from an extractive, researcher-led observation to a relational, co-constructed process. In this work, knowledge was not simply discovered or analyzed by the researcher but rather emerged through mutual understanding and collaborative dialogue. This approach directly shaped the ethical stance of my thesis, contributing to the overarching commitment to reject extractive research practices and ensure that research insights, knowledge and outcomes are meaningfully returned back to the participants and the involved community.

On the other hand, Co-design emerged in the 2000s in the human-centred design context in industry to bring non-designers into the creative process. The co-design process focuses on creative collaboration that shifts the roles of researchers, designers and users (people), transitioning users from passive subjects to “experts of their experiences” [402, 419], who are actively involved in knowledge development, ideation and concept development, while researchers focus on leading and guiding users and providing scaffolds that support people’s need for their creative expression. This

contributed to the development of hands-on, co-creative activities that enabled us to work closely with our blind collaborators in supporting their creative potential throughout the research process.

I started my research inquiry by reviewing literature on blindness and reminiscence. However, back in 2018, when I first started this project, there was no relevant prior work in this specific intersection. Although *Blindness* and *Reminiscence* are two actively researched topics in HCI, research on *Blindness* in HCI has largely touched on accessibility issues and practical challenges, such as mobility, navigation, and accessible tools, which are often designed under the implicit assumptions of the sighted perspective [271]. On the other hand, *Reminiscence* is mostly studied from the perspective of memory research on older adults with dementia or in medical contexts, such as how memory functions in the brain. Therefore, I decided to take a qualitative, participatory design approach to understand blind people's lived experiences and to move away from the "sighted in mind" perspective. This proposed the following research question for the first, exploratory research for my thesis project:

RQ1: What are the ways people with blindness capture, revisit and share meaningful life experiences and memories, and what is the role of interactive technology in supporting their reminiscence experiences and memory practices?

To address this research question, I aimed to conduct in-depth, qualitative research with people with blindness to listen to their experiences of reminiscing and remembering, the challenges and desires in their memory practices, and their expectations of technology in the context of reminiscence. I hoped this would eventually point to design opportunities to support situated, nuanced reminiscence experiences for people with blindness.



Figure 1.1. Many blind participants kept old photo albums in their homes. What is the meaning of these visual artifacts and what are their own practices of capturing and sharing memories?

For recruitment, I reached out to local non-profit organizations for the blind and low-vision, as well as to online blind communities on Reddit. Eventually, I recruited 9 people with blindness and visited their homes to conduct individual semi-structured interviews. Participants shared their everyday experiences of making and sharing memories and also showed a collection of meaningful mementos and places in their homes. Each session lasted between 90 and 150 minutes. (See more details in Chapter 3)

In total, 9 interviews generated more than 17 hours of recordings, field notes and visual documentation (photos and videos). Analyzing the collected data, we generated three overarching themes regarding how people with blindness capture and remember the past, the use of physical and digital possessions for reminiscence, and desires for future practices of reminiscence. Building on these findings, we suggested three design opportunities to support reminiscence experiences for people with blindness: (i) *Remembering through Sound*, such as audio recordings, voices and soundscapes, (ii) *Remembering through Social Interactions*, such as visual descriptions, storytelling, and

shared memories, and (iii) *Remembering through Tactile Impressions*, such as physical objects and their presence and tangible aesthetics. This study is published as:

> MinYoung Yoo, William Odom, and Arne Berger. "Understanding everyday experiences of reminiscence for people with blindness: Practices, tensions and probing new design possibilities." In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*, pp. 1-15. 2021.

Building on this work, I decided to further investigate *Remembering through Sound* in the next phases of my thesis project, using a participatory design and co-design approach. Upon concluding this exploratory phase, there was an issue with sharing the research outcomes and findings from the 9 individual interviews. Since the interviews were individual, our participants were genuinely curious and wanted to know what others shared because they had never been asked about deep questions on reminiscence. Unfortunately, due to the pandemic, we were unable to host any in-person gatherings in 2020-2021. Moreover, we did not want to share the published paper as PDFs directly because our participants had to read through academic jargon and complex academic writing structures, with citations and references, on screen readers. I felt there was a significant gap, as we wanted our participants to be on the same page before we moved on to the next phase of participatory design and co-design. Also, on a personal level, this was a matter of reciprocity—acknowledging that this study would not have been possible without them, appreciating their contributions, and inviting them to continue participating. These challenges and reflections led to the following research question:

RQ2: How can research insights derived from the research participants' lived experiences be shared and translated back into reciprocal design practices so that they can engage with the research insights and knowledge in meaningful ways?

This research question became a strong motivation to explore alternative ways to share our findings in a suitable form for our participants. From the earlier interviews, we learned that sound was the most preferred medium among our participants, so we collaborated with a sound studies lab in the communication department to create an audio summary of the published paper. Building on the sound studies and decolonial theories, we created an hour-long audio documentary as an alternative form of research

publication. I simplified and narrated the themes and findings in plain language, then used participants' own voices from the interview recordings to feature their quotes in the paper. Also, the audio documentary was layered with background music, sound effects to highlight key components of participant quotes and themes, and reflective questions and communicative pauses for the listener (mainly the research participants) to engage with the paper's themes and the questions we wanted to pose for deeper reflection.



Figure 1.2. Full version of an hour-long audio documentary was shared and published on SoundCloud.

The audio documentary was posted and shared on SoundCloud for our participants to easily access, listen to, and share with others. The theoretical framing, design decisions and development of the audio documentary were described, analyzed and published as:

> MinYoung Yoo, Lauren Knight, William Odom, and Arne Berger. "Storywork & Reciprocity: On the Design of an Audio Documentary that Extends HCI Research back to Participants." In *Proceedings of the 2022 ACM Designing Interactive Systems Conference*, pp. 1345-1357. 2022.

This experience of working on a different way of sharing research outcomes, heavily shaped by our positionality and our participants' preferences, inspired me to propose the concept of *Alternative Research Outcomes (AROs),* which will be discussed later in this dissertation.

Moving forward, I chose to pursue further investigation into *Remembering through Sound* among the three design opportunities identified in RQ1. The next step was to work closely with the participants to understand their memory practices and

experiences of sound, and to make sound memories together through participatory activities and the co-design workshop. The research question to be addressed was:

RQ3: How do people with blindness capture, interact with, or reflect on meaningful personal audio recordings for reminiscence, and how can we co-design alternative forms of sound memory that support their preferences, needs, and desires for personal and social reflection in sound?

Although the first exploratory study suggested three design opportunities—*Remembering through Sound*, *Remembering through Social Interaction*, and *Remembering through Tactile Impression*—to support the reminiscence experience for people with blindness, many questions remained to be explored in the context of sound memories. Therefore, we began with group interviews, where we collaboratively brainstormed and decided on the following participatory activities, which led to the co-design workshop on sound memories. This work is accepted and published as:

> MinYoung Yoo, William Odom, Arne Berger, Samuel Barnett, Sadhbh Kenny, Priscilla Lo, Samein Shamsher, Gillian Russell, and Lauren Knight. "Remembering through sound: co-creating sound-based mementos together with people with blindness." In *Proceedings of the 2024 CHI Conference on Human Factors in Computing Systems*, pp. 1-19. 2024.

When the pandemic restrictions were finally lifted, we conducted group interviews to discuss our participants' everyday experiences, preferences, and challenges with memories captured in sound and interactions with meaningful audio recordings. While all participants possessed treasured personal audio recordings that ranged from a few minutes to several hours, memories in sound were mostly personal and did not resonate well when shared with others. Also, they found it challenging to capture meaningful moments because they happen so fast and are easily forgotten, making it difficult to capture in real time. Therefore, we came up with the idea of capturing near-past sound memories, in which the research team served as an imaginary device that captured meaningful moments.

To begin with, the entire scene was recorded using multiple devices, including field mics and pin mics. Whenever participants faced a moment to capture, they gave a cue by snapping their fingers or clapping to mark the timestamp. Then, these moments were retrieved later, with all recording devices combined and synced, to get the audio

highlights as sound memories. In small groups, our participants chose an activity that they wished to make sound memories of—the activities varied from medieval sword fighting to horseback riding to walking around the neighbourhood with a granddaughter. Once the audio highlights were retrieved, we shared them with the participants and followed up a few months later. Although all participants liked the audio highlights, they were not very meaningful, so most participants did not listen to them after first receiving them or forgot where they had saved the highlights when we followed up. Therefore, for the final co-design workshop, we asked the participants to bring their cherished audio recordings or other objects that were sonically meaningful to work on sound memories together, using possessions that already held significance.

During the workshop, we paid close attention to their sounds and explored the associated stories and emotions more deeply, investigating how memory can be reconstructed in sound and, conversely, how sound can reconstruct memory. Then, we let our participants guide us to recreate their meaningful sounds or recordings into new types of sonic mementos by asking meticulous details of their memory, such as the physical location, emotional timbre, time of day, and the people at the scene, also more broadly, like where the memory begins and ends may differ from where the sound begins and ends, or whether there is a sound they clearly remembered but that was not captured in the recording. As a result, three types of sonic mementos were co-created with the participants utilizing the techniques of (i) *encapsulation and condensation*, extracting only the key moments of interest to highlight the overall emotions and atmosphere captured in the recording, (ii) *augmentation and expansion*, adding sound effects, background sounds, soundscapes, voices and conversations that were not captured in the recording to fill the missing memories in the recording and (iii) *re-imagination and re-creation*; blending the exact or most similar sound elements (e.g., particular type of a bird, children's song) that match to the ones in the memories to create an abstract summary of a specific moment in the past. Analyzing these sonic mementos and the making process, we discussed how different sound layers (e.g., foreground, middle-ground, and background), pace and length, and framing memories in sound influence the experience of reminiscing and remembering. We also analyzed how people's voices could hold temporal values that convey the passage of time and point to a specific era at the time of recording, suggesting the value of sound memory and considerations for creating memories in sound.

At this point, I had a few options to pursue, either to make an interactive prototype with field deployment that materializes the sonic mementos to support the reminiscence experience of sound memories, or to keep engaging in a participatory, collaborative process that stays close to the participants in understanding and exploring their lived experiences and perspectives. The former option of making a prototype did not feel fully justified or convincing because both the sonic mementos and the participants' desires varied widely and were highly personal. I would have made too many assumptions about designing for my participants' very specific lived experiences and offering them something I create. Thus, instead of converging the design ideas to a few (or one) prototype, I decided to engage more in the participatory design framing.

So far, our discussions, findings, and analyses have focused on the past and the present—both current and past memory practices and reminiscence experiences, which made me wonder, what are our participants' desires for future practices of reminiscence, such as creating legacies, hoping for new, emerging technologies for memory practices, possibly in 20, 30, or even 50 years from now? Therefore, as a final phase in my thesis project, I chose to co-speculate about my participants' future desires and wishes regarding their memory practices through design fiction and storytelling, asking the following research question:

RQ4: How can co-speculative design fictions, grounded in the situated lived experiences of blind collaborators, reveal their imaginations and desires for future memory technologies, and how do they critically challenge norms in current and emerging technologies regarding longitudinal reminiscence and the curation of memory traces and legacy for people with blindness?

For this phase, two essential design orientations are *speculative design* and *design fiction*. Speculative design aims to critique current social or technological norms through provocative artifacts, uncovering potential consequences or influences before they become a reality. Guided by this approach, we planned to co-create future-oriented, imaginative artifacts that probe possible, probable, or preferable futures and open new areas of inquiry into our participants' future reminiscence practices. On the other hand, design fiction involves fictional technologies or artifacts that are understood within a narrative context. We leveraged this framing to use our participants' narratives, inspired by or related to their lived experiences, as discussion points to raise questions, provoke

creativity, and explore the personal and social means of using their imagined memory technologies.

Before exploring the imaginative memory objects with the participants at the co-speculative design workshop, I first developed four speculative memory concepts—*The Egg*, *The Eraser*, *The Box*, and *The Long Pause*—that directly build on what they shared in the previous interviews and sessions. I shared the descriptions of the four memory concepts and posed reflective questions to the participants prior to the workshop. At the workshop, we talked about how our participants felt about the four memory concepts, what made them curious, which concepts resonated with them, and what made them uncomfortable, sharing personal perspectives and, more broadly, blind people's perspectives on the future of sound memory. Then, we worked with the participants in small groups to ideate and develop design fiction stories that best describe our participants' envisioned memory object and practice, from 20, 30 or even 50 years from now. Participants thoughtfully crafted design fiction stories that reflect what they wish to leave behind and what they want to carry on. We supported our participants in developing their own imagined memory objects—*Tiger X*, *Birthday Recorder*, *Dual-Deck Tape Recorder*, and *Treasure Chest*—that reflect their future expectations for memory technology, co-creating two design fiction short stories for each memory object, resulting in a total of 8 short stories. These short stories cover a range of formats from letters and diaries to instructional manuals and product descriptions of their imagined memory devices. Together, these stories indicate bigger opportunities for memory technology for blind people that can influence and be scalable for sighted people as well.

At this point, a significant shift in our positionality, both methodologically and ethically, occurred as our relationship with our participants evolved into a long-term collaboration. Since the design fiction stories are deeply rooted in our participants' lived experiences, we decided to drop the pseudonyms and use their real names to properly acknowledge their creative contributions to this research and the authorship of their stories. I want to highlight that this shift was a much-needed step toward respecting our participants as ongoing collaborators, co-creators, and co-authors. (We referred to our participants as our *collaborators* from this point.)

Analyzing the design process for developing the imagined memory objects and the design fiction short stories, we found that these speculative concepts and stories point to

the *reorganization of the narrative self* and the desire to *leave a posthumous legacy*. More importantly, we found that the memory objects, or their intended uses, involve *extended waiting* for the right moment that triggers deep reflection, reminiscence, and remembrance, which goes against the philosophy of always-available, efficiency-driven and demand-seeking behaviours in modern technology. Building on these themes, we suggest design strategies and three types of agencies to consider for creating a longitudinal memory system that supports long-term reflection and the continuous curation of legacy in memory for people with blindness. As of now, this work is in preparation for a full-paper submission to the upcoming ACM CHI 2027.

Inspired heavily by the experience of creating and sharing the audio documentary with our research participants, their loved ones and the involved community (See RQ2), the concept of exploring broader ways of dissemination, namely *Alternative Research Outcomes (AROs)*, plays an important part in my Ph.D. program, in addition to the thesis project. After publishing a paper on the design and development of the audio documentary at ACM DIS 2022, I hosted a workshop at DIS 2023, gathering people who share the same enthusiasm and interest in translating research outcomes into different formats. Along with a few attendees who were interested in collaborating and in further commitment, we continued the discussion for 12 months, exploring the following research question:

RQ5: How can HCI research outcomes be created in alternative forms that go beyond traditional textual dissemination by offering creative, diverse endpoints that communicate research insights to broader audiences, and what are the key qualities that define their value and significance in the research process?

This inquiry stems from a growing recognition within the HCI community that traditional peer-reviewed papers often keep rich and valuable insights behind the paywall and institutional barriers, making them much less accessible to the related and involved communities outside of academia. Developing alternative outcomes is not merely about translating text, but more about recognizing that different forms and disseminating unique dimensions of research process, reflection, dialogue, and critique. To investigate how these forms might operate in practice, we collected six ARO case studies—*Audio Documentary*, *DIY Tutorial*, *Documentary Shorts*, *Digital Media Content*, *Art Exhibition*, and *Zines*—and shared the experience of making and sharing them through a series of

online and in-person sessions to discuss, reflect on, and iterate on emerging themes and critical inquiries into the key characteristics and values of AROs. Then each collaborator sent their written reflection, which I consolidated and analyzed. Collectively, we proposed four emerging qualities of AROs—*Translational*, *Situational*, *Transparent* and *Initiatory*—that uniquely distinguish AROs from science or research communications and academic publications. Also, we discussed the alternative values that AROs aim to pursue, which may be unaligned with the traditional knowledge-creation process in academia. Lastly, we posed open questions that had yet to be answered and needed to be explored to initiate continued discussions with the broader HCI community regarding alternative ways of sharing research outcomes. Our work was published and presented at ACM CHI 2025:

> MinYoung Yoo, Sophia Ppali, William Odom, Yumeng Zhuang, Kritika Kritika, Wyatt Olson, Catherine Wieczorek, Heidi Biggs, Arne Berger, Audrey Desjardins, Ron Wakkary, Kathryn E. Ringland. "Translating HCI Research to Broader Audiences: Motivation, Inspiration, and Critical Factors on Alternative Research Outcomes." In *Proceedings of the 2025 CHI Conference on Human Factors in Computing Systems*, pp. 1-24. 2025.

It is important to note that our collaborative work on alternative research outcomes, collecting strong, inspiring cases from a wide range of contexts, and continued discussions on the theoretical framing, potential methodological contributions to HCI research and the unique values of sharing and generating knowledge through alternative forms is ongoing.

Overall, this dissertation presents blind people's lived experiences of reminiscence and remembrance, their preferences for sound memories and different techniques of making and translating memories in sound, the desires and wishes for future memory technologies and the design strategies to support blind people's long-term curation of their memories, and finally, the practice of making alternative, reciprocal ways of sharing the research outcomes. The intended audiences of this dissertation are HCI design researchers and practitioners who are interested in: (i) understanding and designing for blind people's reminiscence experiences, (ii) seeking insights into sound-based or audio memory, (iii) working closely with people with blindness (or people with other disabilities) in developing collaborative methods and activities throughout the design process, and (iv) working on alternative ways of translating research outcomes.

1.2. Overview of Chapters

Collectively, the five research questions presented and summarized above, and the following investigations and analyses each contribute to the chapters of my cumulative dissertation:

Chapter 1 introduces the overarching research context and questions and provides an overview of my research program.

Chapter 2 presents a literature review on the related topics and prior work.

Chapter 3 describes the exploratory study based on individual semi-structured interviews with blind people about their reminiscence experiences.

Chapter 4 reports on and discusses the design and development of the audio documentary that translates an academic publication for the research participants.

Chapter 5 describes the participatory design process for understanding sound-based memories and co-designing sonic mementos with the participants.

Chapter 6 reports the design process of co-speculating the future of memory practices and memory technologies for people with blindness.

Chapter 7 explains and proposes the concept of Alternative Research Outcomes (AROs), describing the definition, four core qualities and the open-ended questions posed to the broader HCI community.

Chapter 8 concludes the dissertation with reflections on the long-term collaborative relationship with the research participants, contributions and limitations of my work, and implications for future work.

Chapters 3, 4, 5, and 7 are adapted from my previous first-author full papers published over the past 6 years of my doctoral program. In summary, the trajectory of this thesis moves from understanding the situated, everyday reminiscence practices of people with blindness (**Chapter 3**) to practicing reciprocal responsibilities by designing an accessible, audio-based translation of research outcomes for the research participants (**Chapter 4**), which in turn collaboratively shaped the following steps to explore blind

people's interactions and lived experiences with sound and to co-create intimate sonic mementos from participants' cherished audio recordings and meaningful sonic objects (**Chapter 5**) and moving beyond the past and current memory practices and reminiscence experiences to co-speculate on future memory technology for blind people to suggest design strategies and agencies for designing long-term reminiscence and remembrance for people with blindness (**Chapter 6**). Running in parallel with the thesis project and strongly inspired by the audio documentary, the conceptualization of Alternative Research Outcomes (**Chapter 7**) highlights important considerations and contributions to exploring alternative ways of disseminating research outcomes and knowledge to a broader audience beyond academia Together, these five research inquiries investigate how interactive technology can support blind people's situated reminiscence experiences, exploring design strategies of non-visual, sound-based, and longitudinal memory curation, while demonstrating how the design process and research outcomes can be worked together as an ongoing and reciprocal practice through a long-term collaboration.

Finally, in **Chapter 8**, I wrote more detailed reflections on my research achievements and trajectory in the long-term, ongoing and collaborative relationship that I have developed with the research participants over the course of 7 years, and also about the significance, contributions, limitations and implications of my work to situate it in the broader HCI community, hoping to make a concrete research contribution to the field of HCI, interaction design and participatory design.

Chapter 2.

Literature Review

This chapter presents different threads of literature and prior work related to the empirical, practical, and methodological foundations of this dissertation. To contextualize a seven-year participatory research journey centred on reminiscence for people with blindness, this review bridges the fields of HCI, Sound Studies, Research through Design and Participatory Design.

I begin by presenting an overview of how memory is constructed with life experiences and personal possessions, leading into digital possessions and technology-mediated reminiscence in HCI, tracking how interactive systems support personal and social memory practices while highlighting the limited work in this area for people with blindness. Then, I describe prior work on sound memory, soundscapes, and sonic interactions to ground sound as a deeply emotional, primary medium for reflection. Next, I outline the epistemological framing of Research through Design (RtD), justifying how knowledge is generated through the making of artifacts, design activities and speculative concepts, as well as how the design research process can be critically reflected to generate further insights. This is then followed by a deeper dive into Participatory Design (PD), positionality, and ethics, providing the theoretical background for long-term, non-extractive community engagements. The following section covers the landscape of designing with, co-creating, and co-speculating with people with different abilities, especially blindness, to shift the paradigm from a deficit-based perspective to a co-creation approach. Finally, the chapter concludes by reviewing how research outcomes can be transferred and translated into different forms other than written publications, considering the concept of Alternative Research Outcomes (AROs). Together, these six threads provide a holistic overview of critical gaps and relevant areas of the literature for my research program.

2.1. Memory, Possessions and Reminiscence

Reminiscence—the cognitive and social practice of recalling past experiences and personal histories—has been framed and studied in HCI research as a vital practice

for understanding of self, emotional well-being, and social connections [46, 69, 482]. While Webster et al. broadly define reminiscence as "the recall of personally experienced episodes from one's past" [478], the authors distinguish between three types of reminiscence: unstructured, conversational storytelling (*Simple Reminiscence*), a more structured, synthetic evaluation of both positive and negative life events to promote a positive self-identity (*Life Review*), and supporting people in severe depression, assisted by specialists in a psychotherapeutic context (*Life Review Therapy*). Within this spectrum, my research trajectory foregrounds the qualities of Life Review. I define reminiscence as an integrated, holistic practice that goes beyond recalling fragmentary memories.

In HCI, reminiscence and remembrance have been studied through daily interactions with digital data and physical belongings within the messy routines of everyday life, particularly regarding personal data and interactions in technology use. Early attempts include gaining a broader overview and understanding of people's practices of making memories. Van Den Hoven introduces the notion of Materializing Memories, demonstrating how external memory cues, such as physical/tangible objects, locations, and people, are important for recalling memories and highlighting the role of interaction design for creating a positive remembering experience [222]. Van Gennip et al. investigate a range of involuntary memory cues in people's everyday lives to explore design opportunities for technology to support people's reminiscence and note the trade-offs involved in selecting the right timing and moment for reflection [181]. Expanding into domestic contexts, research shifted toward understanding the social and emotional accounts underlying memory archiving and retrieval among families. Kirk and Sellen examine the purposes and values of sentimental family archives in homes, showing that home archiving practices are not always tied to memories but are also associated with other values associated with sentimental objects [259]. Petrelli et al. conduct a field study on creating time capsules for families with children to explore what people want to remember in the longer term and suggest design opportunities to support longer-term autobiographical memory [363]. Further, Lindley conducts a field study on older adults who create digital family archives for posterity, describing associated practices with inherited family archives to reveal a distinction between personal memory and memory for family [276]. Collectively, these works establish that technologies for reminiscence should accommodate carefully timed triggers and cues, resonating physical and sensory

anchors, and balance not only private introspection but also shared memory archives, such as family heritage.

Another thread of work examines the role of technology and digital media. Traditionally, material possessions play important roles in personal and shared memories. They extend people's sense of self through their things, in part by drawing on them as resources for self-reflection on the current and past self [32], life goals and achievements [101], and mediating people's experiences of reminiscing about past life and prospectively reflecting on the future [73, 296, 479]. As technologies have become widely adopted, people's practices have expanded, and possessions have grown to include personal data archives [344, 464, 471]. 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., [85, 212, 334, 337, 341, 489]). This stream of HCI research explores how people's practices of recollecting and reminiscing on the past could be better supported by interactive technology, and demonstrates that when personal data is used as a creative, reflective resource, interactive technology can foster deeper self-reflection and meaningful narrative construction. In particular, a key body of work focused on attaching digital content to existing physical mementos (e.g., [463]) informs that digital memory traces gain emotional weight and physical permanence when paired with tangible artifacts. Further, systems expanding into other forms of personal data, including images, video, audio recordings, and location histories [226, 301, 453], becomes a great inspiration for my work to explore rich personal data that is sensorially grounded – various types of sound, in the context of my research – for reflecting on and remembering the past.

There is a body of research that highlights the value of re-experiencing digital data from the past [57, 85, 311, 341, 343], including social media [447], emails [200, 467], online maps [360, 484], photos [345, 463] and sound files [117, 240, 366], to support reminiscence experiences. For example, Van Den Hoven, Sas, and Whittaker edited a special issue that introduces seven papers tracing existing works that explore technologies for managing personal memory, from early methods of recording memories to the recent growing attention on digital media and lifelogging tools [223]. Peesapati et al. report *Pensieve*, a system that sends memory triggers by randomly selecting

personal social media content with reflective prompts [361]. Tsai et al. present *Reflexive Printer*, which is critically designed with intended drawbacks to support technology-mediated reminiscence [454]. Cosley et al. present a system that supports “individual, spontaneous reminiscence” by sending memory triggers collected from social media content [361] and reflect further on the experiences of everyday reminiscence, especially to autobiographical memories for self-reflection [95, 367]. Isaacs et al. report positive experiences with life logging and emotional well-being through technology-mediated reflection via a custom smartphone application that records daily events [231]. This line of inquiry moves beyond simply capturing data for immediate, everyday reflection to address the longevity of personal data. Notably, Gulotta et al. reframed digital artifacts to highlight the complex lifespan, stewardship and inheritance practices on digital legacy [193]. This shift in perspective demonstrates that digital memory traces are not only ephemeral for short-term consumption but also evolve within personal possessions for long-term temporality, accommodating life transitions and enduring for future generations.

Prior research has largely focused on people without disabilities, and it is important that the HCI community make efforts to include more diverse perspectives and experiences from people with different abilities. Specifically, in my research, I focus on people with blindness. Within HCI reminiscence research, studies centred on people with blindness remain exceedingly rare (representing roughly 5% of published works [511]). More importantly, because reminiscence technologies rely almost exclusively on visual media – such as photo libraries, video archives, and graphical timelines – how people with blindness engage with their material and digital possessions (e.g., photos on social media [35]) and the non-visual sensory, emotional, and social ways in which they revisit the past remain underexplored. In my dissertation, I aim to fill this gap between people with blindness and their reminiscence experiences by not only understanding their possessions and personal data but also their lived experiences, to propose design opportunities and insights into the roles of interactive technology in supporting blind people’s situated, lived experiences of reminiscence and remembrance.

2.2. Sound Memories, Soundscapes, and Sonic Interactions

Sound shapes environments and social relationships, and often acts as a profound, dynamic sensory trigger for autobiographical memory that can be extended to shared memories. Within HCI and design research, sound and audio have been one of the actively explored areas for non-visual remembrance. This body of research has unfolded along two complementary threads: the analytical exploration of situated sounds and soundscapes to gain a rich understanding and to offer possible implications for remembrance, and the material development of bespoke sonic artifacts for memory.

The first approach focuses on analyzing soundscapes within specific environments to understand their social meanings and generate design implications. Oleksik et al. explore the role, importance, and meaning of domestic soundscapes and offer conceptual foundations for *sonic interventions* by sound management practices that monitor and control the real-time flow of sonic information in the home [348]. Dib et al. compare sounds with photo-taking activities to investigate the role of sound in social reminiscing by collecting sonic souvenirs from families during their holidays [117]. Their work describes how sound enables active, collaborative reminiscing and captures *iconic representations* of events in much more varied, familial, and creative ways than photos. However, sound is much harder to interpret and has limitations when solely used as a medium for remembering. To overcome the ambiguity of sound, researchers have turned their focus to interactive modalities that give form and control to sonic data. For instance, Caramiaux et al. proposed three distinct sonic interaction models—*conducting*, *manipulating* and *substituting*—that map physical gestures to sound, to recall and re-experience memorable auditory events through rich, expressive sonic interactions [71].

Parallel to these analytical inquiries on sound and soundscape, there is a stream of designing, creating, developing and deploying interactive artifacts to capture and anchor sound memories, taking a Research through Design (RtD) approach. These works have frequently used materiality and tangible interactions to give physical form to memories captured in digital audio. Oleksik and Brown present an exploratory study investigating the domestic rhythms of recording and interacting with audio as a form of a small, interactive *Sonic Gem Bowl* [347]. Petrelli et al.'s *FM Radio* [366], an *embodied digital memento*, allows families to tangibly interact with, replay and share sonic

mementos of their past holidays, offering insights into the design of technology for affective interaction with personal digital mementos in sound. Similarly, researchers have explored form factors that intertwine personal sound memory with intimate, everyday objects. Niemantsverdriet and Versteeg introduce the design of a sound locket as an interactive jewellery piece to critically examine the intersection of interactive jewellery, technology, and autobiographical reflection [324], while Jayaratne developed the *Memory Tree*, an interactive prototype that uses localized sound-bytes as a tangible tool to support reminiscence [240]. Duel et al. introduce *Audiography* to explore the social capturing and sharing of constrained, ten-second audio snippets [122], and Hsieh et al. present *SoundCapsule*, a mobile application that leverages serendipitous audio playback to explore appropriate digital materials for unexpected moments of retrospective reflection [226]. Furthermore, Heshmat et al. develop the design and use of *FamilyStories* to demonstrate how asynchronous storytelling systems can capture instant, localized feelings to support emotional connection between distant family members [215]. Taken together, this body of RtD research demonstrates that materializing sound by giving tangible form creates an engaging, intuitive, and embodied experience of personal memory. Prototypes from these works represent how non-visual, audio-based memory systems can be made effective when integrated into everyday physical objects, leveraging thoughtful interactions to prevent cognitive overload.

More recently, the discourse surrounding sound design has matured to interrogate who acoustic systems are built for and how they are authored. While earlier RtD work on sonic interaction establishes sonic expressiveness at the interaction level (e.g., Caramiaux et al.'s gesture-based interactions [71]) to manipulate sound, acoustic properties, and re-experience auditory memories, Wirfs-Brock et al. present a manifesto of *Open Sonifications* [495], call for an inclusive approach to data sonification from a critical perspective, advocating for expressiveness, participatory methodologies, and a plurality of perspectives in how sound is designed and experienced. Taken together, these works demonstrate the value of sound and audio memory as rich, generative reflective material, exposing a vital need and great potential to adapt and translate these sonic strategies into unique, non-visual sensory practices for people with blindness.

2.3. Research through Design Approach and Reflecting on the Design Process

Research through Design (RtD) is a research methodology and framework proposed by Zimmerman et al. [515] that enables interaction designers in HCI to make research contributions grounded in design practices. In this foundational paper, the authors point out that design has a strong impact in practice but struggles to integrate design principles in research and suggest concrete lenses and examples to illustrate the RtD framework and its potential to make research contributions.

This development of design research approaches also involves shifting perspectives to extend the boundaries of design inquiry through various methods and techniques. *Cultural Probes* are introduced to elicit inspirational design ideas and participant self-reflection rather than objective data [171, 179]. *Experience Prototyping* enables both researchers and participants to gain first-hand, embodied experience by actively engaging with hypothetical interactions and prototypes, rather than relying on retrospective accounts of current habits to evaluate how future concepts might feel in practice [65]. Similarly, *Technology Probes* broaden the scope of design inquiry beyond traditional utility testing and experiments by deploying open-ended, functional prototypes in real-world contexts to simultaneously collect field data, investigate technical feasibility, and open the possibility of co-designing technologies with users [229]. Building on these efforts, Gaver further articulates the epistemic foundation of RtD, explaining how practice-based research creates provisional theories through the exploration, speculation, and crafting of conceptually rich artifacts, in contrast to the rigid generalizations and hypothesis-driven paradigms of traditional philosophy of science [172]. Another significant thread in design research concerns the speculative aspect of design. Auger introduces the concept of *Speculative Design* as a method to provoke imagination about the future and critique current practices [16]. Pierce further explicates alternative designs, such as speculative design and critical design, in relation to other types of design and design in general, categorizing design approaches into three groups [368].

As these approaches become more developed and mature, evolving discourses in Research through Design demonstrate a collective shift toward embracing the messy, nuanced, and deeply reflective realities of the design process. Rather than treating

design research as a process for producing polished artifacts and sharing successful narratives, RtD scholars increasingly value the intermediate knowledge, alternative designs, and productive failures that emerge within and beyond timelines. Gaver et al. describe the symptoms and reasons for failure, arguing that traditional evaluation approaches are limited in determining success or failure [177]. Goveia da Rocha et al. advocate for embracing “loose ends”, encouraging a shift from solution-driven approaches to exploratory inquiry where failures can become opportunities for new journeys [188]. Similarly, Howell et al. examine failure through the lens of retrospective trioethnography, reflecting on past projects to uncover failures that were not included in their success narratives and leading to more rigorous knowledge production by exposing unconscious aspects of their experience. [224]. Recognizing such failures that are not captured in the academic publication is vital for the field as it challenges the pressure toward neat, performative successes, and eventually contributes to the framing and understanding of an important epistemic value of RtD that often resides precisely within these messy, undocumented moments of tension, friction, pivoting and failure.

Rather than taking design knowledge as a static output, evolving RtD literature emphasizes how design insights emerge dynamically through practice, documentation and temporal reflection. Therefore, different ways of capturing, reflecting on, and archiving the design research process have become critical to how design knowledge is constructed and communicated. The efforts to pursue the design research process have led to unpacking the different kinds of knowledge acquired throughout the process. The early concepts of Annotated Portfolios articulate design processes and outcomes as knowledge, which later expanded to intermediate knowledge that explores how design artifacts and annotations can contribute to knowledge creation in academic research [170, 286]. Bardzell et al. demonstrate that documenting the research process is essential for capturing and translating design knowledge into generative academic knowledge [22]. Desjardins and Key focus on the ‘through’ part of Research through Design, revealing how critical design insights are constructed from the untold, messy, and non-linear realities [111]. Expanding on the temporal aspects, Oogjes and Desjardins propose a vocabulary to articulate the temporalities of RtD, illustrating a shift in perspective on how design insights are formed, recognized, and reported [351]. Collectively, these works explain how knowledge production in RtD is an active, ongoing

process, where documentation and temporal reflection from messy design activities turn into valuable insights.

Taken together, this dissertation is deeply positioned within this methodological landscape. My research directly builds on existing RtD work to pay close attention to the messy realities, such as a series of pivoting and long-term negotiations, by actively documenting and reflecting on the details in the design process. Throughout my seven-year research trajectory, I have leveraged Researcher through Design to examine the underexplored area of blind people's reminiscence practices. Employing a variety of tools and methods, I engaged with blind collaborators to co-speculate sonic mementos, positioning the interactive activities and artifacts produced in the process as critical instruments of inquiry for unpacking their situated everyday experiences of reminiscence.

2.4. Participatory Design, Positionality, and Relational Ethics in HCI

Participatory Design (PD) is an approach in which people who use the system play a critical role in designing it. PD originated in the Scandinavian context, with a deep connection to democracy, values, and conflict as a design resource, encompassing not only technological change but also changes in people, organizations, and practice, along with the imagined use of the system [191]. Over the past two decades, this democratic ethos has shifted design research from a user-centred paradigm—where designers merely observe users—toward a landscape of co-design with active participation. As Sanders and Stappers trace, this evolution of design research and practice redefines the roles of researchers, designers and users, reshaping the landscape of design [402]. They distinguish *co-creation* as any act of collective creativity applicable across many domains shared by two or more people, while defining *co-design* as a specific application of collective creativity across the entire design process, involving both designers and people not trained in design.

However, although the democratization of the design process has expanded the reach of HCI and design research, applying co-design frameworks, often generalized to the general public and people without disabilities, to disabled and marginalized communities without a critical lens has frequently resulted in shallow interventions,

misunderstanding of values and misguided empathy. Therefore, there have been calls for critical considerations and perspectives on designing for disability to challenge the traditional accessibility paradigm that focuses on framing disabilities as negative. Moving beyond experience-based approaches to empathy, Spiel et al. combine Actor-Network Theory and Critical Discourse Analysis to construct a holistic, nuanced understanding of neurodivergent children's experiences with technology [423]. Bennett et al. advocate for a fundamental paradigm shift that prioritizes the lived experiences of disabled individuals as central contributors and design experts by including their voices in design and prioritizing their role as central contributors [36]. Bennett and Rosner further criticize how simulation-based *empathy activities* can inadvertently distance people with disabilities by reducing their lived realities to a temporary impairment and reinforcing paternalistic design biases [37]. This is also highlighted in Hofmann et al. through a reflexive analysis of instances where their own disabilities were misunderstood by researchers, offering methods to better integrate the authentic, situated knowledge of disabled individuals [220]. Ymous et al. identify the epistemic injustice experienced by disabled scholars in the HCI field through a series of vignettes [505]. These vignettes illustrate the consequences of pervasive dehumanization that results when academic narratives are created without direct participation, ultimately aiming to reclaim the ownership of their narratives. Grounded in these initiatives, Spiel et al. advocate for a formalized community of researchers dedicated to pursuing the perspective of critical disability studies within HCI [430].

These critical re-evaluations of disability design intersect directly with discussions around relational ethics, pluralism, and diversity within the design process. Ethical considerations in HCI and design research have evolved from viewing participants as passive users of accessible devices and services to recognizing them as people with unique personal perspectives and lived experiences. Within HCI, efforts to broaden understanding of marginalized populations and individuals have taken several methodological approaches. In Experience-Centred Design, Wright and McCarthy emphasize empathy and dialogue to account for the full human experience [500], shifting the perspective of *knowing the user* from cognitive usability to responding to the user's world from their own perspective. The authors note that empathy is an attitude, an orientation towards understanding and helping the user by being attentive to the affective and emotional aspects of the human relationship between designers and users,

which is not something that is achieved through a single method. On the other hand, Participatory Design (PD) more directly addresses power and agency by shifting from empathetic observation to democratic design practice. Galleguillos and Coskun review 46 PD projects involving less privileged participants, identifying participant diversity, methods, and stages of involvement. Yet, they argue for more transparency and open communication in PD practices, encouraging critical reflection on how methods ensure participant influence, how methods align with participant needs, and how participation influences design outcomes [267].

These relational and participatory commitments to centring dialogic engagement, shared agency, and mutual accountability align closely with feminist values in interaction design, such as reciprocity, intersectionality, plurality, and long-term care. Fox and Rosner demonstrate how the research dialogue can be sustained well beyond the initial study timeline by creating and distributing localized community zines, offering strategies for staying connected with research sites [151]. Building on their previous feminist work, Fox et al. focus on intersectional feminist perspectives within the CSCW community to analyze how power, oppression, and systemic privilege operate in the design of socio-technical systems [149]. Without this intersectional rigour, institutional diversity initiatives often lose their meaning. Colusso et al. (2019) use design fiction and visual parody to illustrate the potential unintended consequences of diversity initiatives, revealing how diversity can become a superficial branding exercise that obscures deeper issues of inequality [91].

In the context of my dissertation, this rich body of literature provides a strong foundation with a critical lens and ethical responsibility for working with and supporting my participants, taking ethics as an ongoing, situated commitment of care and sustained accountability throughout the research process. My research directly responds to the extractive tendencies often present in disability-focused participatory work. Rather than treating the blind community as a site for collecting data, my work builds on ethical commitment rooted in reciprocity and care, sharing creative agency and returning outcomes and insights to my collaborators over time.

2.5. Designing For, Designing With and Co-creating with People with Blindness

In the HCI community, designers and researchers have collaborated with people with blindness (often grouped with people with different levels of visual impairment) across various topics and contexts. Historically, designing for people with blindness has been approached from solutionist perspective, mostly focused on practical and daily accessibility challenges in the context of assistive technology, such as mobility/navigation [18, 52, 90, 139, 146, 248, 400, 459], position/location tracking [295, 315], substitutive senses [82, 238, 263], screen reader and usability [53, 70, 137, 165], and braille conversion [219], to name a few. Consequently, the term *assistive* has been criticized because it connotes that people with disabilities need *assistance* from a fully-abled perspective without direct involvement and participation of people with disabilities [505]. This is a questionable proposition because every technology assists people in accomplishing things in a “better” way, but it is only referred to as “assistive” when we aim to marginalize disabled people by assuming they need assistance to take part in an abled world [96, 430]. 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 [271]. The 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 [214] 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.

Supporting and enriching other important aspects of blind people’s lives through technologically mediated experiences would require blind people’s participation. Researchers have emphasized that normative approaches to “practicing empathy” by mimicking being blind through using blindfolds are counterproductive at best and often

inappropriate and insulting [37]. Silverman [417] explains that a temporary roleplay increases empathy, but such a short experience could lead to miscommunication between the designers and the people who actually use it. Instead, the author encourages heuristic learning about blind people's challenges and preferences through collaborative activities and positive engagement. In advocating new pathways, researchers have argued that it is essential to foster rich, inclusive, and deep engagement with people with disabilities and other populations throughout the design process [36, 292, 396]. In this vein, Magnusson et al. offer inspiration and practical suggestions for designing for and with people with visual impairments, emphasizing a co-design approach grounded in an inclusive mindset [291]. Similarly, blind scholars have emphasized the critical need to acknowledge the design capabilities of people with disabilities [36]. By the same token, Participatory Design continually advocates for involving people in the design process. In particular, Metatla et al. [303], have shown a number of avenues for conducting participatory design research that does not necessitate vision to partake. Muller [314] introduces a number of narrative structures in the participatory approach, such as stories, photographs, dramas, videos and games. Also, Brewer reports on the challenges of conducting voice- and tactile-based co-design workshops with people with visual impairments, offering a critical discussion of co-design approaches to better facilitate workshops for the visually-impaired [60].

While these works have challenged the top-down, solutionist framing of assistive technology, the overarching paradigm of co-designing with blind people has still not yet moved past immediate accessibility challenges. Most of the collaborative research in this space still leaves deeper, situated nuances of blind people's everyday life experiences largely underexplored. Consequently, empirical research into the specific values, emotional landscapes, and personal desires that truly matter to people with blindness—such as reminiscence, playfulness, social connection and self-reflection—remains limited within the HCI literature. To design for the fullness of blind people’s experience, there must need more research that shifts its focus away from practicality and toward open-ended, experiential inquiries. This may require developing and deploying creative, idiosyncratic artifacts and co-design activities that takes blind people as creative experts of their own lived experiences. For example, Hauser et al. [207] 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 with vision impairment from a ludic, experience-centred perspective.

In other domains outside blindness and reminiscence, this shift has prompted a variety of co-design techniques and approaches aimed at closer, more creative engagement with participants. For example, Berger et al. developed co-design workshops to support people's creative ideation for emotionally valuable smart objects in the home [38], while Wakkary and Andersen introduce the *Magic Machine* [12], a novel workshop technique that leverages open-ended making to unlock participants' creative potential and unique perspectives on technology to support the creation of deeply personal materials. Similarly, engaging non-experts through DIY making, Gaver et al. deploy *YoYo Machines* [174], an open-source DIY design kit that enables people to construct and customize their own peripheral and expressive communication devices to help them stay socially connected while physically separated during the pandemic. In community-based contexts, Hay demonstrates collaborative zine-making as a PD process and discusses its contribution to the co-construction of meaning [209]. Further, Frauenberger et al. [157] developed a series of participatory activities that engaged sensory interest and storytelling to help children with special needs co-create a technologically enhanced learning environment. Briggs et al. [61] produced short movies featuring different use-case scenarios for technology that is not explicitly shown in the films, using the ambiguity of the technology featured in the films to trigger creative imagination in participants, namely *Invisible Design*. Similarly, Vines et al. [468] introduced *Questionable Concepts* to discuss new banking technologies for older adults by creating a set of concept cards of serious and playful ideas, allowing the ambiguity of concepts to lead to new insights.

More importantly, there is a body of work that carefully documents the entire co-design process to emphasize the consideration of multiple positionalities and sustainable outcomes. Bonetti et al. [51] document a full co-design process with children to co-create *Emotional Capsule*, an interactive object for collecting unexpressed emotions and sharing them anonymously within the classroom. Groten [192] explores how collaborative design practices can challenge and unsettle normative, individualized design approaches, highlighting the plurality of positions and voices in design artifacts and processes. Scheepmaker et al. [405] discuss the design of a sociomaterial toolkit for

teachers to empower neurodiverse children's creative engagement with technologies, also emphasizing the challenge of leaving sustainable outcomes when a project comes to an end.

Together, these prior works on how co-design practice has been shifting in other domains reveal the gap in designing for and with people with blindness. At the same time, they have deeply inspired and shaped the research program and methodological goals of this dissertation, taking a pivotal turn in the design dialogue toward a critical focus on plural perspectives and values, relational ethics, and creative, engaging design activities in the domain of blindness and reminiscence.

2.6. Summary

Collectively, this literature review chapter outlines a critical need to reframe technology-mediated reminiscence from its visual-centred paradigm, to better support blind people's reminiscence experiences by more deeply engaging with the evocative, situated, and non-visual dimensions of reminiscence that is rooted in blind people's lived experiences. Methodologically, although critical accessibility and participatory frameworks have challenged top-down, solutionist perspectives of assistive technology, there is still limited research on documenting non-extractive, co-creative design process with people with blindness. To address these systemic empirical and methodological gaps, I adopt RtD as the primary methodology, complemented by long-term PD and co-design methods specifically tailored to the lived experiences and desires of the research participants, to probe on the possibilities and opportunities for interactive technology to support meaningful everyday reminiscence experiences for people with blindness.

Chapter 3.

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

3.1. Overview

As noted in the Introduction, I started my research inquiry by reviewing literature on blindness and reminiscence. However, back in 2018, when I first started this project, there was no relevant prior work in this specific intersection. Although Blindness and Reminiscence are two actively researched topics in HCI, research on Blindness in HCI has largely touched on accessibility issues and practical challenges, such as mobility, navigation, and accessible tools, which are often designed with "sighted" in mind [37, 271]. On the other hand, Reminiscence is mostly studied from the perspective of memory research on older adults with dementia or in medical contexts, such as how memory functions in the brain. Therefore, I decided to take a qualitative, participatory design approach to understand blind people's lived experiences and to move away from the "sighted in mind" perspective. This proposed the following research question for the first, exploratory research for my thesis project:

RQ1: What are the ways people with blindness capture, revisit and share meaningful life experiences and memories, and what is the role of interactive technology in supporting their reminiscence experiences and memory practices?

To address this research question, I conducted in-depth, qualitative research with people with blindness to listen to their experiences of reminiscing and remembering, the challenges and desires in their memory practices, and their expectations of technology in the context of reminiscence to draw design opportunities to support situated, nuanced reminiscence experiences for people with blindness. I recruited 9 people with blindness and visited their homes to conduct individual semi-structured interviews. Participants shared their everyday experiences of making and sharing memories and also showed a collection of meaningful mementos and places in their homes. In total, 9 interviews generated more than 17 hours of recordings, field notes and visual documentation

(photos and videos). Analyzing the collected data, we found emerging themes on how people with blindness capture and remember the past, the use of physical and digital possessions for reminiscence, and desires for future practices of reminiscence. Building on these findings, we suggested three design opportunities to support reminiscence experiences for people with blindness: (i) *Remembering through Sound*, such as audio recordings, voices and soundscapes, (ii) *Remembering through Social Interactions*, such as visual descriptions, storytelling, and shared memories, and (iii) *Remembering through Tactile Impressions*, such as physical objects and their presence and tangible aesthetics. In this chapter, I unpack the details of this exploratory design study[1].

[1] This chapter is adapted from a publication in ACM CHI'21 conference: MinYoung Yoo, William Odom, and Arne Berger. "Understanding everyday experiences of reminiscence for people with blindness: Practices, tensions and probing new design possibilities." In Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems, pp. 1-15. 2021.

3.2. Introduction

Material possessions play important roles in mediating people's experiences of reminiscing on past life experiences and reflecting on the future [32, 73, 101, 479]. 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 [236]. As technologies have become widely adopted, people's practices have extended due in part to growing amounts of personal data archives (e.g., [134, 259, 344]). Along with these shifts, there are 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 over time (e.g., [135, 173, 448, 454]). 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., [57, 95, 328, 345, 360, 366]). Yet, despite its size, this body of work has largely focused on sighted populations. We believe it is necessary and incumbent on the HCI community to include more diverse people and populations. Our research aims to open up an area that has not received much attention to date: people with blindness.

The majority of HCI research related to people with blindness focuses on overcoming practical challenges, such as spatial navigation (e.g., [90]) and usability (e.g., [53]). This work has made major contributions to designing technology that helps improve the lives of people 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.

This research project takes a step towards better understanding the experiences of reminiscence among people with blindness. Specifically, we conducted a qualitative field study with 9 participants with blindness (7 early blind and 2 late blind) investigating their practices of individual and social reminisce. This paper makes two contributions. First, we offer a rich, in-depth understanding of our participants' situated practices, cherished artifacts, social interactions, as well as perceived challenges and desires related to their experiences of reminiscence. Second, we 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 with blindness in capturing, sharing, and reflecting on significant memories from the past.

3.3. Background

Related work falls in two areas: designing for and with people with visual impairment; and personal data and digital possessions.

3.3.1. Designing for and with People 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 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 [18, 90, 139, 146, 248, 415, 459], web browsing and usability [53, 70], and screen readers [137, 407]). 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 [505]. 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 [96, 430].

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 [271]. 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. This makes users with disabilities return to their original habits and inventive workarounds that they had developed. Hersh and

Johnson [214] 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 [37]. 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 [36, 292, 383, 396]. Relatedly, from a universal design standpoint, a world designed with disabled users in mind would lead to better accessibility for everyone [199]. Similarly, Silverman [417] encourages a heuristic learning of the challenges and preferences of people with blindness through face-to-face collaborative activities that promote the positive involvement of people who are designed for. More broadly, Hauser et al. [207] 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 with vision impairment from a ludic, experience-centered perspective.

To date, research into how people with blindness capture, keep, share, and reflect on their life experiences in support of reminiscence, self-reflection and social connection has been largely overlooked. Our work contributes to this literature by presenting a rich understanding of experiences, practices, needs and desires of people with blindness around capturing, archiving and revisiting moments in their lives through technology.

3.3.2. Personal Data and Digital Possessions for Remembering and Reminiscence

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 [101] articulate the complex ways material things represent the development of life goals and

achievements. Belk [32] 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 [296]. 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 [73, 479].

As technologies have become widely adopted, people's practices have extended, due in part to growing amounts of personal data archives [344, 464, 471]. 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., [85, 212, 334, 337, 341, 489]). 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., [463]) as well as to support the capture and exploration of images, video, audio recordings, and location histories [226, 301, 453].

There is a body of research that highlights the value of re-experiencing digital data from the past, including social media, emails, online maps, chat logs, photos, and music, to support experiences of reminiscence [57, 117, 240, 311, 360, 366, 447, 484]. For example, Cosley et al. present a system that supports "individual, spontaneous reminiscence" by sending memory triggers collected from social media contents [361] and reflect further on the experiences of everyday reminiscence, especially autobiographical memories for self-reflection [95, 367].

Yet, prior research has largely focused on non-disabled populations, and it is important that the HCI community make efforts to include more diverse populations. Very limited research in HCI has revealed that people with visual impairment do actively engaging with personal data that include such as photographs and on social media platforms [35]. However, there has been no research into the ways in which people with

blindness experience reminiscence and the role of digital and non-digital possession shaping these practices.

Collectively, our work 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, we aim to build on and extend prior work by inquiring into the unique experiences and perspectives of people with blindness. Beyond work that has come before, we offer new findings on how people 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 with blindness.

3.4. Field Study Method

3.4.1. Positionality of Research Team and Participant Recruitment

For this study, our target group was people with blindness. The reason we selected this population is because in Canada, where we conducted our research, the blind community comprises only 10% of the total size of the vision-impaired community [289]. By targeting a more marginalized population, we hoped the result of the research could also be applicable and beneficial to the larger vision-impaired community. This approach does present limitations; for example, it makes it hard to generalize findings to ‘all’ people with blindness. However, considering the lack of work in this area, we wanted to begin with a smaller, but diverse group of people with blindness to gain a richer descriptive understanding of their practices, needs, and desires as a whole to inform what might be salient issues for future research.

Our research team was comprised of three primary researchers, none of which are blind or experience severe visual impairments; and it is important to acknowledge our positionality. Author 1 has conducted 1 year of participant engagement and observation with a local non-profit organizational branch of a major national institute for the blind. Author 2 has prior experience volunteering with a non-profit social program that paired younger adults with older adults that are living with vision impairment, where the primary goal is to support positive intergenerational socialization and dialogue. Author 3 has completed 1 year of community service volunteer work in a school for blind

and visually impaired students and, more broadly, has 6 years of experience in co-designing together with people from different walks of life and different abilities. These lived experiences have provided our research team, individually and collectively, with first-hand insights into the lives of some people with vision impairment. However, in we ourselves cannot experience what it is like to live with vision impairment or blindness; and this is an important limitation to acknowledge. These experiences did play a role in our intention to conduct this research project through a sensitive and careful approach with the aims to foregrounding our participants' voices and open up new possibilities that, through further exploration, could positively shape the lives of people with blindness.

With this in mind, we first approached by visiting a local non-profit organizational branch of the Canadian National Institute for the Blind (CNIB) and used a snowball sampling approach to recruit our participants. Then, more participants were recruited through online flyers and word-of-mouth. We recruited a total of 9 participants (4 females and 5 males) from the metropolitan area of a large city in western Canada where this research was conducted. Our resulting sample represented a pool of people with blindness at different life stages and in many different occupations. Importantly, 7 participants are 'early blind', meaning that they were blind from or very soon after birth. 2 of our participants became completely blind later in life (known as 'late blind'). Although the blind community is a highly heterogeneous group, early-blind and late-blind persons were both recruited for this initial exploratory study. Our field research concluded in February 2020 as the global pandemic set in, and further in-person research with human subjects was restricted (at this time, we had already captured over 17 hours of interview data). We refer to each participant with a pseudonym.

- **Luis** (mid-30s, early-blind) loves sailing, lives on a sailboat, and is fluent with technology.
- **Ray** (mid-30s, early-blind) became totally blind at the age of three. He is a martial arts instructor and a counselor for people with blindness.
- **Meg** (early-20s, early-blind) is a recent graduate from university and lives with her beloved guide dog.
- **Carol** (late-60s, early-blind) is retired and worked as a typist and in data entry for more than 20 years. She enjoys talking with her siblings (who are also blindness) over the phone.

- **Carl** (mid-60s, late-blind) was a video camera operator (for feature films) and loves photography. He lost his sight 15 years ago, and he still is a passionate photographer.
- **Jessie** (late-20s, early-blind) loves music and is training to become a music therapist.
- **Janet** (late-60s, early-blind) is retired and worked as a special education instructor for visually impaired people for many years.
- **Frank** (early-70s, early-blind) is Carol's blind sibling who always liked the sound of boats and cars. He enjoys going on boat trips and listening to audiobooks.
- **Rob** (early-60s, late-blind) became totally blind in his 30s. He is a technology counsellor for people with blindness. Rob loves technology and travelling.

3.4.2. Study Details and Data Collection

We conducted one-on-one semi-structured interview sessions with each participant in their home that lasted between 1.5 to 2.5 hours. We selected participant's home settings as the site for our research because it enabled them to provide first-hand insights into where they kept meaningful possessions as well as how they mediated their practices of reminiscing on the past. Each interview session a range of retrospective and prospective topics. The retrospective part aimed to develop an understanding of each participant's orientations toward their patterns and rhythms in their practices of reminiscing on the past. This involved an introductory interview exploring how specific triggers or cues brought back past memories, the role of physical or digital possessions in these processes, and how current life experiences are captured (whether physically or digitally). This part helped establish a baseline for understanding participants' attitudes and orientations toward reminiscence. Participants gave consent to use photos of themselves as well as their homes, possessions, and personal stories within academic publications and presentations.

We then asked participants to give us a home tour to help us understand the kinds of meaningful possessions they kept, how often and in what ways they interacted with them, and the narratives they attributed to them. We asked participants to show physical or digital possessions. We paid close attention to the language participants used to describe similarities and difference, and how they triggered reflective experiences. This often led to detailed descriptions of personal experiences, thoughts

and/or challenges regarding most artifacts. These tours provided a situated approach to facilitate participants in sharing personal experiences and to probe on tensions that emerged with their significant possessions (whether digital or physical).

The final part of the interview aimed to initiate an exploratory, generative dialogue on participants' desires for capturing, keeping, and revisiting memories. Participants often shared insights on where technology failed to support their desires and practices. We concluded the study by giving participants an opportunity to ask questions about our research, future directions, or to elaborate on topics they wished to discuss.

3.4.3. Data Analysis

We audio-recorded all interviews and took field notes and documentary photographs. Analysis of the data had been an ongoing process as the interviews were proceeded. The recordings from the study produced 17+ hours of recordings. Relevant segments in the recordings were transcribed. After each interview, field notes, video, and photographs were repeatedly reviewed by the research team. Open coding was used to surface tentative insights that were noted and grouped to identify emergent patterns across the data [98, 184]. Through this iterative process, the research team organized data into themes. Data was coded in weekly meetings; overlaps and differences in interpretations of the data were discussed through Axial coding [98, 306]. We also created conceptual models and affinity diagrams to reveal unexpected connections across participants. Bi-weekly meetings were also held with lab members outside of the project to challenge our assumptions and to corroborate the themes.

3.5. Findings

In the following sections, we present several examples taken from field observations and interviews with participants that capture the emerging themes: how memories are sensorially captured and evoked; how physical and digital possessions mediate individual/social experiences of reminiscence, and emergent tensions in situations of social reminiscence; and desires for future practices of reminiscence.

3.5.1. Pathways to Capturing and Remembering the Past

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, we provide examples that help illustrate these different experiential qualities, place-based associations, and social practices of capturing memories and looking back on the past.

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.

Touch represented a highly significant sense that participants frequently mentioned across our interviews. **Ray** characterized tangible textures on cherished physical objects as offering among the strongest "gateway to the past." **Ray** mentioned that he used to create his own artwork to remember special experiences. On top of that, he described a cherished set of action figures from his childhood, each of which he attributed very specific memories:

> The 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. This is why sometimes I go out of my way to track down an action figure that I remember from my childhood. 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. (**Ray**)



Figure 3.1. Ray's two action figures are on the table in the living room (left); Ray's artworks that resemble superheroes (right).

Nearly all participants shared **Ray's** viewpoint and remarked that tangible gateways to the past could be accessed by running their fingers over their respective material possessions. After enough tactile experiences had accumulated and the texture had been memorized, several participants reported being able to recall the 'feel' of the object and access this gateway to past memories without having to touch it.

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 remembered serendipitously encountering key smells in her everyday life could trigger vivid memories of past travel experiences of particular locations during a specific season. **Rob** described how he captures an important life experience through by a mixture of his senses:

> 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 makes me really appreciate the different sounds of trees. 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.

Recollecting Through Being in the Place

Another key general theme in our 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. The locations that led to these experiences for participants were diverse, ranging from **Meg's** bedroom to **Jessie's** kitchen, to the cockpit and cabin of **Luis's** sailboat. **Meg** associated many memories with her beloved guide dogs. She elaborated on the significance of her bedroom:

> 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 an emotional area. (**Meg**)

Participants were often able to describe and reflect on their past experiences within places of personal significance. **Jessie** said the more time she spent in a place, the more special and meaningful it got. She remembered numerous mundane but valued memories are made in the kitchen through all the rushed and lazy mornings. When **Luis** was asked to share the most memorable place on his boat, he answered:

> Easy. Cockpit. Because the cockpit is where on a nice sunny day, you seat at the back of the boat, my friend and I are sailing, or 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. (**Luis**)

Just by mentioning the place, **Luis** was able to recall very specific details of associated memories – not only about the place, but also about the people he spent time with. Participants' favorite spots evoked emotional memories from their past. 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.

Visual Descriptions from Other People

Our 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. As an early-blind person, **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 seen things [like a sunset or an orange color]. 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 a wondrous voice. I look through his eyes. Whenever it's a visual concept, it's always through the eyes of somebody else. I treasure those descriptions. 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 late-blind person who lost his sight completely in his 30s, **Rob** described an intimate collaborative practice shared with his sighted wife when capturing memorable landscapes and vistas:

> When [my wife] and I go for a walk, a beautiful little bay where the sun setting over the backside of the Island is quite spectacular. I will never ever lament the lack of access to that. When we see the beautiful sunset, [my wife] starts to explain what she sees; colors, shapes and all that stuff. I thoroughly enjoy it while I'm there and while I'm experiencing with her. 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. Next, we turn to the varied roles that physical and digital possessions played in mediating participant's practices of capturing and revisiting memories.

3.5.2. Possessions as Resources for Reminiscence

Participants kept cherished possessions that were closely connected to their past memories. We observed a wide range of possessions, including physical objects like photos, analog recordings, and mementos that were kept, often in highly personalized collections in the home. We 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. Next,

we offer examples that help capture themes representing our participants' interactions with and orientations towards these things.

Ambient and Focused Sound

Across all participants, we found that audio recordings emerged as the primary type of digital possession that they cherished and revisited. As **Ray** put it, the voice recording software on smartphones enabled him to "have the luxury [of] keeping the memories alive." During the interview, **Luis** said to the research team, "audio recordings for us are like photographs for you guys." The recordings "[serve] like a reminder" for memories as they 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 us 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. Recordings of ambient sound were often used to capture the emotional feeling and atmospheric timbre of experience as a whole. For example, **Frank** described going on boat trips and making many digital recordings that capture a diversity of sounds from the tour:

> I said to people 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**)

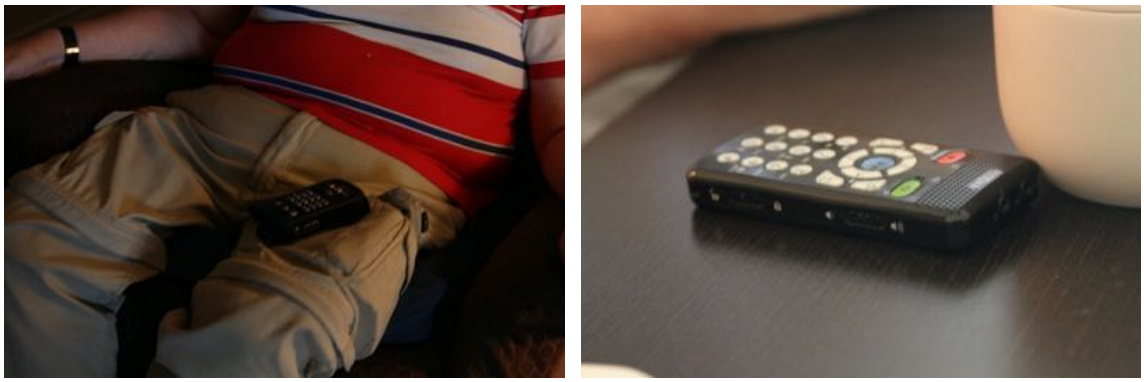

Figure 3.2. Frank's digital recorder which can also play audiobooks (left); Carl's digital audio recorder (right).

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

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:

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

However, across our participants, we commonly 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.

Visual 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. 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. For example, **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. At the end of that, they offered me that I could buy a photo. I was, 'Okay, this would be cool to bring back to my friend,' but [the photo itself] was nothing to me, but my friends were like, 'Oh **Luis**, there you are on an elephant!'
>
> For me, the bigger memory was the handmade photo frame from the village. It has woven cloth, and all around the edges were all the beads. A photo frame was a much more significant memento or a keepsake than the actual photo inside. For sighted people, the frame would just the consolation prize, but for me, it was the main event, and the photo was the consolation prize. (**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.



Figure 3.3. Similar to Frank (pictured here), many participants enjoyed showing photos on the wall and describing memories they associated with each photo.

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 revisiting those experiences], I can discern a lot from just by the automatic [timestamp and location] data that’s captured. (**Luis**)

Video was another preferred resource for reminiscence due to its combination of visual and audio components. **Jessie** describes 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 [others can] see what they're doing. (**Jessie**)

Echoing Jessie, **Rob** highlighted video was his most preferred way to capture memorable moments. He shared his experience of going back to recordings of family interviews, which evoked sentimental feelings and vivid recollections:

> We pulled all the recordings, lots of pictures, categorized them in different folders and put that together in two DVDs. 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**)

Our participants also 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 with visual impairment (which the screen reader can read) enabled social media to offer a valuable resource to support reminiscence on the past. **Meg**, like many of our participants, described her practice of writing customized descriptions of photos that she shared on Facebook that were specifically tailored toward her friends who are blind (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**)

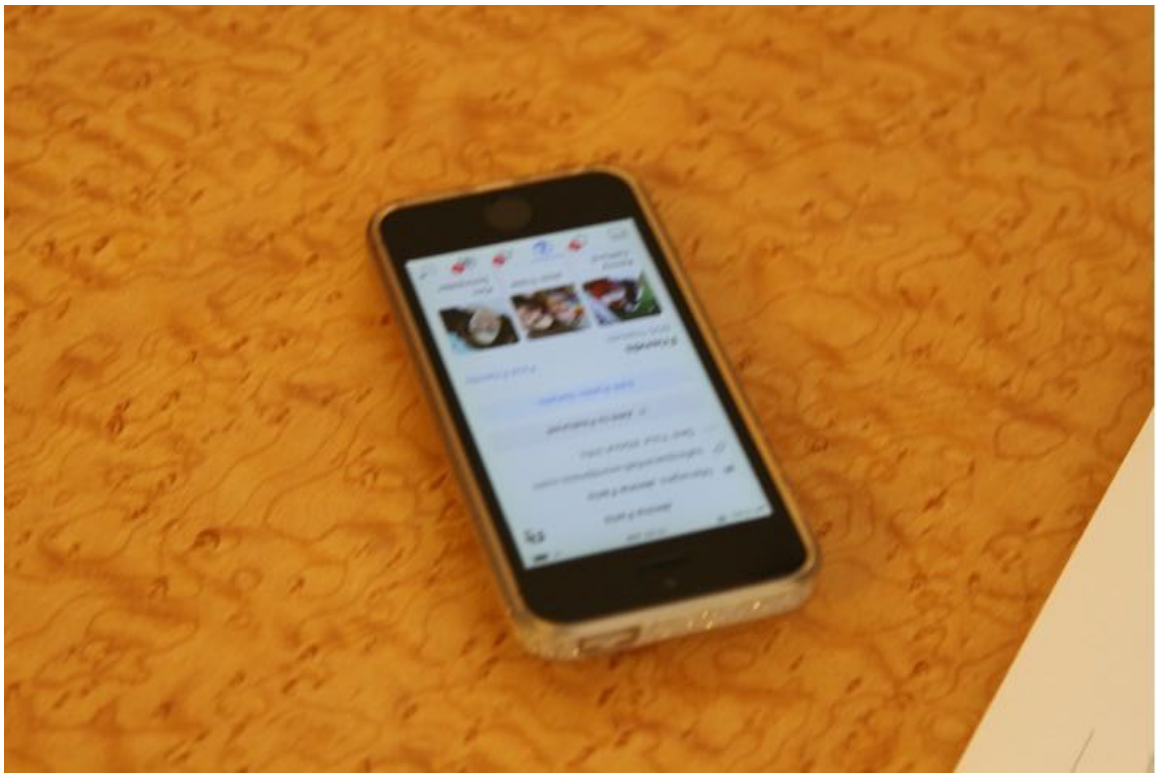

Figure 3.4. Participants were highly active on social media, often using it for interacting not only with people they also commonly encounter in person, but also people they meet online.

Our 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. Before we left, we created a private Facebook group that we only invited close friends and family to be part of 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, we posted check-ins and linked to a Wikipedia talks 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. People left comments and questions across our trip. 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**)

Emergent Tensions in using Digital Possessions as Resources for Collocated Reminiscence

The use of visually-oriented possessions to mediate social, collocated experiences of reminiscence could also lead to tensions. All participants reported that at some point, they felt emotionally distant when revisiting memories with others with sight, especially during family gatherings, where many past memories were shared through photo albums:

> [Photo albums] makes 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. I feel like I am missing out on all these pictures. (**Jessie**)

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**)

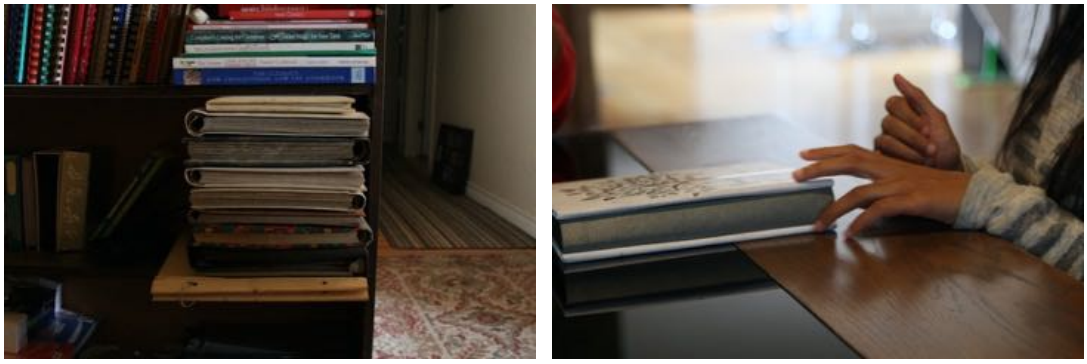

Figure 3.5. Photo albums often created tensions between participants and sighted loved ones when they were drawn on as resources to support the practice of collocated memory sharing.

Revisiting memories through solely audio recordings sometimes did not resonate well with sighted loved ones. 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.

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.

3.5.3. Towards Future Practices of Reminiscence

Our field study also probed on our participants' future expectations and desires for how design interventions might better support their practices of reminiscence and reflection.

Values in AI Image Description

In earlier sections, we have reported on the value and richness that participants attributed to loved one's verbal descriptions of places and life events. These actions provided participants with vivid details of a significant memory, as well as the opportunity to establish an emotional connection with the person that conveyed the description. While it was not expected to be the 'same', our 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 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**)

Although **Ray** became blind at age 3, he had no memory of the color red or what any other color "looked like." Nonetheless, knowing that his mother's hair color was red in the photo remained important to him. This sentiment was common across participants (e.g., although **Luis** had no knowledge of what the color orange is on a visual level, it was valuable for him to be aware of where it was in his photos). Many participants used AI-image description, or simply relied on other loved ones, to understand the location and connection of particular colors in relation to the people or experiences captured on photos.

Inclusion and Experiences with Tactile Photography

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. However, most participants had been largely unable to use tactile photography due to a high cost in production as each was 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.

Interestingly, **Janet** had prior experience teaching children with blindness to learn to read tactile photography from various stock photos that represented both abstract and real situations. She noted that a key challenge is that while people 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 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 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 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. (**Ray**)

Crafting a Legacy to Pass Down

Our 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'd 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, to help people understand what it was like at the time when I was alive compared to how different it is when they are alive.
>
> Once, somebody gave me a little 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. So, when 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 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.

3.6. Discussion and Implications

While there is a growing amount of HCI research on improving technology to better support experiences of reminiscence, people who have disabilities have largely been overlooked; and, as a consequence, little is known about the practices and experiences of people with blindness. A key contribution of our study is to provide a richer understanding of how people with blindness capture, share, recollect and reminisce on past life experiences in light of their needs and desires. We found 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 our participants or for their loved ones. Next, we describe a set of design possibilities that build on themes in our findings and extend them through a generative perspective. Importantly, our 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 with blindness.

3.6.1. Remembering through Sound

Our 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.

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 our 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 [117, 121, 348, 366]. 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., [122, 301, 379]), 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 with blindness could be one possible direction. Additionally, building on prior research proposing interactive sonic jewellery [324], 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.

Exploring the Potential of Asynchronous Audio Sharing Systems to Mitigate Tensions

While our 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. Our 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. [117] and Oleksik et al.'s [348] 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.

We 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 [215, 246, 282, 347] 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.

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

Our findings also build on recent work that dispels a misconception that people with blindness are not interested in or engage with digital photos and visually-oriented dynamic media [35]. Although our participant pool was diverse in terms of life stage and background, 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.

Supporting Collocated Remembering

Prior HCI research has shown the value of pairing descriptive audio with photographs [164, 294] 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 [163, 215, 330, 341, 345, 371, 453, 454]. 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 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* [164] 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 [366] 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 [334, 343] 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 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.

3.6.3. Remembering through Unique Tangible Experiential Metadata

Advances in additive and subtractive manufacturing (e.g., 3D printing, 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. We found physical features of cherished possessions were key catalysts for our 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.

Translating Visual Memories to Tactile Photos

Tactile photos could act as a resource for connecting people 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 [303, 319, 325]. 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.

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 [311, 325, 364]. 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 [422]. One direction that could help alleviate some of these barriers is through leveraging existing communities, such as See3D [446], 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.

Yet, 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 [112, 162, 325]. 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 with blindness to create other forms of digitally fabricated mementos and memory objects [57, 325, 326, 410]. Likewise, this is a broader opportunity for inclusion, taking the form of either online communities or in-person maker spaces, where people with blindness and people with sight can mingle and benefit from the unique capabilities and perspectives of each other.

3.7. Conclusion and Future Work

We have explored how people with blindness engage in practices of individual and collective reminiscence on the past. A key goal of our paper 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 with blindness based on their own practices, needs and desires. Findings revealed novel ways that our 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, we 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.

We see each of these areas as generative opportunities to directly engage people with blindness in co-design activities to further develop design interventions and to question what kind of futures are desirable (and undesirable). Through the process of conducting this research, we found that nearly all of our participants expressed the realization that they themselves wished to find out more about the reminiscence experiences of people with blindness and, in several cases, desired to meet other study participants. Also, we recognize that it is necessary and needed step to appropriately deliver the result of this study back to our participants to build on these findings together. Therefore, we are in the process of distributing the digital manuscript of this paper as well as vignettes and anecdotes distilled from our interviews in forms that we hope will be rich and engaging for our participants. Our 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, we 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.

Chapter 4.

Storywork & Reciprocity: On the Design of an Audio Documentary that Extends HCI Research back to Participants

4.1. Overview

Building on the exploratory study, I further investigated Remembering through Sound using a participatory, co-design approach. Upon concluding this exploratory phase, there was an issue with sharing the research outcomes and findings from the 9 individual interviews. Since the interviews were individual, our participants were genuinely curious and wanted to know what others shared because they had never been asked about deep questions on reminiscence. Also, because we were unable to host any in-person gatherings due to the pandemic and did not want to share the published paper as PDFs, there was a significant gap before moving on to the next phase. These challenges led to the following research question:

RQ2: How can research insights derived from the research participants' lived experiences be shared and translated back into reciprocal design practices so that they can engage with the research insights and knowledge in meaningful ways?

This research question became a strong motivation to explore alternative ways to share our findings in a suitable form for our participants. We collaborated with a sound studies lab in the communication department to create an audio summary of the published paper. As a result, we created an hour-long audio documentary as an alternative form of research publication. In the following sections, I unpack the details of theoretical positioning and production of the audio documentary[2].

[2] This chapter is adapted from a publication in ACM DIS'22 conference: MinYoung Yoo, Lauren Knight, William Odom, and Arne Berger. "Storywork & Reciprocity: On the Design of an Audio Documentary that Extends HCI Research back to Participants." In Proceedings of the 2022 ACM Designing Interactive Systems Conference, pp. 1345-1357. 2022.

4.2. Introduction

The HCI and design research communities have long been concerned with studying and designing novel ways for people to use and live with interactive systems. The traditions of participatory design and co-design aim to directly involve people as core stakeholders in and across design processes. These approaches have enabled HCI and design researchers to make substantial contributions to improving and extending many ways in which technology can enable and support people across the many tasks and experiences that encompass their everyday lives. Yet, researchers who work closely with participants in the field are often confronted with ethical challenges. One specific issue is how to equitably and reciprocally "give back" to research participants once the project comes to an end [151, 405, 470]. While HCI and design researchers agree that plans need to be envisioned for what happens when a research project is completed and they "leave the field" (e.g., [169, 232, 443, 462]), it still is a recurring challenge on how exactly such strategies can be feasibly enacted. Additionally, translating theoretical or empirical knowledge derived from HCI research into a form that can positively engage both the people that participated in the research itself and the general population alike, can be slow, unpredictable, and incongruent (e.g., [31, 91, 394]).

In what ways can HCI and design researchers contribute back to the research participants and communities that support the advancement of academic knowledge for our field? How could designing more engaging and accessible forms of knowledge for the populations we work with help us take a step toward supporting such relations? And, what insights might be reflexively revealed through producing such alternative forms of knowledge?

Our point of departure into investigating these questions and grounding our own thinking in this space begins with our recent prior field study with 9 participants that are living with blindness [508]. The majority of HCI research related to people living with blindness has focused on overcoming practical challenges (e.g., spatial navigation [18] and usability [53]). The goal of our previous field research was to establish a grounded understanding in how technologies can be designed to support experiences of everyday reminiscence for blind people. Findings revealed that blind people drew on their

sensorial capabilities, their possessions, and their social relationships as resources for reminiscence, and tensions emerged complicating their practices. Interpreting these findings led to opportunities for future research aimed at creating technology that better supports capturing, sharing, and reflecting back on significant memories of past life experiences for blind people.

Another important finding was that participants realized that they had rarely been prompted to consider how they record, remember, and share their life experiences. Clearly, these practices are vital for blind people, as they are for all humans. Nearly all participants in the field study wished to find out more about the other study participants' reminiscence practices and, more generally, the experiences of other people living with blindness. This desire from our participants indicates that there is a necessary and needed step to deliver the results from the field study back to the population of study in a form that is appropriate and accessible, to spark further conversations between participants, while opening a channel to researchers as a continuation to explore longer-term participatory research. This resulting implication is aligned with broader calls in HCI and design research communities to develop alternative ways of creating and distributing knowledge back to research participants in the service of establishing more equitable relations [310, 332, 405, 429, 476]. Yet, specific cases demonstrating how such rich, unique, and accessible forms of knowledge can be created through design practice, especially in engaging with diverse groups of participants, are relatively sparse and more examples are needed to nurture and diversify this emerging area.

Building on our prior research [508], we describe and critically reflect on the seven-month design-led research process to create an engaging audio documentary made through the inclusion of our participants' voices and narratives. While research communication has gained significant momentum in the recent years – most notably audio based artifacts and performances like podcasts and science slams – a key issue is that channels between participants and from participants back to researchers are usually lacking. Our goal was to create a form that can be given back to the participants themselves as well as the broader blind community. Through specific design decisions and, eventually, implementing our audio documentary via the interactive sound platform *SoundCloud*, we aimed to both give back and simultaneously open the opportunity for participants to communicate with us, the research team, as well as with each other. This

form of research dissemination simultaneously helps us create a stronger relationship which is supportive to the longer-term participatory research we aim to produce and in building reciprocal relations. However, designing this audio documentary was not merely an act of translating their recent research paper into an audio format. Rather, this process required careful consideration to overcome several tensions related to narrative flow, treatment of participant voices, pacing, and building in communicative silences [2] for pause, reflection, and response.

To grapple with such tensions and frame our design inquiry, we are informed by concepts which are, in part, drawn from decolonial theory. Inspired by Tony Fry's assertion to 'dig where you stand' [166] – which broadly provokes designers and researchers to engage with the contemporary cultural, political, and ethical realities of where design work takes place – we were motivated to draw on key concepts from decolonial methodologies across our creative practice. Giving back to communities has long been a goal of participatory design, and this concern, along with key commitments to how knowledge is transferred, has also been examined through decolonization lenses. In the context of our own work, a set of distinct decolonial concepts helped to guide the design of the audio documentary.

In this paper, we describe and reflect on our design-led process of creating this audio documentary and interpreting critical-reflexive insights emerging through our process to propose questions, commitments, and opportunities for future research and practice. This paper makes two contributions. First, it details insights into how a design-led process can be applied to transforming an HCI research publication into an intelligible alternative form for research participants in the service of supporting reciprocity. Second, it offers a case study that helps expand conceptual strategies for mobilizing audio-based forms of HCI research.

4.3. Background and Related Work

Related work falls into the two areas: 1) participation, reciprocity, and science communication & 2) decolonial theory and sound studies.

4.3.1. Participation, Reciprocity and Science Communication

Involving people is a common goal in design, as it improves the chance that design outcomes are aligned with people's life worlds and needs [419]. From ideation to deployment, there are many design processes that promote closer involvements and participations, including a wide variety of well researched workshops, methods, and toolkits. However, the beginnings and endings of participatory design processes are notoriously difficult issues to tackle. Most academic funding cycles have set start and end dates. It is difficult to begin participatory design work because researchers have to establish relationships with people, communities, and the general public; they have to build infrastructures for fruitful disagreement, joint decision making, and negotiating values and goals. It is similarly difficult to end participatory design work. After all, participants are often quite involved in the design process and later on, may continue to integrate the tangible outcomes of the participatory design process into their work and life. It is an open challenge to make sure results are sustained when the project ends and that participants are valued for their involvement [232, 443]. As such, the participatory design community spends considerable research in designing touch points and bridges for successful onboarding and offboarding [469].

For many years, disseminating knowledge in academic papers was the somewhat natural end-point for research, with papers often being published behind paywalls and relying on academic jargon, making them hard to get and hard to grapple for people. More recently, much progress has been made in disseminating scientific publications through alternative forms such as social media, science slams, comics, zines, podcasts, DIY tutorials, design artifacts, or exhibitions (e.g., [54, 115, 124, 151, 153, 175, 180, 372]). Here, researchers explain or manifest their often complex and complicated work in more approachable and accessible terms or artifacts. Taken together, these approaches also open a way for the interested general public to have a direct backchannel to researchers. HCI design research is particularly well-suited to investigate novel avenues for opening and sustaining these modes of communication. Fallman [138] argues that the core activity of design research is to give shape and form to intangible knowledge, and in doing so, establish bridges between theory and practice. There exists a remarkable array of tangible design artifacts, aimed at initiating and

upholding conversations between designers, co-designers, and the general public (e.g., [38, 78, 129, 310, 469]).

There is, however, comparatively little attention on the opportunities of audio-based artifacts bridging design knowledge and practice. Such artifacts for science communication and knowledge dissemination span from hyper-audio to wiki-style knowledge structures explorable for marginalized groups [15], or better accessible within museum contexts [365], science songs, and even spoken newsletters in messenger apps [496]. Podcasts are perhaps the prime example of manifesting scientific knowledge in a digestible form that, together with social media, also enables a backchannel. They are valuable sources of exchange between the scientific community and the general public, acting as a public space to share and to discuss scientific knowledge, to get an informed understanding of science [10, 290]. Certainly, listeners of podcasts may utilize social media to connect back to the speakers. But, audio-based artifacts have not been utilized to their full potential, to continue, to deepen, and to widen the conversations with and among participants.

4.3.2. Decolonial Theory and Sound Studies

The history of Western sound studies research is foundationally tied to the World Soundscape Project, which primarily focused on recording soundscapes across time and exploring new ways of tracking environmental changes invisible to a visually centric society [451]. As the field has evolved from its environmentalist agenda in its early years [483], sound studies has become a theoretical approach to understanding a variety of sonic inquiries: the evolution of the ear and listening technology [196, 391], the history of voice [26, 110, 230], and more recently an exploration of listening as a culturally diverse, racialized, and individually unique process [393, 431, 449]. For example, critical geography scholar Am Kanngieser examines the use of sound as a political and social tool to identify the presence of inequality in order to “build new and creative terrains for human and more-than-human negotiations” [42:5]. Collectively, the field of sound studies offers an ear to non-visual relationships through which to understand evolving realities between the natural world and human interaction. Similarly, the inequalities present in these sonic relations can also be used to illuminate inequalities among populations and communities [251].

While these works are often referenced as pivotal forces and foundational texts for sound studies research, one prominent challenge of this field is that it is historically situated in colonial thinking and Euro-centric perspectives on listening. To decolonize this field, Dylan Robinson's research identifies the normative and unmarked forms of listening privilege that exist within settler colonial listening positionality. Confronting listening positionality as it is enacted through research production, researcher interviews, and the listening process, are integral to engaging in stories and conversations with individuals who exist within diverse perspectives. Robinson suggests that a critical listening positionality and decolonial lens seeks to prompt questions regarding "how we might become better attuned to the particular filters of race, class, gender, and ability that actively select and frame the moment of contact between listening body and listened-to sound" [55:11]. Sharing stories through sonic interventions extends a decolonial research approach, maintaining stories within shared story worlds [13], while also encouraging listeners to confront their own societal, cultural, physical, and emotional filters that impact how and why they engage in various listening practices.

Another prominent decolonial dimension explored within the field of sound studies, and an integral aspect of sonic production, is the use of storytelling and voice in knowledge sharing and dissemination. Stories offer a glimpse into diverse lived realities and position researchers in response to these spaces; "Stories can intervene on dominant narratives, create space for counternarratives and in doing so challenge the settler-colonial status quo in pursuit of decolonial futures" [487]. Sonic forms of storytelling allow qualitative researchers to extend their work and create space for individuals to share using their own voice and on their own terms [487]. Considering a researcher's ethical implications in this work, Archibald remarks that a researcher needs to respond through a set of seven principles: respect, responsibility, reciprocity, reverence, holism, interrelatedness and synergy [13]. These principles demand that a researcher consider their participants in each aspect of research and production, ensuring that stories are not removed from their context and that individuals are not overlooked or abandoned throughout the process. In sum, storytelling can be explored through a decolonial lens by creating a space for participants to recall events and experiences, by appreciating diversity of lived experience, by honoring such as a powerful teacher [313], and by affirming the collaborative creation of knowledge [197,

313]. In shared storytelling spaces, the collaborative nature may also open a dialogue from individual experience to a larger collective worldview [399].

The production of audio-based research may offer spaces to explore these new dialogues with participants in various settings, placing them in conversation through audio editing; however, there is still a need to decolonize research production itself, emphasizing legitimacy of sonic stories as a form of knowledge production and distribution [3]. Along these same lines, there has also been a push to recognize the social and political markers of this form of creative design-led research and distribution. Sonic production allows researchers to maintain affective responses held between interviewer and interviewee, while also encouraging and building ethical relationships with participants. By maintaining stories within the speaker's voice, it lends well to decolonial aspirations of *storywork*, maintaining stories within the communities, thereby building upon said principles of respect, responsibility, reciprocity, and synergy [13]. Similarly, community-led research projects can contribute to equitable, reciprocal relationships and increase public impact by engaging with the community beyond the interview process [420]. In essence, the primary issue that sonic forms of research aim to combat is the development of research that does not serve the community in conversation [118]; when working with specific communities there is accountability tied to how research findings are disseminated, to honour the process of learning and sharing as ceremonial [491]. From a listener's perspective, sonic production also develops a social activity in that listeners are unable to remain passive; instead, they are called into a form of conversation and dialogue, and, in this way, subtly asked to develop kinship with the narrators and storytellers as an attentive and responsive listener [205].

The design-led process of creating the audio documentary detailed in this paper allowed us to consider the ways in which participants' voices from our previous field study [508] traversed sonic spaces and how their experiences create collective soundings and understandings. In essence, this form of engagement encourages an empathetic listener, positioning them in conversation with the interviewee. Considering sound as a political medium [251], the use of sound and voice in this format helps to create spaces to challenge common forms of subjugation tied to the visually impaired communities. It allows for collective individual experiences to navigate shared various forms of reminiscence, and it enhances some of these experiences through sonic cues

added in post-production. Similarly, the production of an audio documentary allows us to maintain *communicative silences* which carry embodied expression and emotion that are lost in translation of an audio format to written word [2].

Our work aims to bring together these strands of research. Drawing on guiding concepts from decolonial and critical sound studies literature, we want to investigate how an HCI research publication can be transformed into an intelligible alternative form for research participants in the service of supporting reciprocity. We aim to consider how a decolonial approach to creative research production with storytelling may offer new approaches to HCI research and design, exploring how their stories might help us find ways to disrupt and redesign existing ableist technologies and systems, and to open a backchannel for the exchange between the scientific community, our participants, and the general public. Through describing and unpacking our design-led approach through a critical-reflexive lens, a secondary goal is to extend strategies for mobilizing audio-based forms of HCI research.

4.4. Process and Approach: Designing the Audio Documentary

4.4.1. Theoretical Concepts and Motivation

Our approach originates with and is tied to the design-led research approach in HCI. We adopt a designer-researcher position that gives prominence to first-hand insights emerging through the creation of real things that materially ground conceptual ideas through their actual existence—"a process of moving from the particular, general and universal to the ultimate particular – the specific design" [318]. Designer-researchers often function as a small but multi-disciplinary team that is reflexively focused on the experimental and novel outcomes of the design process that critically and reflectively arrive through creative practice (c.f. [83, 340]). Thus, design research in HCI can contribute a highly insightful, first-hand, and reflexive view of practices of making in relation to higher-level concepts, framing key decisions in the design process. From a high level, our work builds on a trajectory of research in DIS and HCI that emphasize the creation of new knowledge through design practice and a reflexive designer-researcher approach (e.g., [23, 105, 138, 433, 514]). We take inspiration from research calling for

moments of pause and critical reflection on key episodic moments in longer-term design processes (e.g., [111, 160, 161, 329, 336, 473]).

As a design research team, we created the audio documentary drawn from our prior fieldwork [508], to engage in a process of transforming their research publication into a format that could be given back to participants largely motivated by their own desires to better understand the experiences of each other. We wanted to create an engaging format that resonated with the research participants' interest in audio as a rich format to tell stories. We also wanted to build in moments of pause to actively invite reflection, contemplation, and response throughout the audio documentary.

To frame our design inquiry, we are informed by concepts from decolonial theory and the need to strengthen the communication between researchers and participants. As noted earlier, our own research and the positionality of our design research team is primarily situated in a Canadian context where there exists a movement to engage with decolonizing methodologies, theories and ways of knowing in academic research and education (c.f. [182, 427])[3]. In this sense, decolonial methodologies also concern themselves with reciprocity and how knowledge can be shared with communities, which influenced the context of our own work that helped guide the creation of the audio documentary.

4.4.2. Method

A set of distinct, but related concepts helped guide our design-led process of creating the audio documentary. We draw inspiration from concepts of *storywork* and *storyworlds* where the stories and sonic worlds bound in the voices of participants are maintained, allowing conversations to exist in reciprocal and interrelated ways [13]. This lens also pushes us to consider sound as a political medium through questioning the researcher and the listener positionalities, and, in this way, encouraging empathic listening by positioning the researcher and listener in conversation with the research participants [393]. We similarly have worked to produce an audio experience that aims to

[3] We respectfully acknowledge that other areas of the world also contain major contemporary movements to engage with decolonizing methodologies (e.g., see [427] for an in depth synthesis of perspectives across Australia, New Zealand, and Canada). We here emphasize Canada as it is the site where this research takes place.

disrupt normative practices of research dissemination and production in HCI work through, in part, maintaining stories in the voices of our participants. This choice is one we have made to challenge listening positionalities, to situate the listener in a space to question their listening filters, and to consider a different worldview [393]. The production of an audio piece works to create these moments of listening through another space and in conversation with and among the other participants, and our structural format of the audio documentary, with the inclusion of questions, aims to prompt these moments of inquiry. Finally, the goals of our work are aligned with the decolonial recognition that written dissemination of knowledge is not 'enough' and that research must be returned in a way that supports and aligns with our participants and invites response [118]. Archibald remarks that a primary aspect of respect and responsibility when working with communities is to produce the research dissemination in a format most accessible and supportive of the community that had contributed to the work [13]. Our choice to create an audio documentary works to align itself with recent HCI initiatives to maintain relationships and dialogue following research (e.g., [405, 429, 443]), decolonizing the abstractive forms of interviewing by prioritizing equitable and relational forms of communication. The audio documentary format has been chosen because it is easily accessible for individuals to find online, and it is a supportive medium for our blind participants. Audio documentaries are also more accessible than written distribution which typically remains behind paywalls and institutional barriers.

This audio documentary is part of an ongoing multi-year participatory design research project. Participants specifically asked us to share insights from all interviews to understand and to reflect on each other's experiences. For our participants, an audio format was preferred over written dissemination, specifically hearing each other's voices instead of researchers retelling stories on each participant's behalf. With this audio documentary we support reciprocity and mutual learning. At the same time, it was a collective decision among all parties to not involve participants directly in the production of the audio documentary. Importantly, upon completing the final draft of the documentary, we sent the audio file to participants to confirm that they are fully comfortable with what is being shared. In sum, the documentary serves to maintain, deepen, extend the conversation, and support subsequent participatory design work within our collective longer-term project.

With this as a backdrop, the development of the audio documentary consisted of the following. Over the course of seven months, we carefully reviewed the data from our previous fieldwork [508], which consisted of mostly raw interview recordings and theoretical literature. Similar to Schön's notion of design as a conversation with materials [406], we engaged in a reflexive dialogue with the empirical and theoretical, our understanding of our participants and academic jargon, and rounds of development and critique, to arrive at the final audio documentary. This iterative and creative process enabled us to reflectively examine the interplay among the original field recordings of the participants' stories, voices and lived environments, the script developed to thematically guide the listener, sound design choices to amplify the participants' storyworlds, the SoundCloud platform for distribution, and their individual and collective relation to our conceptual framing.

4.4.3. Researcher Positionality & Ethics

Our design research team was comprised of four researchers. None of which are blind or experience severe visual impairments; and it is important to acknowledge our positionality. **Author 1** has conducted 2 years of participant engagement and observation with a local non-profit organizational branch of a major national institute for the blind. **Author 2** has not had experience working directly with blind populations. However, author 2 has recently completed a graduate degree in communication, specializing in sound studies and decolonial theory. Alongside the academic work, author 2 has ample experience as a sound designer and audio producer in both academic and community roles. **Author 3** has prior experience in volunteering with a non-profit social program that paired younger adults with older adults that are living with vision impairment, where the primary goal is to support positive intergenerational socialization and dialogue. Author 3 also has over a decade of experience in sound design and music production. **Author 4** has completed 1 year of community service volunteer work in a school for blind and visually impaired students and, more broadly, has 6 years of experience in co-designing together with people from different walks of life and different abilities.

The lived experiences that the participants have largely provided our design research team, individually and collectively, offered first-hand insights into the lives of

people with vision impairment. However, we ourselves cannot experience what it is like to live with vision impairment or blindness; and this is an important limitation to acknowledge. These experiences did play a role in our intention to extend our prior field research [508] through a decolonial lens that aimed to situate participants' voices and stories in relation to each other in a rich audio format that could potentially be more engaging and inviting than the original paper, which was primarily written for an academic HCI audience. For this audio documentary participants agreed to have their voices used and shared, their names have been anonymized and the Research Ethics Board of the first author's university approved this approach.

We documented our design-led process as it progressed, and annotated key design choices and decisions in light of our conceptual framing as we moved towards the final audio documentary. This paper offers a collective account by us as a research team; however, it does not aim to report on each and every design decision. We attend to specific design decisions that were productively shaped by key higher-level concepts, as well as cases in which frictions emerged. Next, we offer a synthesized account of design decisions and instances in relation to key guiding theoretical concepts.

4.5. Beyond Looking Back: Unpacking the Making of the Audio Documentary

Our previous field study explored the reminiscence experience for people with blindness and draws design insights that could enrich the experience from 9 interviews with people with blindness [508]. Largely, the findings are categorized in three areas; (i) Pathways to Capturing and Remembering the Past—how people with blindness currently reminisce, (ii) Possessions as Resources for Reminiscence—types of personal belongings that provoke recollections and tensions in social sharing, and (iii) Towards the Future of Reminiscence—alternative and possible ways to extend the reminiscence experience. Building on these findings, we suggested design implications in three areas; sound, social interaction and tactile expression. The audio documentary aims to translate and describe these research outcomes to give back to the participants and the community.

The graphic featured in *Figure 4.1* offers a visual description and annotation of the audio documentary. Additionally, we encourage the reader to listen to the *Beyond*

Looking Back audio documentary which is available on SoundCloud.[4] The visual overview of the audio documentary (*Figure 4.1*) outlines color codes and different types of markers. Importantly, this figure does not aim to marginalize or quantify our participants' participations, but to recognize and appreciate their contributions, in addition to provide a reference for navigating the documentary. The main foci are the three themes in the findings section of the paper with a hint of the design initiatives in the discussion section. The opening begins with explaining the purpose, motivation, positionality as well as participant introduction. Largely, the first and the last themes are identical, but the second theme is focused more on the digital media, social interactions, and tensions in reminiscing together with the loved ones. The audio documentary concludes with the appreciation to the participants and an invite to get involved in future research. In what follows, we report on the key frictions that we encountered through the process of making the audio documentary and the design decisions with underlying theories that supported us in ultimately overcoming these frictions in three separate categories: Composition, Production and Publishing.

[4] To listen to our full audio documentary, please refer to the following URL on SoundCloud: https://soundcloud.com/homewarelab/beyond-looking-back-full-audio-doc.

A textual transcript of the entire audio documentary can also be downloaded as an auxiliary material through the ACM digital library: https://dl.acm.org/doi/10.1145/3532106.3533539.

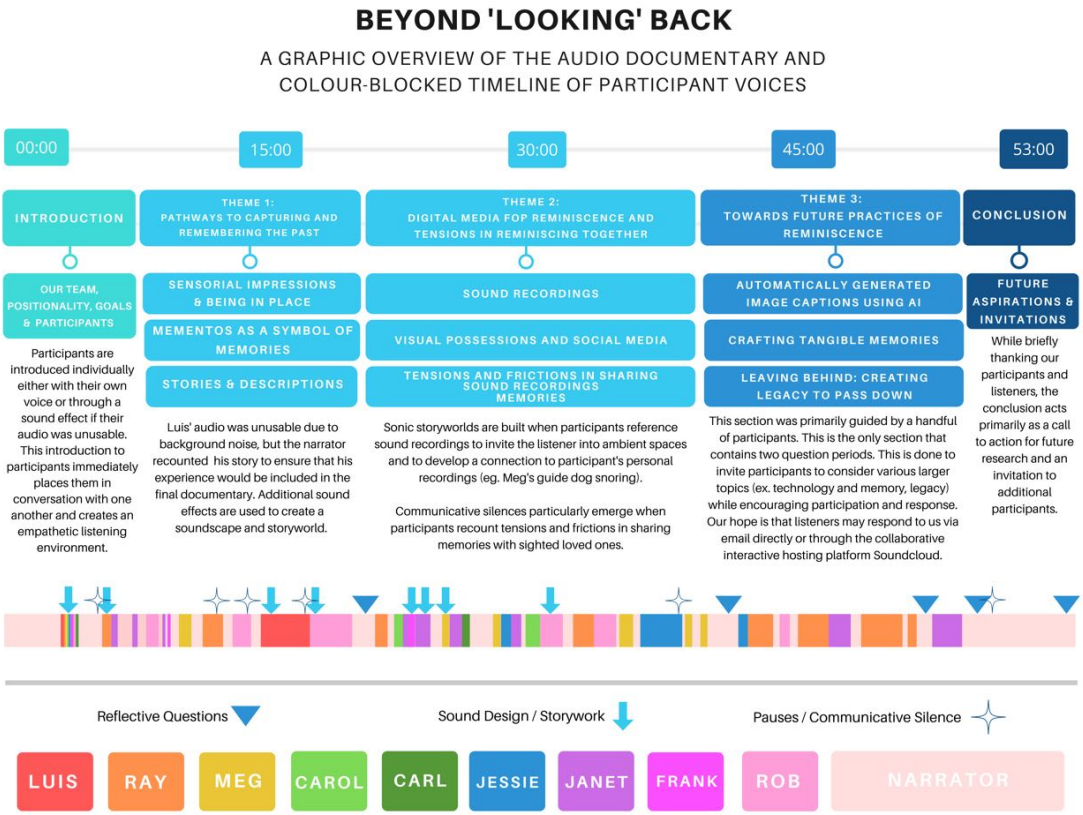

Figure 4.1. Visualized infographic of the audio documentary. From the top, each line represents; (i) the timeline, (ii) thematic distribution and descriptions and (iii) the color-coded timeline indicating the participants, sound techniques and reflective questions.

4.5.1. Composition

At the early stage, design goals prior to recording were to reduce the complexity of the audio documentary for better digestion, and to offer questions that bring the listener into this reflective conversation. In composing the audio documentary, we describe the frictions in the following areas; (i) Setting a Proper Tone, (ii) Equity and Equal Representation in Large Data, and (iii) Creating Space for Reflection and Engagement.

Setting a Proper Tone

The first key decision was defining an appropriate tone for the audio documentary while considering our positionality. Translating academic knowledge from a

published paper required a critical reflection on who we are, why we do this translation, what we translate, and finally, how we deliver this knowledge. Inspired and influenced by epistemic decolonization [426], the audio documentary is our attempt to shun the misperception of assuming ourselves as representatives of knowledge, generated through working with the blind community. Our dissemination of the voice recordings is us “talking back” and with [63:8] our participants and the community. While the publication from our prior field study [508] offered a space to collectively explore some of the topics, themes, and quotes that emerge across participants, the audio documentary is not to report the research findings in an academic tone. Our goal was to ensure the audio documentary is approachable and amalgamates the research outcome into an easily digestible audio format for our main audience.

We wrote the script in plain language that avoids technical or theoretical terms, and academic jargon. Also, grammatical structures were revised. For example, long and complex sentences are broken into simpler structures, and impersonal pronouns are replaced by definitive pronouns. Further, we were careful in using analytical words. Interpretive terms, such as ‘effective’, ‘investigate’ or ‘study’, were removed and rephrased to neutral terms, such as ‘tell’, ‘explain’ or ‘describe’. We focused on elaborating in-depth statements on our positionality, intensions, and personal motivations, rather than introducing a thorough theoretical background and preceding research. In sum, we aimed to maintain the affective responses and emotional relationships that were held between interviewer and interviewee, as well as their recollections of memories.

Equity and Equal Representation in Large Data

Our next dilemma was rooted in pursuing equity and fairness. We aimed to equally balance each participant’s share (duration in audio). This is to appreciate and recognize all participant’s contribution to the project. For those whose voices are not featured in the documentary (due to technical issues), their contributions are recognized by mentioning their pseudo-names and describing their stories in the narration. After the first round of editing, we noticed that assembling merely the quotes presented in the academic paper resulted in over three hours of audio before the narration was attached. While we aimed to integrate each participant equally, there were moments where we had to highlight quotes from certain participants and drop less significant themes.

Compared to academic publications in a written format, audio snippets were much harder to cut or paraphrase. For example, when participants used pronouns (e.g., it, him, we, they…), a proper context must be provided, which made the quote even longer. In another situation, if participant quotes included extensive descriptions, we had to decide whether to include such details for richness or to remove them for the sake of space. We must find an adequate balance between completeness and compactness, while paying careful attention that we do not lose each participant's intention in the quotes.

Also, we re-structured the themes in the audio documentary. Presenting more themes may offer additional areas to reflect from the listener's point of view; However, from the second author's previous experience, we noticed there is a higher mental load for the listener as the running time of the audio documentary would become quite long. Following this insight, our audio documentary is designed to remain under an hour. We had to be very selective about what we cover in the documentary. The audio documentary is a linear structure with little movement and confusion between larger themes and sub-themes so that themes can flow easily and concisely for the listener. We found the audio format is not efficient for presenting a complex structure as opposed to an academic publication in a written document. In a written document, accessibility tools, such as screen readers, are available to assist people with blindness to move between the overall structure by reading the headings. With such tools, even in the middle of the document, it is possible to skip back to anchor points for each heading as checkpoints. However, it is much more challenging in the context of an audio documentary as the listener may get lost in the complex thematic structure. Therefore, sub-themes in the research findings were pruned and re-arranged for a better flow in the audio format.

In the original data analysis, we developed three major themes, which were broken into 13 sub-themes and 5 sub-sub-themes. In the published paper [508], these findings were distilled to three major themes, and 9 sub-themes in total, merging and dropping minor themes that are described by fewer quotes. In the audio documentary, although the number of themes and sub-themes remained the same, we re-organized the structure to emphasize themes that were shared by the participants. For example, our theme on mementos is one of the key findings that shows how participants used physical possessions as a gateway to their past memories. In the paper, this topic is

presented under the theme of sensorial impressions. However, since all participants mentioned mementos and described how they cherish them, we decided to create a separate sub-theme for the audio documentary. Overall, these decisions and reconstructions have yielded a more compact, tightly organized documentary which we were able to produce in a shorter timeframe.

Creating Space for Reflection and Engagement

Once quotes, themes and the structure were set, the next friction that surfaced from our motive for creating space for the listener to engage with the participants and our inquiries in the documentary. Written accounts of participants' narratives are often unable to capture the emotional impact of phrasing and the pauses that contain stories in and of themselves. Thus, audio is a suitable medium for offering sonic space for asynchronous conversation. We achieved this goal by implementing two techniques in the documentary: three types of reflective questions and *communicative silences* [2].

Building on our analysis and reflections, we posed questions for the listener. These questions offer a different dimension in the audio documentary that pushes the boundary beyond the passive listening. They intend to lead a dialogue between various audiences: the researchers and the participants, the participants themselves, and the participants and listeners. They encourage listeners to reflect on the reminiscence experiences described and unfolded from our participants' stories. As a result, we developed three types of questions – **Correlate**, **Expand**, and **Envision**.

Correlating questions ask the listener to think back on their own personal experiences in connection to what's presented in the documentary. For example, "*What are the ways you recall memories?*" "*What are your own ways of using digital possessions to look back on your past?*" "*What does it mean for you to craft a legacy? What are the possessions that you would like to pass down?*"

Building on the listener's personal experiences, **Expanding questions** encourage the listener to think further into what is described in the documentary, to consider new insights given participant's stories and research findings. "*What are some other ways that we could create a moment of collaborative reminiscence?*" "*What are some other ways that encourage deeper engagements between blind and sighted people in remembering and sharing memories together?*"

Envisioning questions invite the listener to imagine experiencing a given situation. "*Suppose you are able to create a figure that represents a specific moment from the past. What moment would you create? How would it be translated into a physical figure?*" "*What if an audio repository collects audio recordings paired with additional information captured at the time of recording, such as timestamp, GPS location data, weather, date, or season? How would you use this audio repository?*"

In the context of our research, the asynchronous dialogue works to create a form of pseudo-synchronicity to maintain the participatory nature of this project and encourage reflection in specific moments. The explicit moments, created by a mixture of three types of reflective questions invite the listener to enter the co-design mindset. Correlating questions put the listener on the same page with the participants by asking them to share in similar experiences. Finally, expanding questions and envisioning questions are aimed to explore future participations and imply our research inquiries.

Another important quality throughout the piece is the maintenance of silence. Throughout the documentary, there are a few moments where silences are removed to ensure the flow of the sonic piece, but there are numerous pauses that contained emotion and communication within the stories. In this asynchronous conversation, the maintenance of silence plays an important role in creating a sensitive connection, inspired by Acheson's perspective of communicative silence. As Acheson explores, we consider silences in the documentary as more than "a background for expressed thought". Rather, we actively use silence as a "gesture" where the listener, the participants in the documentary, and the listener's inner self are encouraged to meet together [2].

Overall, having the right tone, equal balance for each participant, and being able to interact with the silences between participant stories, narration, and reflective questions, all contribute to offer a nuanced and relational understanding of our participants' responses, offering insight which is removed from the edited textual descriptions. Next, we report on the frictions and challenges we faced when working with the audio files in the process of producing the audio documentary.

4.5.2. Production

In producing the audio documentary, we aimed to emphasize the emotional textures that are present within our participants' stories. We believed an emphasis on these emotions could help to immerse the listener in the documentary and engage in active listening by responding to participants' stories and reflective questions. For this purpose, we decided to use the participants' own voices in the documentary. Yet, the dominant challenge was to address sonic disruptions in audio files so that we could feature each voice clearly, ensuring they blend well with the other sonic components in the documentary (e.g., narration and background music) for a better listening experience.

Overcoming Sonic Disruptions in Interview Recordings

Audio quality was one of the key determining factors as to whether we included a participant's voice from their recorded interview. When we conducted in-person interviews, we did not anticipate the field recordings would be used for another project in the future. Their interviews were conducted in participants' homes and, thus, casual 'living' noises (e.g., children playing, home appliances) had leaked into the field recordings. We had to listen to the audio field recordings and determine which clips should be included based on the audio quality, as some recordings are muffled while moving the mic, some are distorted by small electrical blips from the microphone, and some recorded in loud / noisy situations which disruptions like a car honking or airplane engines overhead. By ensuring we had clear audio, it was much easier to sonically invite the listener to the interview location and to clearly disseminate the findings in a succinct and clear way.

Participants' voices add uniqueness not only to the listening experience but also to their personal stories that were shared in the audio documentary. Unlike reading participant quotes in academic publications, getting to know each participant by their voices and paying attention to their tones as they tell their stories establishes a strong emotional connection. This connection is first introduced in the beginning of the audio documentary when the participants' voices are attached to their individual introduction statements. While this introduction increased the overall length of the documentary, we strongly felt it is a needed portion in the documentary. Yet, another friction arose for the

participants who did not have a quote in the documentary, either due to poor audio quality or those who were removed for space. We had gone through an extensive discussion about whether to hire voice actors to fill in these gaps, but we decided not to bring in a third person to 'act' on behalf of our participants as we did not want to blur the authentic value of the voices; instead, we wanted to prioritize consistency by featuring the participants' voices only. There was one quote in particular where Luis was describing his experience of seeing natural phenomena through his friend's eyes. His voice could not be included in the final audio edit even after careful adjustments to the clip, as it was overpowered by loud sonic disruptions. Instead, we borrowed the narrator's voice to describe the scene and the experience on behalf of the participant to preserve a seamless flow in the documentary.

Re-creating Scenes with Additional Sonic Layers

Jo-Ann Archibald utilizes the term *storywork* [13] to signify the importance of Stó:lö stories and storytelling as a form of knowledge. Archibald shares there is power in stories and teachings outside of structured educational and social value. Inspired by these concepts and decolonial aspirations of knowledge formation and dissemination, we began to consider the implications of our work when abstracting stories from our participants for written dissemination and analysis. In essence, we were stripping our participants and storytellers of their voices through an extractive editable format. Wanting to give back to this community and consider the importance of maintaining stories with our storytellers, an audio documentary allowed us to explore these aims and to develop reciprocal and responsible relationships with our participants. Creating an audio documentary surrounding the interview recordings worked to situate the listener in conversation, as well as the participants in conversation with another. These moments for cross-conversation between shared perspectives emerge throughout the audio documentary and offer moments of synergy and connection. They also develop an empathetic listening experience where listeners are invited to listen and respond to the questions and considerations, creating moments for both speaker and listener to engage in storywork or communal discussion within the space of shared storytelling. Sonically, there are moments where we were able to develop the soundscapes of our participants' storyworlds. In conversations with participants' who share the importance of these sonic cues, we are able to transport the listener to these locations and memories, to situate the story within the soundscape, and to sonically embody their emotional experience.

When we began to edit the audio documentary, we relied heavily on the contextual clues from the written quotes in the academic paper and the voices from the interview recordings to design the sonic environments imaged by the participants. After numerous iterations, we implemented carefully chosen sounds that highlight the characteristics of participants in connection to their descriptions. For example, when Janet describes a boating trip, the listener will hear the sound of water and boat engines in the background. At other times when there was no hint to a sound reference in a participant's quote, we chose moments where the addition of a soundscape felt natural. Yet, there were some moments in editing where we noticed that additional sound effects took away from a rich description, as it became too distracting, or it felt out of place. For example, Rob described the shared experience of creating a documentary with his family. While there may have been an opportunity to include sonic cues in this space, to imagine the soundings of this family memento, the addition of these sounds would detract from the sincerity of the story and would deter listeners from focusing on Rob's emotive experience. In this scenario, his storytelling and voice required full listening attention. Moreover, the background music was used for boosting an emotional atmosphere of the stories and as a sonic cue for smooth transitions between different sections (e.g., themes, reflective questions and communicative silences). From the producer's perspective, designing and choosing sounds and soundscape had been a unique experience as we constantly reimagining and reflecting on re-creating participants' rich experiences through sound.

The sound layers form a well-blended mix of focused sound (e.g., a participant's voice and additional sounds to their stories) and ambient sound (e.g., soundscape and background music to help create the mood and the scenes) , which extends our previous study's finding on the two types of sound components [508]. Participants' reflections in the form of focused sound, mixed with additional forms of ambient sound, was designed to offer a rich listening experience. Overall, sharing the stories through sonic interventions extends our decolonial approach, maintaining the stories within the participants' shared storyworlds, while also following Robinson's suggestion of challenging listener positionality [393], encouraging listeners to confront their particular perspectives and worldviews that impact how and why they engage in certain moments of shared listening.

4.5.3. Publishing

Finally, we report on the design and ethical decisions regarding the public dissemination of the audio documentary, during and after completing the audio documentary. We hope our audio documentary maintains the emotional aspects of storytelling which further sensitize the listener and the design team as they are able to sort through the data and stories through the voices of our participants. Further, we wish to establish a continuous communication around and beyond the audio documentary by publishing the audio recording on a platform with public access.

Publishing as Single Episode Documentary

Our audio documentary naturally flows as a form of knowledge translation from story to listener when situated in this format. It is made from multiple rounds of edits that collectively tell a story, but the flow from the storytelling space to the listening experience feels quite linear, moving from the recording to audio sharing experience easily. The role of the sound designer resembles that of the writer of an article, choosing quotes, mixing, and mastering voices to develop a sonic world. However, where writing has more leeway to move or paraphrase words to create seamless reading, manipulating a quote to abstract the key theme in sonic dissemination is far more difficult and often impossible to manipulate flawlessly. Thus, the individual's knowledge and experience sharing is fully maintained, pulling their full description and relaying this to the listener's experience.

To better present these collective and homogeneous stories from 9 interviews, we chose to produce the audio documentary as a single episode—a dedicated, independent episode that gives a sense of completeness. It also allows for enough time to invite listeners to hear the stories of the participants and research findings without placing any expectations on their return for future episodes. We hoped to capture audiences in one sitting, to introduce them to the topic and share key findings. The purpose of project is not to deliver the entire analysis. It is meant to be a gift for participants and therefore the design of a single episode to be distributed also aligns with this goal.

Choosing the Platform for Distribution

We had carefully reviewed and selected a platform to publish the audio documentary. In selecting the platform, we did not have deeper knowledge on whether the platforms support accessibility features and are compatible with screen readers. We leveraged our broader network and relationships with the blind community to elicit their own opinions and experiences on using various digital platforms for listening to audio. Although these discussions touched on platforms like Anchor, PodBean, and YouTube, SoundCloud emerged as the most promising platform for distribution. SoundCloud is an open audio distribution platform that has a large popularity among people living with blindness and visual impairments due to its integration on smartphones and well supported accessibility features. Equally, there exist numerous sound studies scholars and sound artists that regularly upload audio projects and documentaries to SoundCloud for distribution. It allows the creator to easily embed their sound on other websites in accessible formats. SoundCloud is also highly participatory in nature as it allows listeners to comment on specific sections or on the piece as a whole. This quality was well aligned with our goal of inviting listeners to respond to the reflective questions posed in our audio documentary. A free SoundCloud account allows for up to 3 hours of audio (maximum file size of 4 GB). Thus, we uploaded the full audio documentary, while also uploading separate sections which we combined into one playlist. In this way, listeners can choose to engage with the full audio documentary or jump to specific themes. The process of distribution through SoundCloud creates space for facilitating participation and co-creation as listeners are encouraged to respond to the questions via comments or potentially to reach out to us directly.

4.6. Discussion & Implications

Although participatory design and related approaches have been widely adopted in the HCI and design research communities, the need to develop novel and diverse strategies for nurturing reciprocal relationships with research participants remains a central concern. In parallel to recent research [151, 405, 443], our approach to making the audio documentary directly aims to cultivate a reciprocal connection with research participants and continue dialogue after a major phase of field research had concluded and the research team had ‘left the field.’ A key contribution of the audio documentary is

to employ a design-led practice to create an alternative form of research publication for the participants. Inspired by guiding concepts at the intersection of decolonial scholarship and critical sound studies, we created this transformation and extension of knowledge by foregrounding participants' own voices and engaging in storywork to set them in dialogue. We also leveraged their sonic environments and our own subtle sound design techniques to generate unique storyworlds that re-create lived experiences. Through integrating reflective questions and communicative silences, we provoke the listener to consider their own positionality and encourage involvement in the moment of listening and, potentially, in future stages of our participatory research. Next, we explore and reflect further on our making and unpacking of the audio documentary and articulate opportunities this design research case suggests for future HCI research.

4.6.1. Mobilizing a Decolonial Lens for Supporting Reciprocity through Audio-based Interactions in HCI Research

A decolonial lens may offer different ways to view the Research through Design process and to question and unlearn the researcher and listener positionalities. Listening to the stories as storywork is a prominent decolonial choice that has been made through this process that challenges the listening positionality. Situating our findings within the stories and participants' own voices leaves power in their soundings and places participants in conversation with one another. Our recognition of this positionality and the inquiries we offer, aims to encourage listeners (and ourselves) to confront these positionalities and unlearn some of our ingrained behaviour and sensory processing. This recognition could suggest a new perspective on how researchers design sonic interaction to communicate research inquiries or findings with participants. Throughout the research process, different types of communication can occur. It could be interactive and synchronous, such as screening procedures and individual/group interviews. For this type of communication, there is an opportunity to include a sonic interaction designed around participants' or researcher's voices to explore motivations, inspirations, and instructions in a collective listening experience. This strategy could give rise to stronger emotional connection and shared understanding among participants and researchers, as opposed to reading findings or questions from a prepared script. For communication that is more subtle and asynchronous like emails and letters, sonic

interventions could come into play; on top of the written words, a supplementary audio instruction can be attached to offer a rich emotional layer that text alone cannot deliver.

Revisiting Robinson's view, critical listening positionality challenges the listener to seek for the filters (e.g., race, class, gender, etc.) that select and frame what we listen and how we listen [55:11]. This idea of critical listening positionality has a potential to influence participatory design and inclusive design approaches. Storytelling is one of the dominant methods in inclusive design for respectful engagement with knowledge from a different perspective [21] and for unpacking unique and situational experiences [346]. Critical listening could offer an additional layer to reflect on how the stories are heard and presented. For example, through the development of small pockets of storyworlds (e.g., Luis' boat trip), the listener is transported to these moments of intimate, nonhuman storytelling. Decolonizing listening in these spaces requires the listener to consider some of the ways that they not only relate to those forms of sonic information, but also how they relate to our soundings. Unlearning the leading position in research could re-define the researcher's positionality to situate themselves equally with participants in considering new insights together and forming collaborative research relationships. Thus, a recognition of the listeners and researchers' positionality, a push towards listening outside of this positionality, and an appreciation of sound in and amongst sounding agents, can all be applied in future HCI research aimed at better supporting reciprocity with the communities that research teams design for and with. More broadly, these implications build on and extend recent efforts in the HCI and design research communities to continue dialogue and relations after leaving the field and critically reformulate research 'outcomes' in more reciprocal and equitable ways [151, 405, 429, 443].

4.6.2. Embracing Different Forms of Engagement with and Embodiments of Participants' Data

Performing research with a specific community requires that a researcher be highly attuned to the needs and preferences of that community [77:122]. Our research participants asked us, the research team, to produce a piece of knowledge transfer in a form they could access, absorb, and use to reflect. These desires and our reciprocal creation and distribution of the audio documentary highlight how creating such artifacts

can be useful, if not essential, to keeping longer-term participatory processes going, even if they are not created by everyone involved. This also highlights the need for design research teams to be flexible and to adapt the participatory design process when circumstances and participants ask for such.

When working with people living with blindness, there is an accountability of knowledge sharing that is tied to the research findings and honouring the relationships with participants that emerged through the research project. Selecting and working within an accessible medium that participants already utilize demonstrates the researcher team's flexibility to these needs. Likewise, it demonstrates that the team is not only honouring the relationships built and stories told, but they are maintaining a healthy relationship with current and future participants. In our case of continually working with research participants from our previous work [508], the most accessible medium was audio. There are two key factors that guided us to arrive at the final form; (i) participants' preferences and experiences and (ii) the characteristics of collected data.

Insight into participants' preferences and experiences were originally developed and synthesized through our previous field study [508]. From the collected data, it was clear their research participants preferred a few dominant qualities: physical presence, tactile impression, social interaction, and audio. We chose two of these qualities in the form of audio documentary – social interaction, as sharing stories, and audio. We believed the audio documentary resonates well with participants because they expressed a high sensitivity to different forms of audio and, more practically, all possessed digital devices that can play sound files as well as audiobooks. We could have pursued creating other alternative forms of knowledge derived from the reporting from the prior field study. For example, a series of 3D-printed souvenirs that represent a snapshot of moments the research findings, which was a proposed design implication in their work, although it likely would not produce the same narrative form, emotional resonance, and capacity to initiate further dialogue and bring participants together.

In HCI and design research, there exist an ongoing interest in exploring alternative forms of representing data (e.g., [135, 143]). Our approach shares the same view, focusing on a corpus of field data collected and analyzed for an HCI audience. Looking into the characteristics of the participant data can suggest creative ways of connecting research outcomes to an alternative form. While there are other types of

data, including photos, field notes and video clips, audio files from interviews are often the most prominent data. Indeed, audio can encapsulate many rich elements in the recording, such as tonal qualities, soundscapes, emotions in each participant's voice, and social interactions when participants' loved ones jumped in the conversation. The qualities captured in the data are not easily reproduced. There is an opportunity for future research to extend this approach through new design cases and unpack how field data can be given new forms that, in turn, might inspire new ways of explorations conversations about research outcomes with research participants. Our research expands existing methods of science communication by utilizing participants voices. This approach may offer the added benefit of enabling interviewees to listen to the other interviews in a structured way and to relate to or reference them when being involved in future participatory design work. In this way, interviewees are extended the opportunity to come up with their own, perhaps more fitting, analysis that might illuminate details that the research team may not have been able to grasp. More broadly, future research in this area could lead to new insights on how creating alternative forms of HCI knowledge can further open pathways toward participatory sensemaking, analysis, and design among research and the communities they work with, while also contributing to ongoing efforts aimed at supporting broader distribution Most of this research took place in the Greater Vancouver area in Canada on the unceded traditional territories of the Coast Salish peoples of the Katzie, Kwantlen, Kwikwetlem (kwikwəƛəm), Qayqayt, Musqueam (xwməθkwəyəm), and numerous Stó:lō Nations. This research is supported by the Natural Sciences and Engineering Research Council of Canada (NSERC), the Social Sciences and Humanities Research Council of Canada (SSHRC), and the Canada Foundation for Innovation (CFI)..

4.7. Conclusion and Future Work

We have described and critically reflected on our design process of creating an audio documentary that aims to extend HCI research back to participants in a valuable and accessible form. Reflecting on the entire process of creating the documentary, from composition and production to publishing, we described key frictions that we encountered and explained how we worked to eventually address them. To support our design decisions, we drew on guiding concepts at the intersection of decolonial theory and critical sound studies, using techniques such as storywork, storyworlds and

communicative silence to achieve a better way of unpacking research outcomes. Based on these reflections, we highlighted opportunities for adopting a decolonial lens in the context of HCI research for future explorations into alternative approaches for engaging with participant data against the backdrop of longer-term participatory design processes with research participants. As the audio documentary is finished and published, we distributed the documentary to our participants as we move toward the next research stage. In this way, the audio documentary not only serves as a gift for participants, but also acts as a genuine invitation for future research. Ultimately, we hope our approach inspires future research into how academic knowledge produced in the HCI and design communities can be more approachable and delivered to the broader public, especially research participants and their relevant community members.

Chapter 5.

Remembering through Sound: Co-creating Sound-based Mementos together with People with Blindness

5.1. Overview

As a next step, I worked closely with our participants to understand their memory practices and experiences of sound, and to make sound memories together through participatory activities and the co-design workshop. The research question to be addressed was:

RQ3: How do people with blindness capture, interact with, or reflect on meaningful personal audio recordings for reminiscence, and how can we co-design alternative forms of sound memory that support their preferences, needs, and desires for personal and social reflection in sound?

Although *Remembering through Sound* was suggested as one of the strong design opportunities suggested in the first exploratory study to support the reminiscence experience for people with blindness, many questions remained to be explored in the context of sound memories. Therefore, we began with group interviews, where we collaboratively brainstormed and decided on the following participatory activities, which led to the co-design workshop on sound memories, in which we co-created three different types of sonic mementos. In this chapter, I report the detailed design processes and the making of the sonic mementos, suggesting the value of sound memory and considerations for creating memories in sound[5].

[5] This chapter is adapted from a publication in ACM CHI'24 conference: MinYoung Yoo, William Odom, Arne Berger, Samuel Barnett, Sadhbh Kenny, Priscilla Lo, Samein Shamsher, Gillian Russell, and Lauren Knight. "Remembering through sound: co-creating sound-based mementos together with people with blindness." In Proceedings of the 2024 CHI Conference on Human Factors in Computing Systems, pp. 1-19. 2024.

5.2. Introduction



Figure 5.1. Co-design workshop session with participants

Long before the advent of writing, many ancient cultures relied on oral traditions to pass down their histories, myths, legends, and stories [128]. These oral traditions often involved the use of spoken words, songs, and ritual chants to deliver or preserve important information and narratives, making and preserving memories through sound, and connecting people more intimately with the natural world [155, 374]. The sounds of wildlife, flowing rivers, and rustling leaves were integral to their daily lives. These natural soundscapes provided practical information and left lasting impressions, contributing to people's personal and cultural memories.

Later, the invention of sound recording technology in the late 19th century revolutionized how people made memories with sound. For example, Thomas Edison's phonograph and subsequent developments allowed individuals to capture and reproduce sounds, including voices and music [375]. The advancement of digital technology has enabled individuals to create, store, and share sound memories like never before. Voice messages, sound recordings, and music playlists have become

modern forms of sonic memory. In the Human-Computer Interaction (HCI) and design community, there is a growing body of research exploring people's experiences with sonic memories (e.g., [117, 226, 240, 324, 347, 366]) to capture, revisit and share their memorable life experiences with significant others. However, ironically, these initiatives primarily focus on the sighted population. Although blindness is an actively researched topic in the HCI community, the majority of research has focused on overcoming practical challenges, such as navigation (e.g., [19, 146, 248]), screen readers (e.g., [53, 70]) and usability of digital services (e.g., [5, 20, 62]). How audio might be explored as a material that could enrich other vital aspects of the lives of people with blindness, such as reflection, social connection, and reminiscence, has been overlooked [508].

Before this background, we ask: How do people with blindness capture, revisit and share their cherished audio recordings with loved ones? What are the important qualities that make audio recordings meaningful for people with blindness? What are the preferences, desires, challenges and limitations in interacting with personal audio recordings for reminiscence? How can we design together with people with blindness to support them in creating meaningful memories in sound in a way they prefer to possess and enjoy? How can we translate their personal audio recordings into alternative types of sound memories to promote personal and social reminiscence?

Drawing on Research through Design [172, 512, 515] and co-design [51, 402] approaches, our research investigates these questions by designing sound memories together with people with blindness. As a continuation of our research project on designing for the reminiscence experience of people with blindness [507, 508], we report on a 12-month co-creative design process, where we took a series of careful and respectful steps to work closely with participants, building towards an in-depth co-design workshop, where we translated cherished audio recordings owned by our participants into alternative forms of sonic memories. We discuss three sonic mementos in detail and present three design opportunities: (i) *Encapsulation and Condensation*, (ii) *Augmentation and Expansion*, and (iii) *Re-creation and Re-imagination*. Further, our discussion articulates insights into the nascent and emerging design space of remembering through sound. We describe three design strategies to promote collective remembering in sound and three design recommendations to support better remembering through sound for future research and practice. This paper makes two

contributions. First, we offer three types of sonic mementos as novel design opportunities that can extend beyond personal audio recordings cherished by people with blindness. Second, we propose recommendations on the design space of sound and sonic mementos for supporting personal reminiscence and collective remembering through sound in future HCI research and practice.

5.3. Related Works

5.3.1. Designing for Remembering and Reminiscence

Remembering is the cognitive process of bringing past knowledge, events, or experiences from one's memory to present awareness. Yet, as Tulving described [131, 455], some memories—categorized as "episodic memories"—are oriented towards recalling specific events and experiences rather than general knowledge and facts about the world. Thinking and talking about our past relies on autobiographical or social remembering. This is an essential practice for people to promote positive self-reflection, construct ideas of one's future self, or maintain social bonds [45, 64]. Butler introduced the concept of "life review" [69]—a process in which people reflect on their life and past events, experiences and memories. Life review has been further developed in relation to the concept of reminiscence, a deliberate and positive process of recalling and sharing memories from their personal possessions and stories (e.g., [268, 308]), often in an emotional and nostalgic tone.

In the HCI and design communities, remembering and reminiscence are essential to understanding and designing technologies that involve meaningful possessions, memories and personal experiences [181, 222, 223]. Recently, there has been a growing interest in understanding interactions and experiences with digital archives as growing digital repositories have created new ways of remembering people's past life experiences [134, 222, 344]. A wide range of digital archives, such as social media, music listening history, sound recordings, and digital photo archives (e.g., [57, 84, 117, 256, 345, 447]), have been explored to offer unique experiences for people to re-live their moments from the past.

Despite reminiscence being an essential part of everyone's lives that defines us uniquely as humans [93, 456], there is limited research on the experience of

reminiscence and remembering for people with blindness. Previously, we conducted an exploratory study investigating how people with blindness capture meaningful moments and reminisce on past life experiences [508]. Findings from this work provided foundational insights into three design opportunities for supporting the reminiscence experience of people with blindness: (i) *reminiscence through sound* (e.g., audio recordings, voices, soundscape), (ii) *reminiscence through social interaction* (e,g., other people's visual descriptions, storytelling, social gathering), and (iii) *reminiscence through tactile impressions* (e.g., physical presence and tangible aesthetics). We build on our prior research by focusing on reminiscence through sound, as it was the most preferred and commonly used medium among the three opportunities, informed by the participants. We extend our previous work through a hands-on, generative approach to gain an in-depth understanding of the reminiscence experience through sound for people with blindness and to explore new design opportunities for creating sonic memories with their cherished audio recordings.

5.3.2. Sound Memories, Sonic Memories

Sound, as an integral part of human experience, has a unique capacity to trigger emotions, bringing people back in time and rekindling the essence of memorable moments, influencing how people perceive and interact with their surroundings [299, 452]. While the study of sound memories is interdisciplinary, bridging psychology, cognitive science, and sensory studies in the fields of design and HCI, understanding how people engage with sound memories has become increasingly important due to its potential implications for designing technologies for open-ended experiences, such as reflection, introspection, and recollection. This is particularly evident in relation to memory and remembering, where auditory cues hold a distinct power in evoking the emotions of past moments to recreate memories [324, 366]. In this vein, sound memories, or 'sonic memories', encompass the capacity of sound to trigger personal reminiscence and emotional responses [117, 347]. These cues can include spoken words and ambient sounds, music, and other acoustic elements that contribute to the richness of personal memories (e.g., [89, 255, 256, 324]). For example, Oleksik and Brown highlight that sound memories are "omnidirectional" as information comes from all directions and are more immersive when captured as opposed to "unidirectional" visual memories, where the person must be behind the camera, constantly paying attention

[347]. This body of work offers a novel perspective on the ways people reconstruct and relive their past experiences through sound.

However, sonic memories introduce unique challenges and opportunities for technology-mediated reminiscence, especially in the design of interactive systems and digital archives, as people's intentions regarding sound recordings and their preferences to organize or share such recordings are largely underexplored. Oleksik and Brown [347] report a significant challenge in maintaining sound archives because there is no "thumbnail" of sound. Therefore, although sound could be more evocative than visual memories, listening to "unaccompanied audio" that provides a little "frame of reference" can result in a lessened impression of listening to sound memories for people who are not involved in the original scene. Further, the authors point out that giving a proper form factor to sound is a major design challenge. Petrelli et al. describe similar concerns [366] regarding the absence of "prominent feedback" when navigating sound files. This leads to "tedious" tasks of organizing, labelling and time-consuming editing. Hsieh et al. [226] agree with the limited control in selecting desired sounds for playback. While the authors leverage this limitation as a design concept to evoke serendipitous experiences, having a lack of control while browsing sounds still remains a design challenge.

Collectively, these insights and challenges make clear design initiatives aimed at sound memories with a comprehensive understanding of how people perceive, recollect, and engage with auditory cues. However, this stream of research has almost entirely focused on the sighted population. Currently, there exists very limited prior research that specifically investigates the experience of reminiscence for people with blindness. As our previous findings point out, sound serves as one of the prominent design opportunities for the practice of remembering and reminiscing for people with blindness [508]. Yet, this research direction has not been actively researched in the HCI and design communities. While how sighted people utilize various sounds to capture and remember meaningful moments resonates with that of people with blindness (e.g., personal audio recordings of soundscape, conversations and voices), designing sonic memories from the perspective of people with blindness requires more attention. Therefore, our research aims to explore further opportunities in the context of sound for people with blindness and how they remember, revisit and share memorable experiences in their lives. We aim to take a collaborative approach, working closely with participants, as it contributes to the design

space of technology that is more inclusive, meaningful, and emotionally resonant with people with blindness.

5.3.3. Designing Together: Co-design with People with Blindness

Designing future technology, together with those that will be affected by it, has proven to balance power distances between designers and co-designers [419]. Sanders and Stappers describe this shift in design as “designing of” products to “designing for” a purpose [402]. The co-design approach reframes ‘users’ as *co-designers* who actively collaborate in knowledge creation. Co-design offers the potential for generating novel, often idiosyncratic, design outcomes that are better aligned with the lives, worlds, values, needs, and desires of involved parties [38]. Yet, co-designing with marginalized communities presents complex challenges to reducing power imbalances and supporting creative capacity [211, 242]. Thus, participants must be positioned as experts of their own lived experience, while facilitators (researchers and designers) utilize their expertise to support participants in leading the design [402]. This approach has been widely adopted in the HCI and design communities to work together with various sensitive populations, including but not limited to people on the autism spectrum, deaf people, older adults, and children (e.g., [158, 397, 409, 490, 501, 504]).

Co-design workshops often involve highly visual tools such as worksheets and low-fi paper prototypes to guide the design process, sketch out ideas, and generate shared understanding. However, researchers have developed alternative methods of non-visual tools and activities to work better with blind and visually impaired participants. Such non-visual methods include but are not limited to: envisioning new technology with scenario-based voice role-playing and tactile artifact-building sessions [60]; using design probe wearable objects for exploring interactions [144, 457]; exploring interactions with 3D-printed objects [271] and sound samples [103, 273]; and developing sound prototypes with everyday objects, such as balloons, sticks and walls [494].

There is a growing need for non-visual methods and activities that can empower participants with blindness as the landscape of accessible co-design develops. Prior works demonstrate how critical attention to the needs of blind people can enable more meaningful and engaging participation [42, 291]. Yet, striking a balance between accessibility and autonomy in the design activities and methods *for* people with

blindness can pose a significant challenge throughout the design process. To date, no co-design workshops have been held at the intersection of the experience of reminiscence for people with blindness and the roles of sound. Therefore, we chose to work closely with participants, positioning them as active co-designers through continuous engagement and exchanging feedback as we developed insights into the design sessions and interactive activities. Our work contributes to this stream of research by reporting our design journey from ideation to developing the co-design workshop with people with blindness from the ground up.

5.4. Project Background

5.4.1. Methodological Approach

Our methodological approach draws from a blend of Research through Design [172, 512, 515] and co-design [51, 401, 402] methods. We aim to establish a collaborative design approach that offers our participants an equitable and engaging decision-making process and respects the principles of inclusivity and reciprocity. This research directly builds on and extends our prior work [508] that describes design opportunities for reminiscence experiences for people with blindness. We aim to address the challenge of designing an inclusive and wholesome co-creative design process for and with people with blindness from the bottom. Our research team engaged in a 12-month co-creative design process in three phases: (i) *Understanding*, (ii) *Exploring* and (iii) *Co-designing*. Each preliminary phase provided important touchpoints that built up to the final co-design workshop in the last phase.

In our view, it is important to account for our design journey, which is similar to the “research journey” [435]. The three phases were not initially developed before the recruitment. Rather, we decided to take a series of small steps, working our way with the participants. As we concluded each phase, we paused to reflect on what we had documented, then checked in with the participants to review the insights drawn from each phase together. This step enabled us to confirm if we correctly interpreted our participants’ voices. Further, such continuous collaboration revealed multiple “design research events” [352] that shaped the next steps.

Our design journey is less about the summative outcomes and more about reporting multiple touchpoints and meaningful reflections and outcomes that guided us to more in-depth insights that finally led to the co-design workshop, which is the majority of what we report in this paper. The co-design workshop aims to draw on personal audio recordings and sonically significant physical objects owned by people with blindness to explore sonic interventions that enrich the reminiscence experience through sound. Overall, our goal is to build on the "feelings, dreams and imaginations" [132] of people with blindness by inquiring into their first-hand, situated and lived knowledge. However, because we ourselves are not blind and have never experienced the life of people with blindness, we planned to be involved in a direct collaboration to address challenges together.

5.4.2. Our Positionality

The research team consisted of three leading researchers, five design researchers and one sound researcher, none of whom are blind or experience severe vision impairment. Thus, it is important to acknowledge our positionality.

- **MinYoung Yoo** has five years of experience collaborating with people with blindness for design-oriented research projects and was involved in volunteer work at a local institution for the blind for one year.
- **William Odom** has prior experience with a non-profit social program that paired younger adults with older adults living with vision impairment, which aimed to support intergenerational socialization and dialogue; they also have several years of experience collaborating with people with blindness for participatory research projects.
- **Arne Berger** has completed 1 year of community service volunteer work in a school for blind and visually impaired students and, more broadly, has 6 years of experience in co-designing with people from different walks of life and abilities.
- **Lauren Knight** has prior experience on a design-oriented research project that collaborated with people living with vision impairment. Within this project, she contributed to understanding a sound-related worldview and developing discussion topics and questionnaires that informed workshop activities.

The following five authors contribute to analyzing collected data, designing co-design workshop activities and hosting the workshop as facilitators.

- **Sam Barnett** has expertise in video and sound production, as well as experience in facilitating workshops and engaging in conversations with youth.
- **Sadhbh Kenny** has prior experience in facilitating co-design workshops with vulnerable youth populations and working with those with differing developmental abilities.
- **Priscilla Lo** comes from a background focused on designing and developing interactive multimedia. Recently, she has been involved with non-profit organizations supporting children and youth with visual impairments.
- **Samein Shamsher** has experience in devising techniques for co-speculation with the public and has worked in a political capacity to advocate for marginalized and vulnerable groups.
- **Gillian Russell** brings years of experience in developing methods and tools for co-creation and co-speculation; she also has experience co-designing *with* vulnerable populations in various academic and industry contexts.

These lived experiences have provided our research team with sensitizing insights into the lives of people living with blindness. However, we ourselves cannot experience what it is like to live with vision impairment or blindness, and this is an important limitation to acknowledge. This pivotal point informed how we conducted this research project with sensitivity and care. With the aim of foregrounding the voices, desires, and values of our participants, we explored new design possibilities that could positively shape the lives of people living with blindness.

5.4.3. Participants and Recruitment

We first contacted participants from the previous study to inquire if they were interested in continuing their involvement in this research. Thankfully, four participants expressed keen interest in participating in the subsequent phases of the research. Then, more participants were recruited through word-of-mouth referrals, as continuing participants introduced us to their friends, significant others and members of their communities. We initially recruited 8 participants, but one participant had to withdraw, leaving a total of 7 participants (3 males and 4 females). We refer to each participant with a pseudonym:

- **Ray** (early 40s) is totally blind and runs a podcast series that shares the life experiences of people with blindness. He also works as an interpersonal relationship counsellor and a self-defence Krav Maga instructor.

- **Luni** (early 40s) was born with low vision and became blind in her early 30s. She is a certified massage therapist who has short-term memory loss but finds her own way to live her life with joy.

- **Carol** (early 70s) was born blind. She studied music and education and worked for over 20 years as a braille proofreader and then as a word processor.

- **Janet** (early 70s) is totally blind. She is a retired teacher of students with visual impairment who enjoys travelling and doing volunteer work.

- **Hana** (late 50s) lost her sight in her early 20s. She moved to Canada as an international student, where she met her husband **Walter** and had a son. She currently works at a pitch-black restaurant that simulates the experience of blindness for customers.

- **Walter** (early 60s), Hana's husband, was born visually impaired and began losing his remaining sight in his 40s. Walter is a former soldier and drummer who has developed his identity through martial arts.

- **Alan** (early 30s) has been blind since birth. He worked at an international student agency where he taught English, was a counsellor, and showed international students around the city. Alan is interested in blindness advocacy, such as participating in research studies and engaging in public safety and policy-making.

For the final co-design workshop, we invited participants' important others to the workshop to work in pairs. 4 among 7 participants—**Ray**, **Janet**, **Hana** and **Walter**—joined the workshop with 2 sighted partners:

- **Scott** (early 80s) is Janet's sighted husband. He exhibits a great sense of humour and enjoys helping others.

- **Michael** (early 50s) is Ray's sighted friend. He is married with two kids and is a retired financial advisor, hockey player and martial artist.

5.4.4. Documenting and Shaping Our Design Journey

Over the course of 12 months, we employed a range of techniques to conduct and document our participatory design process, which began with *Introductory group interviews* for Understanding (phase 1), continued into *Participatory field activities* for Exploring (phase 2), and concluded with a summative *co-design workshop* for Co-designing (phase 3). Importantly, in this paper, we emphasize outcomes produced during the co-design workshop. However, we also summarize the preceding phases that led up to the workshop and provide context for it. Thus, we offer a sequential synthesis

of design research events [352] throughout our design journey, leading up to the co-design workshop.

All sessions involving the participants across the three phases were audio-recorded using two distinct methods. First, lavalier microphones (Zoom F2) were used to capture condensed sounds, such as conversations, verbal descriptions and impressions (Phase 2). Then, handheld audio recorders (Zoom H4N) are used for field activities to capture the soundscapes and atmospheres (Phase 2) and the overall discussion during group interviews (Phase 1) and the co-design workshop (Phase 3). We also took photographs and video clips to document the scenes visually. Field notes describe the reflective thoughts from the researcher's perspective and capture participants' comments made during each interview and design activity session. Each session ended with a concluding discussion as we shared immediate reflections from the field notes, asked for participants' thoughts and impressions, and brainstormed the next steps. Then, the research team organized tentative insights and ideas into reflective field memos [184]. At the end of each phase, the field memos, along with weekly project meeting notes, audio recordings, videos and photos, were repeatedly analyzed to develop affinity diagrams to draw emergent patterns and themes as an ongoing process [98, 305].

5.5. Collaborative Design Process

Next, we report and reflect on each phase of our design journey to illustrate our pathway toward the final co-design workshop. We emphasize our design journey to focus on the "through" part of Research *through* Design [111]. We dedicated these steps to conducting formative research aimed at understanding our participants' needs, desires, and challenges while also maintaining ongoing engagement with them over time.

5.5.1. Phase 1: Understanding – From Audio Documentary to Introductory Group Interviews

The beginning of our collaborative design journey was dedicated to fostering connection and mutual understanding among the team and participants to facilitate engagement over time. We were cautious not to pre-determine the final design outcome;

instead, we sought to explore our participants' potential collaborative interests. Thus, the first phase focused on developing a shared understanding of the main concepts of this research, such as *audio memory*, *audio portraits* and *audio highlights*. The first phase included two key components: the audio documentary and introductory group interviews.

Methodological Approach

After the initial phone screening, participants were invited to partake in an individual, self-paced engagement with an hour-long ***audio documentary*** [507]. The audio documentary was originally created as an alternative research outcome [506] that could be delivered back to the blind community in a more accessible, immersive, and appropriate form. We leveraged this audio documentary to initiate a thoughtful dialogue for our blind participants and the blind community that we have been engaging with over the past 4 years. The audio documentary helped our participants understand the context of reminiscence experience and sound memories. **Janet** and **Hana** later shared that the audio documentary invited them to reflect on their perspective of making and revisiting memories through sound. Then, we conducted ***introductory group interviews*** (Figure 2) centred on sound to establish rapport, gain insights into the participants' perspectives and inform the design of the final co-design workshop in the later stage. We hosted three group interviews separately. Groups were organized based on existing relationships among participants to make them feel more connected and comfortable when sharing their personal stories. Discussions during these sessions first delved into their existing practices, future desires, and challenges around making and interacting with memories in sound. The second part extended to how people with blindness understand and perceive sound, their everyday experiences in relation to sound, and how they envision to capture and revisit memories through sound.

Key Takeaways

The insights gathered from the introductory group interviews revealed intriguing nuances. Despite sound being a desired and preferred medium for capturing memories, participants possessed a limited number of meaningful recordings and rarely listened to them. However, across all participants, it was clear these recordings held great personal significance and were reported to be among their most cherished things. Participants expressed a strong desire to capture the moment while creating memories through sound. They also noted that such valuable moments—our participants named these

meaningful moments as ***sonic highlights***—often happen so fast that they can be quickly forgotten. This underscores the practical difficulty in sonically capturing significant moments. A common workaround was to leave a sound recorder running during special occasions. However, this approach raised additional challenges making it difficult to pinpoint and share meaningful moments within lengthy audio recordings. The need to avoid large recordings also introduced another limitation: it was difficult for participants to have the foresight to 'know' when a memorable moment was going to occur. Thus, these constraints made the experience of capturing impromptu *sonic highlights* in audio extremely difficult. During our collective discussions, **Walter** and **Alan** suggested that it would be interesting to develop a concept that could emulate how *sonic highlights* could be captured on the scene.



Figure 5.2. Introductory group interviews with participants in three groups: Janet, Ray and Luni (left), Carol (middle) and Alan, Hana and Walter (right)

5.5.2. Phase 2: Exploring – Participatory Field Activities

In Phase 2, our focus shifted to fostering more hands-on, interactive activities with our participants. We consider this phase to be pivotal in opening up our participants' lived experiences and creative capacities; it allowed us to scaffold the outcomes of these activities to empower participants to take the lead in the design process.

Methodological Approach

To continue investigating how participants might desire to collect *sonic highlights* of live experiences, we invited participants to choose an activity or event they would enjoy participating in groups. Our research team drew inspiration from "go-along" interviews [72] involving shadowing and observation to develop a lightweight

participatory field activity that would capture *near-past* moments that just happened and passed. The idea was to gather “retrospective sound” [210, 348]. However, although this idea was suggested by our participants, it was still unknown whether this was actually a design direction that participants would prefer. Further, designing a working prototype to do this would take considerable development time and resources. Thus, instead, our research team acted as an imaginary device. While participants enjoyed their moments at the events they attended, the accompanying research team—equipped with sound recording devices—shadowed the participants. Participants were also wearing microphones as the research team continuously recorded the surrounding soundscape while shadowing them. The concept of “ambient sound” that comprehensively captures the experience as a whole resonated with our participants' experiences, which appears in our prior research findings [508] and the audio documentary. This also aligns with the concept of a “soundscape” as defined by Pijanowski et al., wherein a soundscape is described as an amalgamation of “biological, geophysical and anthropogenic sounds” originating from a landscape where the collection of sounds varies across space and time, reflecting crucial ecosystem processes and human activities [373]. Likewise, our participants perceived that capturing the soundscape at the scene of a memorable event was critical to understanding the nuanced experience and emotions at key moments during it.

When participants encountered a *sonic highlight* worthy of being captured, at that precise moment, we asked them to give an auditory cue (e.g., snapping fingers or tapping their mic) as a marker in the recording. The research team later spotted the cues in the recordings and retrieved 15-20 seconds of the near-past moments around the cues to capture participants’ points of interest. These *sonic highlights* were created as a set of mp3 files and shared with the participants via email for them to revisit or use however they desired.



Figure 5.3. Ray and Luni went horseback riding as their participatory field activity.

When choosing an activity, we encouraged participants to explore a wide array of options, ranging from momentous or unique events to mundane activities. They were free to choose any experience they wished to capture sonically, reflecting their personal preferences and interests. As a result, a set of activities our participants elected for the participatory field activity to make sound memories were diverse.

- **Ray** and **Luni** went horseback riding for their anniversary (Figure 5.3). They both had ridden a horse long ago, but not recently. During the activity, they recorded many moments of surprise and excitement, such as when they first met the horses and proceeded to go horseback riding. Later, the instructor let them pet and feed horses for their special occasion.

- **Hana**, **Walter** and **Alan** participated in an introductory swordplay session at the European Martial Arts institution (Figure 5.4). It was Alan and Walter who decided on the activity. Hana got curious to find out what it was about and ended up really interested in learning the theories and science behind the medieval battle.

- **Carol** invited the first author to her home for a fresh cup of coffee (Figure 5.5). She enjoyed making coffee in the morning and chatted for an hour. While talking about many small things, she marked a few highlights, such as her

favourite sports, childhood dreams, impressions and experiences on the research.

Janet wanted to make sonic highlights of walking with her granddaughter, Christina, and a guide dog, Sam (Figure 5.6). It was her daily routine, but because spending time with Christina was so special to Janet, she felt inclined to make audio memories of them going for a walk.



Figure 5.4. Hana, Walter and Alan took the Swordplay 101



Figure 5.5. Carol enjoyed a coffee chat in the quiet early morning with a series of small laughter.

Later, we shared the sonic highlights with the participants and followed up with them by phone calls and descriptive email replies. Participants were impressed by how other sounds that they could not notice in the scene were captured so clearly, giving them an alternative view of reviewing their experience. For example, **Ray** was surprised how he was able to hear the horse's footsteps in the highlights that he had never noticed or paid attention to for the whole time. Similarly, **Hana** liked the soft clinking sounds of gauntlets that brought the feelings of touching and wearing them. **Alan** commented that he would choose highlights of *"special sounds"* and *"unique moments"*, such as the unique metallic sound of a round shield blocking a long sword, over recording information about medieval history that he could easily find on YouTube. Participants commented that having the sonic highlights made them ponder, *"What is the meaning of having access to the highlights of an event?" "What do I wish to do with these highlights?"*



Figure 5.6. Janet made audio memories from her mundane routine of walking with her granddaughter, Christina.

Key Takeaways

The participatory field activities gave us a major insight into uncovering specific attributes that our participants valued in their audio memories. These activities also served to prime them with sonic highlights in preparation for the upcoming co-design workshop. While we found the initial concept of capturing sonic highlights from the previous phase was highly desired as an aspirational concept, it did not work as expected in practice for two reasons.

First, we discovered that a 'less demanding' interaction was crucial for effectively capturing audio memories during special events. Capturing the sonic highlights with a

simple cue was enjoyable and intuitive, but some participants were so absorbed in the moment that they forgot to provide cues to mark the highlights. Our research team was able to find a workaround by 'cherry-picking' highlights on behalf of the participants. Given our close observation and indirect involvement in the scenes, we could anticipate when participants might find the experience intriguing. We later reviewed the chosen sonic highlights with the participants, and they were pleased that we were able to identify the highlights that emotionally resonated with their own impressions. However, all participants agreed that even a simple conscious interaction was too obtrusive, could disrupt the experience, and was ultimately unwanted.

The second challenge emerged when we checked in a month after sharing the sonic highlights. Although the participants appreciated the sonic highlights and kept them, most of them eventually lost track of their whereabouts among other digital files, complicating their accessibility as a valuable resource for reminiscence. Thus, instead of capturing and creating new sonic memories, our focus shifted towards working with the original sonic memories that participants had repeatedly mentioned. We aimed to design for the unique experience of remembering that unfolds through the existing sound recordings.

These insights played a significant role in shaping our design direction and served as resources for designing the sound-based activities. It is important to note that the intention behind this approach was not to evaluate the participatory field activity method itself, but instead, we sought to understand the participants' experience with having such an imaginary device for capturing audio memories and to explore potential design opportunities with the sonic highlights. In summary, conducting the participatory group activities was rooted in our commitment to continuous engagement to understand participants' worldviews and to translate their stories, ideas, personal experiences and desires into actionable design elements that ensured their voices and perspectives were core to guiding our process.

5.5.3. Phase 3: Co-designing – Develop and Host the Co-design Workshop

Our research team reviewed all insights from the introductory group interviews, sonic highlights obtained from the participatory field activities, and participants'

reflections on the sonic highlights to develop the final co-design workshop. Finally, we came up with three activities inspired by the approaches of storytelling [17, 141, 398], co-listening [80], and co-speculating [252, 279, 475] in the context of sound. The final co-design workshop was led by four facilitators and assisted by three supporting members of the research team. The workshop lasted three hours and drew six attendees, consisting of four (**Ray**, **Janet**, **Hana** and **Walter**) of the seven participants and two attendees significant to them (**Scott** and **Michael**), resulting in three pairs. Each participant pair, a facilitator and a supporting member, formed one focus group, with the main facilitator overseeing the workshop (first author) and supervising across the three focus groups.

Activity 1: Sensitizing and Storytelling—Prior to the workshop, participants were asked to bring a cherished audio recording or a sonically meaningful object. Additionally, they were encouraged to bring a significant person from their lives, such as a friend, partner, or family member. The first activity commenced as a large-group discussion. It started with an icebreaker, providing an opportunity for both participants and facilitators to introduce themselves and share the types of sounds they loved and disliked. Then, each pair shared the sounds or objects they brought, describing the significance and the stories behind them. Facilitators guided the discussion with reflective and exploratory questions, aiming to unveil emotional and social dimensions within the audio and stories, such as: What is the theme of your memory? What are the sounds you remember the most in this scene? Are there any unexpected sounds captured in the recording? What are the other senses involved in this memory?

Activity 2: Co-listening—Each focus group moved to separate rooms, where they dived into their sounds and personal stories. The questions were designed to encourage in-depth conversations about their inspirations and aspirations for transforming their cherished audio into a desired form. Our insights from the participatory field activities (Phase 2) revealed that the sonic highlights often revolved around specific and distinct sounds. Guided by this understanding, we explored questions while closely listening to the audio together to understand how memory is reconstructed in sound and, conversely, how sound reconstructs memory. We asked: How do you feel when listening to the recording? What is the first/last sound you remember from this memory? What is the highlight of this memory? Which sound resonates with you the most in this

recording? What was in the background? Is there any sound you remember but not captured in the recording?



Figure 5.7. Storytelling (top left and bottom right) and co-listening (top right and bottom left) sessions for activities 1 and 2.

Activity 3: Co-speculating—Lastly, facilitators collaborated with participants to translate their audio and associated memories into meaningful sonic representations, following their lead. We started by prompting participants to elucidate the surroundings, atmosphere, and environment of the memory scene, such as the physical place, the emotional climate, the time of day, and the people who were present in the scene. The question “How should the memory start/close?” especially helped participants envision how their memories can be meaningfully represented by sound according to their preferences. Building on their personal audio pieces, each facilitator used sound-editing software, free online sound databases, and a microphone to record their voices and short narrations to craft sonic mementos, following our participants’ guidance closely. As a result, we created three sonic mementos that are vastly different. In the following section, we provide a detailed description of three sonic mementos and the process of co-creating them together.



Figure 5.8. Participants listening to the final sonic mementos created from the co-speculation session.

5.6. Co-design Outcomes – Three Types of Sonic Mementos

We present three types of sonic mementos created together with the participants during the co-design workshop as case exemplars, which illustrate the outcomes of our 12-month co-design process. As textual descriptions may not fully deliver sonic qualities, we have attached three sonic mementos as supplementary materials.[6] The original versions include *Sparring Highlight* and *Baby Bell*, while *Boat Trip* is an anonymized version where people's names mentioned in the recording are replaced with a short dip of silence.

5.6.1. Encapsulation and Condensation - Ray & Michael's Sparring Highlight

Ray brought a 28-minute recording of a Krav Maga session. Although neither Ray nor Michael specifically recalled the session, listening to it evoked an embodied reaction in both. As we listened to the audio together, they identified that listening to the violence of the session brought up the same rush of adrenaline and sense of danger as being in the room itself—they could feel it physically. For this reason, Ray occasionally listened to the recordings he makes of Krav Maga sessions, while Michael, though he had never re-listened to the recordings before, was moved by the experience. Ray and

[6] Selected audio highlights and three sonic mementos can be downloaded and listened from the supplementary material on the ACM digital library: https://dl.acm.org/doi/10.1145/3613904.3641940.

Michael identified the value of reliving this experience, yet they found the 28-minute recording unwieldy to navigate, unfocused, and impractically long. As our discussion unfolded, we arrived at the idea of creating a sonic highlight that prioritized the elements of the recording that triggered this embodied memory and that also included sounds that provided context, a narrative throughline, and dramatic flair. Drawing from Ray's background as a podcast creator, Ray brought valuable insights into sound editing to the table. He had previously edited recordings of his Krav Maga sessions to use as the opening of his podcast. He shared his perspectives and concrete suggestions on weaving a narrative through-line that drives through the sonic highlight.

Upon listening to the sound recording again, Ray and Michael were able to pinpoint specific sounds that were iconic or indicative of recurring memorable phenomena from their Krav Maga sessions. The violent sounds of pads being hit were immediately agreed on as the core triggering sound, and thus, two clips of pad hits formed the backbone of the sonic memento. Another key sound was the instructor, whose gravitas and presence are a core component of their memories of the sessions. In the sonic memento, the instructor's voice served as punctuation and was interwoven throughout. It was often heard in the background of other clips, such as pads being punched and kicked, and contributed to the decision-making process regarding why these specific moments were chosen. We used the instructor's voice, issuing specific commands to create a framework in which the other sounds from the class could be inserted.

Tensions also emerged in the recording. A particular sound—the presence of Electronic Dance Music (EDM) playing in the background—was much more noticeable in this original recording they brought, which was different from how they remembered the usual sparring sessions. Because the loud music broke their focus, they wanted it to be removed as we created the sonic memento. When asked whether there was value in retaining the background music to be true to the authentic experience, Ray and Michael were more interested in editing the memory to their preference. The essence of their experience was the powerful energy and emotion evoked by the sounds of the sparring session, which both Ray and Michael wished to capture and preserve. This discussion reaffirmed our shared understanding of the goal of this sonic highlight.

Sonic Narration: The sonic memento begins with the Krav Maga instructor shouting instructions and clapping at the class. This is followed by the sound of pads being hit, with occasional grunts and scuffles. The instructor's voice can be heard in the background. This is followed by a new instruction to the class, telling them *"two hits"*, and then a sound *"GO!"*. You then hear the percussive sound of elbows hitting pads. This is followed by two clips of a trainee groaning and then yelling in pain before a clip of positive encouragement from the instructor: *"Yeah, yeah, that's it!"*. The sonic memento ends with indistinct mumbling, conveying the atmosphere of the room.

5.6.2. Augmentation and Expansion - Janet & Scott's Boat Trip

Janet and Scott brought in several audio recordings from a trip they had taken together to an Island off the coast of Western Canada. Taking an audio recorder to eventful moments was a common practice so that they could later listen and share the experience with friends and family. Janet, especially, valued these recordings as they featured rare instances of both her and Scott's voices. The recordings ranged from two to five minutes. While these clips already served as a well-established form of sonic memories, key questions emerged: *What could be done with these recordings to enhance their characters? What could be done to the recordings to allow them to be shared more easily with friends and family?*

As Janet and Scott recounted stories beyond the recordings, it became evident that certain sounds were absent in the recording, contrasting with their memories of the event. For instance, Janet recalled a clinking metal sound from the boat's deck. Scott did not recall the clinking sound, but Janet clearly remembered it. Conversely, Scott remembered "a nice low humming sound" of the boat motor that was missing in the recording. The motor sound was probably too soft to be caught by the recorder, yet the sound was vivid in his memory. This realization prompted them to closely retrace moments, at times, adding missing sounds to enhance the sonic experience.

To evoke the atmosphere and emotions tied to the soundscape, Janet and Scott decided to add specific sounds and narrations to the sonic memento. Janet expressed a desire to add a Puffin sound—a common local seabird found around the island. In more detail, she specifically asked to gradually increase the volume of puffin sound as the boat arrived at the cliffs where puffins nested. Puffins laid eggs in the flat areas between

the rocky cliffs, the tour guide explained. Near the cliff, Janet and Scott both felt the boat bouncing up and down due to strong ocean tides breaking through narrow and sharp rocks, making the sound of “the water moans the rock away”. Janet noted it as the sound of the irregular and indented coastline of the Atlantic Ocean as opposed to the sound of the gently curved shoreline of the Pacific. These meticulous details were translated by catching the details of each sound component and finding the right sound—imported from the online sound libraries—and volume that best described and represented the ones in their memory. The final edit included the sounds of the boat motor, the specific calls of seabirds, the sensation of the wind, the weather, and finally, the sprays of the ocean. The contextual markers created with a complex mixture of sounds played an essential role in vividly retelling the story of their trip and giving a sense of *timing* that added another level of richness to the atmosphere.

On top of the added sound components, Janet wanted to include short narrations in the final version of the sonic memento that give hints about the information that cannot be explained solely through sound, not only the details of the trip but also their emotions and inner thoughts throughout the trip. This led to a further dialogue of when the memories ‘start’ and ‘end’ as well as the key highlights throughout the audio recordings to form cohesive narratives. For example, the entire trip “felt cold” because they forgot to bring proper clothes on the boat, but Janet and Scott couldn’t wait to go back to a warm hotel room by the end of the trip, which was how the memory of their boat trip concluded.

Sonic Narration: Janet and Scott’s sonic memento begins with the sounds of gulls and the motor of a boat as it pulls away from a dock. Janet’s narration starts shortly after as she describes where they are and why they are taking a boat tour, then shifts to describing the scene, including the weather. Scott’s voice joins the narration, providing a bit of humour to the description that they hope to see Puffins and Gulls. As the audio continues and their narration ends, we hear once again the sound of the motor, metal chains and water splashing against the hull of a boat, all of which were not present in the original audio recordings. As these sounds fade out from the foreground, we hear Scott describe the shape of the rocky outcrops they are passing, his voice buffeted against the wind and the faint sound of music from a radio can be heard in the background. Janet’s narration picks up again as she describes her reaction to what Scott is telling her and

her inner monologue at the time. As the trip nears its end, Janet and Scott's narration shifts to how they were feeling at the end of the boat tour: freezing cold and ready to be back on dry land but happy that it was something they got to share together. The sound of the motor and of gulls is used to mark the end of both the audio and the memory itself.

5.6.3. Re-imagination and Re-creation- Hana & Walter's Baby Bell



Figure 5.9. Hana & Walter's sonically significant object was a bell wrapped in cloth for their son, Chris.

Hana and Walter brought a bell wrapped in cloth. Asking, *"Why is this bell so important to you?"* triggered a long trail of memories of their firstborn son, Chris. Because both Hana and Walter are blind, when Chris was born, they made a small baby bell wrapped and stitched in a soft cloth and attached it to Chris. Whenever Chris moved, the bell made its unique sound so Hana and Walter could locate him easily. They also attached similar bells to important objects like keys, but Chris's bell had a distinct sound they could recognize immediately. Even when he was sleeping, subtle tossing and turning would tell them where the baby was sleeping. As Chris grew older, he noticed his classmates did not have a bell attached to their clothes. Sometimes, he would stay quiet not to be spotted by his parents—mostly for fun, seldom being grumpy.

Taking the bell as a starting point, Hana and Walter recounted more dinnertime stories, including tales of how Chris ransacked the refrigerator for snacks, his favourite children's cartoons, and the songs he liked. Retelling these stories, they said it was unfortunate not to have any recordings of baby Chris crying or laughing. When prompted, *"How should we put these memories of baby Chris together?",* the stories and narrations began to blur as they attempted to pinpoint a *specific* memory. Instead, Hana

and Walter decided to create a brief sonic summary of an ordinary day with baby Chris. They imagined beginning with the sound they had heard in the morning, slowly moving on to the daytime sound, and later ending with the bathtime song. Building on their emotional impression of the bell sound, they slowly added more details to this memory.

Hana and Walter lived in a lively area near the train station. In the early morning around the summertime, Walter remembered the trains warming up their engines, getting ready to operate their first trip of the day. Hana recalled many birds chirping in the morning. As baby Chris woke up and started to move around the house, they would hear the bell. During the day, Chris enjoyed watching children's animations, such as the Baby Einstein series or the Magic School Bus, on a rocking chair with his *"weird"* but friendly laugh. Hana played lots of children's songs on CD. Chris had a big smile for a particular song that Hana would dance and sing along to beside his cradle. As the song finished, baby Chris went *"Weeeh,"* asking for an encore. Hana and Walter then recalled a long-forgotten children's song that used to be Chris's bathtime song. Every evening during Chris's bath time, his parents would sing the song together. The song always ended with a countdown followed by *"the splash"* as baby Chris was dipped into the bathtub. Hana and Walter were genuinely surprised as lyrics slowly came into their mind when they tried to sing the song together.

For their sonic memento, Hana wanted to record their voices, singing the bathtime song together with Walter, which takes an essential part of their memory. Additionally, Walter wanted to record his own brief description of this sonic memento in case they would share it with others. Together, we reviewed sounds from sound databases, adjusting volumes and timing to appropriate levels, and edited and mastered a short 1-minute clip. During the process, Hana and Walter actively gave real-time feedback, engaging in choosing and modifying sounds. The final version is a retrospectively recorded memory and could not contain all the original sounds they wished to include, but for Hana and Walter, it highlighted how they would want to remember baby Chris, all triggered by a simple bell sound. Interestingly, while no remarkable event was associated with the bell sound, this cherished object and its original sound prompted a recollection of precious day-to-day memories. It helped Hana and Walter recall the overall feelings, atmosphere, and mood brought back by the bell.

Sonic Narration: Hana and Walter's sonic memento starts with the gentle jingling of the bell as it is the gateway to their cherished memories of baby Chris. With American robins chirping, a bird commonly found in that area in summer, baby Chris's favourite children's song that Hana used to dance comes in. As Walter's short narration explains that these sounds are the memories of their son, the children's song gets louder, and the lyrics are heard. A few more jingling sounds depict baby Chris's movement throughout the day, followed by a subtle 'thud' of the fridge door closing. Trains and cars fill the background, creating a relaxing start-of-the-day ambience. As the day gradually fades away, the scene transitions to Hana and Walter bathing with baby Chris, singing the bathtime song together and counting down to the splash.

5.7. Discussions & Implications

Participants possessed personal audio recordings but refrained from actively sharing them with others. Participants expressed concern that those who were not involved in the recordings might not understand, interpret, or empathize as deeply as themselves [508]. Yet, our participants had a desire to share experiences, memories, and emotions associated with the recordings with their loved ones. As Janet stated, *"Everyone has a different way of remembering things. People do try to include people who are blind or have whatever disability and make them feel like they are part of the situation as well.*" Participants and their partners at the co-design workshop aspired for new ways to facilitate shared and inclusive experiences for memories captured through sound. However, they also raised concerns about photography dominating the creation of 'shared memories' among their sighted counterparts. They questioned, *can sound be a proper alternative*?

In what follows, we detail (i) design opportunities to promote collective remembering that encompass both people with sight and blindness and (ii) design recommendations to contribute to the design space of sonic memory in terms of remembering through sound. We acknowledge that these design opportunities and recommendations come from our participants. We reviewed multiple touchpoints during a year-long ongoing, collaborative, and engaged design process aimed at respecting the positionality of our participants.

5.7.1. Collective Remembering through Sound

Sound memories have distinct attributes compared to visual memories. When sharing memories with photos, visual cues prompt people to look at the image, while auditory cues—separated from the visual cues—facilitate reflective conversation. In contrast, when sharing audio recordings, auditory cues must be primarily used for listening to the audio rather than engaging in reflective conversation. It is challenging to verbally describe the experience when the audio is played as the mental focus for listening and reflection may be easily disrupted. However, sound can be a powerful medium for evoking desired moods and conveying the emotions felt by participants when the audio was recorded. We found that fostering mutual understanding is critical when revisiting sonic memories together. Reflecting on our collaborative design process with the participants, we outline four key attributes of sound that are valuable in bringing people together to collectively remember memorable moments.

Emotional Layers in Sound

Participants kept certain recordings (e.g., soundscapes, weddings, family reunions, trips and vacations) for many years, undergoing deep grief when losing them. What makes these audio recordings special is that they hold more than sounds—they carry strong feelings and emotions that go beyond what can be heard. As Ray put it, *"It's really important for other people to understand how someone who is blind can remember things that have happened that are special to us, maybe a little bit differently".* Throughout the co-design process, we learned various sound elements can be placed in the **foreground**, **middle ground** and **background** to offer a rich, reflective sonic experience. This form of classification, used by Schafer, assigns terms such as foreground and background to organize and describe sonic experience [79], extending concepts of figure and ground from visual analysis. Moreover, we observed sounds can move between layers, drawing attention to specific aspects of the environment to invite the listener through guided moments of reflection.

Foreground sounds draw attention to audible cues, such as powerful shouts in *Ray & Michael's Sparring Highlight*, strong gusts on the ocean in *Janet & Scott's Boat Trip*, or the children's song in *Hana & Walter's Baby Bell*. Foreground sounds extend our previous finding on *Focused sound* in audio recordings [508]. While focused sounds

“commemorate close social relationships”, foreground sounds offer a sonic cue to a unique spatial and temporal relationship. They exist as signals—or *sound marks* [404]—to translate a sonic message that requires an individual to listen. Beyond social relationships, foreground sounds leave strong impressions on the listeners, often becoming the starting point of the conversation that touches memories in the recordings. While most of the ‘highlights’ in audio recordings that participants remember and cherish come from the foreground sounds, foreground sounds are not easily reconstructable.

Background sounds provide depth and create an overall tone, forming the mood of a recording while also providing context to the location. Background sounds can be white noise from a certain place or a soundscape of the surroundings. This also develops our understanding in line with earlier findings on *ambient sound*, which is used for people with blindness to “capture emotional feelings and atmospheric timbre” [508] by providing spatial and temporal qualities in a recording. Having these qualities in sound provides reflective and relational experiences, such as the distance between the time of recording and the time of listening (temporal), navigating beyond and outside of the sounding space and time as viewing sound as a *performer* with a location (spatial) rather than simply an aspect of an environment [266]. As we have found in listening practices, these qualities helped us to carefully position ambient sounds in the background, which could reconstruct the atmosphere [79] that resonated with the background sound in participants’ memories. For instance, we added the sound of birds in Hana & Walter’s Baby Bell. Knowing the exact location of their house and season narrowed our search for commonly spotted birds in their area in Summer, leading us to the North American Robin. This level of specificity helped create a distinct atmosphere back in the time that was perceived as emotionally and sonically strong and meaningful.

Lastly, ***middle-ground sounds*** fill the space between foreground and background, providing additional information about the scene to contribute to the overall composition of sound and acting as a transitional space for movement between layers. As our participants reflected and described, sound elements in their recordings constantly changed and shifted. Sounds in the foreground can fade into the middle ground while still contributing to the sonic space but with less attention. For example, in Janet & Scott’s Boat Trip at 5:05, a tour guide plays an important role in the foreground but suddenly fades out when Janet & Scott’s narration comes in. However, the tour

guide keeps having a presence to support the tone and contribute to the overall atmosphere of the recording.

The interplay of sound layers creates a rich, intermixed, and dynamic auditory landscape that takes participants back to when the memory was made. Upon sharing the final versions of the sonic mementos, our participants appreciated the auditory landscape as it made them feel like they were right back in that moment, reliving it with a heightened sense of being there. As **Alan** noted, *"If there is no sound, I cannot recreate the scene."*

Framing the Context in Audio

Framing, where memories start and end in a sonic memento, becomes essential in memory-making through sound. Participants reported that they often find themselves caught up in the memory from the first hint of a sound. Even everyday sounds that may seem unrelated to the main memory somehow fit into the bigger picture, like a puzzle where these pieces blend seamlessly. Building a comprehensive frame for the memory, carefully shaped by sound, allows our participants to bring back memories and old feelings. Our findings clarified how memories evoked by the initial sound in a recording shape the memory trace elicited by the recording. This can happen slowly with a single sound, such as how Hana & Walter's Baby Bell begins with a quiet bell sound, or more immediately with strong energy, like Ray & Michael's Sparring Highlight.

Our participants paid attention to how their memory should close at the end of the recording. Ray wished to conclude their highlight by transitioning to a relatively calming atmosphere of catching their breath and exchanging encouraging words with each other. Hana & Walter asked to close their recording with the splash sound, as taking a bath had always been the last routine for a typical day with baby Chris. Janet & Scott carefully scripted their last lines with a quick recap of their trip, appreciating the time they enjoyed together. Framing memories in sound involves deciding and integrating particular contextual qualities. Putting contextual qualities in an audio recording can determine whether a recording is for personal reflection or social sharing. If it is only for participants themselves, the audio can have less context and be more personal, something they want to return to. On the other hand, participants wanted more context for sharing with others, like how Walter wanted to add a short description at the

beginning of the Baby Bell. Narrations are needed to provide the context and tell a hint of backstory on what to expect, similar to how visual cues in photography provide where the photo is taken at a glance.

Pace and Length for Reflective Absorption

The pace at which participants accept and digest sound elements in audio recordings influenced the collaborative listening experience. While participants tend to *"crank up the speed"* when listening to be more efficient for practical uses (e.g., receiving notifications, reading emails, browsing websites, etc.), they also see the value in slow listening. Similar to the artifacts (e.g., [341, 345, 380, 454]) designed with Slow Technology [198] for fostering a deeper understanding of self and social relationships, at a slower pace, participants were soaked in each layer of sound, catching key emotive nuances in voices and setting boundaries on what memories they are diving into. This eventually led participants to enjoy audio at normal speed, which sighted people are accustomed to. We observed that slowness in sound is related to the ***arrangement of the sonic elements in sound layers***. For Janet & Scott's Boat Trip and Hana & Walter's Baby Bell, participants wanted to space out the sound elements with mellow overlapping sounds to transition to the next scene. Placing sounds at a gentler pace helped them dive deeper into the sound, allowing mental space to let emotions flow and connect to the moments they have saved. For instance, Janet & Scott's Boat Trip was expanded from a 2-minute audio recording to a 7-minute skit, but regardless of the length, Janet engaged in a highly focused and absorbed listening experience with Scott, listening to the final version without speeding up. The ***length of audio recordings*** also contributed to the slow pacing on top of spacing the sound elements. While Ray liked a 1-minute Sparring Highlight, he also desired to create a longer version for his own personal use to consider and enjoy. For the 1-minute highlight, Ray felt rushed because he was *"constantly forced [his] brain to shift through the scenes."* He wanted to find a way to slow it down for the purpose of reflection. Often, our participants created extended audio recordings as they usually let the recorder run in the background, often ending up with multi-hour recordings. However, as participants pointed out, they do not listen to the whole thing, both for themselves and with sighted others, because they do not have time for it and easily lose interest. In this sense, participants enjoyed the extracted highlights from the participatory field activities. However, as Ray and Alan

criticized, editing sound independently requires time and effort, marking real practical difficulties that could emerge.

5.7.2. Recommendations and Considerations for Remembering through Sound

From our collaborative experience, creating sonic memories together felt like a reflective ritual. We sat down and dug into the memories, remembering things they had forgotten (e.g., bathtime song in Hana & Walter's Baby Bell). As a result, sonic mementos act as an entry point to a meaningful reminiscence experience for our participants and their important others who wish to remember things together through a mix of sounds, feelings, and stories. Next, we further interpret findings to detail opportunities for future HCI research and practice aimed at mobilizing sound for remembering.

Voice as a Resource for Temporal Reflection

In our design journey, our participants repeatedly appreciated the significance of voices. While voices carry intricate nuances and expressions for evoking memories and emotions, such as pitch, tone, and prosody, we further observed that voices can add a temporal dimension to sonic memory. When Janet played her audio recording of the boat trip during the co-listening session, Hana and Janet immediately noticed her voice was *"young"*. Similar to how individuals with sight reflect upon the passage of time while looking at photographs of themselves, our participants also experience the ***flow of time*** by listening to their own voices in the past. As Ray described it as a *"time-loop experience"*, a complex set of memories in the recorded voices resonates deeply, creating a strong sense of connection with the past and the people who were part of those moments. In this vein, voice can offer a new perspective in exploring time. As discussed in 5.2.1, our participants feel the flow of time when listening to their voices in old audio recordings. In these recordings, their own or important other's voices were captured at a time from the past, rekindling nostalgic feelings and allowing them to reminisce.

In the HCI and design community, there is a body of research on incorporating temporality into designing with personal data to foster a more holistic, meaningful and

reflective experience (e.g., [84, 256, 343]). Yet, temporal qualities in voices have not been actively explored in the HCI and design communities. Our observations suggest voice has the capacity to produce creative temporal patterns to be applied to interactive systems in personal, social and cultural contexts. However, we learned from our participants that voice recordings are relatively more abundant than other collections, such as music and photography. One approach to negotiate with this limitation is to design for longer-term engagement—interactions that last long, such as dialogues with significant others or family members [215]. For example, one design opportunity could be creating a voice archive for people with blindness to collect treasured descriptions gifted by sighted people around them. As outlined in our earlier publication, people with blindness treasured descriptions of visual concepts (e.g., colours) or natural phenomena (e.g., sunsets, stars in the sky) provided by sighted others as they "look through someone else's eyes" [508]. Giving a physical or digital form for cherished descriptions in their own or loved ones' voices with temporal metadata (e.g., timestamps) can be a meaningful personal collection for people with blindness.

Navigating and Condensing Extended Audio Recordings

Our research revealed two primary limitations that emerged when our participants were required to handle lengthy audio recordings that held cherished memories. Participants struggled to (i) efficiently navigate through long recordings to find specific points of interest within the recording and (ii) translate the recording into a condensed version. Several design strategies could be mobilized to tackle these limitations. First, integrating markers that can be jumped to saved timestamps in the recording can improve navigation. These markers could serve as guideposts, allowing people with blindness to jump to the key moments within the recording swiftly. Then, condensing a lengthy recording can involve pinpointing its highlights. This process requires identifying the most meaningful segments that encapsulate the essence of the memory in the recording. From the participatory field activities, our research team was able to cherry-pick the highlighted moments on their behalf because some participants forgot to give a cue as they were too absorbed in the moments. Yet, making a 'less demanding interaction' to mark the highlight without disrupting the focused listening experience could be a design challenge. To avoid interrupting in situ moments of experience, recordings can be reviewed later to add the markers manually, or they could be added in an automated approach through designing a machine learning algorithm to

review recently or frequently accessed timestamps to mark possible points of interest as highlights. Once these markers are created, AI-assisted algorithms could be leveraged to progressively identify and generate highlights around the marked timestamps automatically. This could not only save time but also offer people with blindness an alternative perspective on their memories, potentially unveiling serendipitous moments. Reflecting on section 'Pace and Length for Reflective Absorption' above, this AI-assisted algorithm approach could also consider the length of a condensed recording, providing more control over the length of the sonic highlights to cater to varying levels of sharing needs. Some memories might be suitable for longer excerpts for detailed storytelling (e.g., Janet & Scott's Boat Trip), while succinct snippets for quick recollection might be sufficient (e.g., Ray & Michael's Sparring Highlight). These design suggestions to navigate and condense extended audio memories require a careful balance between technological assistance and user agency. By incorporating markers, highlights and the AI's capabilities, this approach may allow much leeway for people with blindness to tailor their extended audio recordings while respecting individual preferences on their cherished memories.

Designing for Few

Across our 12-month design journey with participants, we found that although they collectively viewed sound as an essential and primary medium to capture key life experiences, they also did not own large collections of audio memories. While some participants frequently make audio recordings, most are for practical purposes, and only a small fraction of the recordings created on special occasions truly take part as cherished audio possessions for revisitation. This signifies that making audio recordings for memories is not a daily routine for many participants. This seems to be partially because they *"got out of the habit."* Despite having easier access to make audio recordings (e.g., digital recorders and smartphones), maintaining a large, rich audio collection nonetheless required too much time and effort. These findings show there may be value in recognizing quality over quantity and underscoring the depth of meaning that a small number of selected audio possessions hold. This perspective runs counter to the trend in the HCI and design community of designing with abundant personal data for deeper reflection (e.g., vast photo archives). *Designing for few* could offer an alternative approach to engage the effects of information overload [247]. Indeed, some participants commented on how having an excessive number of cherished audio mementos could

potentially *"dilute"* their significance. They were resistant to having an overabundance of audio recordings that may lessen the emotional impact of each individual memory.

Designing for few can build on and extend the HCI and design community's trajectory of values-oriented research aimed at creating interfaces that enhance self-reflection, inner growth, mindfulness and fostering social relationships by celebrating the significance of a carefully curated set of memories [198, 412]. Reflecting on the co-design workshop on sound-based reminiscence revealed that memories are not static entities but are continually reconstructed every time they are evoked, constantly influenced by the atmosphere, mood, emotion, people and other surrounding environments. This suggests that future design initiatives aimed at capturing, augmenting, and re-experiencing a smaller set of sound-based mementos do not necessarily result in people embracing few memories; rather, they emphasize the richness of each personal and social experience elicited.

5.8. Limitations and Future Work

In this paper, we have described our 12-month co-creative design journey that arrived at the final co-design workshop with 7 participants. We have critically reflected on three sonic mementos from the workshop and the insights we encountered in our collaborative design process with participants. We aim to better understand how people with blindness use their personal audio recordings to look back on their past life experiences. Through a nuanced, carefully carried-out exploration, our research marks the importance of a prolonged, iterative design process that is interwoven with multiple touchpoints. We humbly recognize our decision-making process was imbued with a remarkable level of engagement, enthusiasm and dialogue. Participants, their loved ones, and researchers collectively contributed a steady stream of descriptive narratives and impressions. The significance of participants' voices, stories and emotions within their treasured audio recordings played a pivotal role in this design process. We interpreted these accounts to propose design recommendations and considerations to support future HCI research and practice investigating remembering through sound.

However, we acknowledge that there are limitations in this research. First, our design recommendations stem from the situated and nuanced experiences of a small group of participants. While these insights may serve as inspiration for researchers and

practitioners working on related topics—the primary reason why we aimed to detail our design journey—these recommendations may not be easily scalable to undertaking a similar design process in a different context, especially when working with people with different social, cultural or geological background. Second, during the brainstorming of participatory activities, our research team focused on participants' words during the interview as a reflection point to facilitate discussion and ideation on activities participants could choose. An alternative approach could have involved a separate gathering or discussion dedicated to designing the activity. For instance, engaging in a collective discussion conducted with various design activities (e.g., role-playing, body storming, arts & crafts, etc.) or with design toolkits might have yielded different activity ideas. Third, the cross-checking of data with the participants could have been executed differently. Despite allocating dedicated times, either at the beginning or end of each session, to share our analysis and elicit continuous feedback, there is room for improvement in implementing opportunities for feedback exchange. For instance, hosting more frequent get-togethers throughout the design process may have been beneficial. In hindsight, when meeting in person is challenging due to long travel distances, scheduling constraints, or pandemic situations, we could have explored other forms of communication channels, such as online Zoom meetings or group calls. Clearly, there are opportunities for working with blind participants beyond physical settings.

Throughout the research process, we have grappled with a fundamental question in co-design: Who takes the lead in the design process? In our next steps, we remain committed to a long-term collaborative approach to shaping meaningful sonic memories that resonate with people with blindness, reflecting their own unique perspectives, values, desires, and aspirations. In our future work, building on the three design opportunities suggested in this paper, we will continue engaging in a co-design process to collaboratively explore possible creative forms, materials and interactions with participants. This step will inform the design, making, and implementation of participants' sound-based mementos by creating a small set of uniquely designed research artifacts that can be lived with the participants in their homes.

Chapter 6.

Beyond Looking Back: Envisioning Long-term Biographical Archives for People with Blindness Through Speculative Design Fiction Based on Sound Memories

6.1. Overview

So far, our discussions, findings, and analyses have focused on the past and the present—both current and past memory practices and reminiscence experiences, which made me wonder, what are our participants' desires for future practices of reminiscence, such as creating legacies, hoping for new, emerging technologies for memory practices, possibly in 20, 30, or even 50 years from now? Therefore, as the final phase of my thesis project, I chose to co-speculate about my participants' future desires and wishes regarding their memory practices through design fiction and storytelling, asking the following research question:

RQ4: How can co-speculative design fictions, grounded in the situated lived experiences of blind collaborators, reveal their imaginations and desires for future memory technologies, and how do they critically challenge norms in current and emerging technologies regarding longitudinal reminiscence and the curation of memory traces and legacy for people with blindness?

Employing speculative design approach with design fiction, we planned to co-create future-oriented, imaginative artifacts that probe possible, probable, or preferable futures and open new areas of inquiry into our participants' future reminiscence practices. We used our participants' narratives from their lived experiences as discussion points to raise questions, provoke creativity, and explore the personal and social means of using their imagined memory technologies.

Participants thoughtfully crafted design fiction stories that reflect what they wish to leave behind and what they want to carry on. We supported our participants in developing their own imagined memory objects that reflect their future expectations for

memory technology, co-creating two design fiction short stories for each memory object, resulting in a total of 8 short stories. With a significant shift in the positionality as our relationship with our participants evolved into a long-term collaboration, we decided to drop the pseudonyms and use the real names to properly acknowledge our participants' creative contributions to this research and the authorship of their stories. As of now, this work is in preparation for a full-paper submission for ACM CHI 2027. In this chapter, I describe the co-speculative design process of creating design fiction stories with our participants on the future desires of reminiscence experience, memory practices and legacy for people with blindness.

6.2. Introduction

Reflecting, remembering, and reminiscing on our lives and personal histories, and sharing such precious moments with people whom we love, is a fundamentally human experience [46, 482]. Over the past decade, the expansion of digital services has opened up new, meaningful ways for people to record and revisit their memories. Along with rapid technological advancements, such as the rise of AI and AR/VR technologies, have enabled us to create and re-experience memories in far more diverse ways, filling gaps in our records and looking back on the past in creative ways. In this vein, researchers in HCI have investigated on memory, reminiscence, and remembrance with a wide range of technologies and developed new applications for reminiscence. However, most of these works have been tailored predominantly for the general public (e.g., [181, 244, 361, 485]), people with dementia (e.g., [28, 377, 384, 460]) or older adults (e.g., [227, 245, 300, 510]), leaving the unique situated practices and lived experiences of people with disabilities largely unexamined, particularly those living with blindness [511]. To address this gap, we conducted long-term participatory design research, working closely with a small group of blind individuals over a seven-year period to gain a deep understanding and to design together on their everyday reminiscence experiences.

While our previous work focused on the immediate emotional triggers of sound and how audio recordings could uncover insights into different forms of sound memory [509], this study takes a step beyond immediate, day-to-day reminiscence to investigate the broader landscape of blind people’s envisioning of the future of reminiscence,

specifically through the lens of speculative design [16, 140, 368] and design fiction[47, 307, 350]. In this paper, we seek to explore how our collaborators envision future memory technologies, grounded in their own lived experiences, and how they wish to pass down their current memories as a long-lasting legacy for their beloved family members and future generations. By using sound-based reminiscence as our primary point of interest, we look into the unique aesthetic and evocative qualities of audio and sound to achieve a more holistic understanding of the desires and possibilities of biographical memory archives for people with blindness. We question how speculation—design fictions, in our case—developed from personal, situated lived experiences can prompt us to co-speculate on the hopes and desires of future memory practices for people with blindness. Specifically, we ask: How can we assist our blind collaborators in developing design fiction stories grounded in their lived experiences? How do speculative design fictions reveal a deeper understanding of blind people's future memory practices? To what extent do these design fictions challenge current trends and norms in digital services by offering insights into creating memory traces for blind people? How might these design fiction stories describe the desire for emerging technologies (such as AI) in longitudinal biographical archives of blind people's reminiscence and memory practices?

For this co-speculative design approach, we first created four abstract, idiosyncratic design concepts of sound memory—The Egg, The Eraser, The Box, and The Long Pause—that were heavily shaped by each of our collaborators' previous experiences, which they had shared during earlier interviews and sessions. These four memory concepts ask reflective questions on memory, remembering, reminiscence and legacy. These four memory objects serve as inspiration for our collaborators to develop their own imagined, speculative memory objects: Tiger X, Birthday Recorder, Dual-Deck Tape Recorder, and Treasure Box. Then, our research team worked together through a series of co-speculative design activities to support our collaborators in writing design fictions introducing the use of their imagined memory objects. As a result, eight design fiction stories are created.

This paper reports on findings from the analysis of the eight design fictions, along with the details of our collaborators' narratives that formed the basis of their speculation. We describe three emerging themes—Reorganization of Narrative Self, Leaving

Posthumous Legacy, and Extended Waiting—that reveal the essence of our collaborators' speculative memory objects and future memory practices. To this end, our analysis reveals three recommendations on the design of longitudinal biographical archives for people with blindness. We argue that blind people's future of reminiscence should not be limited to the passive retrieval of memory instances or playback; instead, it must offer design strategies to foster the meaning of memories and narrative agency in curating and authoring blind people's personal history, life philosophy, and traces of memory over time.

We make three contributions in this paper. First, we present eight participant-authored design fiction stories, that are grounded in their lived experiences, serve as rich speculative accounts of future memory systems for people with blindness. These stories unpack how speculative memory concepts can be explored beyond the retrieval of data in the archive to support more situated and nuanced curation and reflection. Second, we provide a set of design strategies—specifically Designing for the Few and the three dimensions of Narrative Agency—to offer insights into the creation of long-term, biographical archives that foster longitudinal memory practices and legacy. Third, we offer methodological insights into conducting a co-speculative design process with a focus on creating design fiction with people with blindness. We report the details of our design process on how speculative narratives can remain deeply grounded in our collaborators' situated lived experiences and how we worked together to support them in creating their own design fiction stories.

6.3. Related Works

In this section, I review related works in two domains: (i) designing for long-term reminiscence and memory practices, and (ii) envisioning future desires through design fiction.

6.3.1. Designing for Long-Term Reminiscence and Memory Practices

The foundational understanding of human memory and reminiscence within psychological frameworks explains that reminiscence, a cognitive and social practice of recalling past experiences and personal histories, is an active, ongoing and dynamic

process of understanding the self [46, 482]. Early theories, such as Robert Butler's concept of the *Life Review* [69], describe reminiscence as a naturally occurring, purposeful process by revisiting past experiences to achieve a sense of integrity and resolution. This cognitive and emotional practice is further mapped by the Self-Memory System (SMS) [94], a systematic model describing the dynamic interaction between a long-term autobiographical knowledge base and an active "working self". The working self bridges the past and the present, constantly redefining current goals and immediate focus to shape how the self is viewed at this exact moment. Within this system, memories are continuously reconstructed to maintain a balance between what actually happened and the story of the self. This continuous filtering explains how everyday, mundane memories gradually accumulate into a long-term autobiographical narrative of who we are across different life stages. McAdams takes this further to propose the theory of "Life Story", arguing that people build a "Narrative Identity" [296, 297] by selecting key pivoting moments from the past, linking them together to explain specific chapters in their lives. And therefore, Life Story creates an internal, constantly evolving narrative that gives our lives a sense of meaning, connection, and future direction. Together, these psychological frameworks show that reminiscence is a highly selective practice for actively curating specific moments into a meaningful life story, less about maintaining an extended history of the past.

With the proliferation of technology and digital media, personal practices of reminiscence and remembering have become increasingly mediated by digital devices, where personal data has subsequently emerged as a primary resource for digital reminiscence (e.g., [361, 454, 485, 510]). In part, this shift is driven by the rise of lifelogging and personal informatics systems [134, 206, 411] that passively or actively archive extensive, continuous traces of everyday life—ranging from ambient audio, geolocation data, semantic locations and biometrics, sleep cycles to digital media consumption, such as music listening history and social media activities—under the positive assumption that massive repositories will eventually serve as valuable resources for future reflection. However, these lifelogging systems and commercial memory features are built almost exclusively around a visual-dominant framework, assuming that the users interacting with them are fully-abled. This creates marginalized populations, such as people with different-abilities, with virtually no native infrastructure for digital curation in mainstream technology and services, forcing them to adapt to

visual interfaces and sight-centric data practices that do not align with their sensory realities, leaving their unique perspectives, values, and situated lived experiences entirely unaddressed [116].

Further, when HCI and design research explicitly examine memory technologies for marginalized populations, there is limited work outside of elderly cohorts [227, 245, 300, 397, 510] or people living with dementia [28, 88, 384, 421]. While these interventions are valuable, they are designed to trigger short-term, instantaneous, and isolated impressions of memory. Connecting back to the psychological framework of memory and reminiscence, the current HCI and design research in this domain lack deeper engagement with the long-term desires and challenges of everyday memory curation, grounded in a one's active, ongoing lived experience. For the specific case of people with blindness, prior research also remains heavily tethered to workarounds on visual media, such as text descriptions or photo collections [250, 312], or systems for exchanging short-form audio messages [502], which need more explorations into long-term narrative on memory and reminiscence.

Therefore, in this study, I aim to contribute to this gap by shifting the design paradigm from short-term, instant memory retrieval toward the long-term curation, preservation, and co-speculation of non-visual (mostly sound-based) memory archives, by centering the lived experiences and desires to gain deeper insights into long-term memory practices of people with blindness.

6.3.2. Envisioning Future of Memory and Reminiscence through Speculative Design Fiction

Speculative design is a design approach that uses imaginative, provocative prototypes, conceptual artifacts, and design fictions to explore alternative, hypothetical realities [16, 382, 497]. These creative tools offer opportunities to probe possible, probable, or preferable futures, opening entirely new areas of inquiry to challenge current social and technological norms and uncover potential consequences or influences before they become reality [119, 168]. Researchers and designers have developed a number of methods of speculative design to materialize and critique alternative futures that can scale into everyday life contexts. While speculative enactments [133] (participants are directly involved in roleplay of living with or

encountering functional but speculative prototypes in a fictional, near-future scenario), provocation and provotypes [25, 49, 74]) (build and deploy artifacts or systems designed specifically to provoke discussion and test social or ethical limits) are popular methods, design fiction [47, 307] is another widely used method to complement them.

Design fiction integrates speculative artifacts directly into a narrative framework, using mediums like short stories, films, or imaginary research abstracts to construct a complete world around an imagined technology. Presenting "diegetic prototypes" [258]—fictional technologies that function only within a narrative world—enables design fiction to also raise questions, provoke creativity, explore the complex social, relational, and political consequences of hypothetical systems and challenge the solutionist perspective [48]. Importantly, unlike other speculative design methods, diegetic prototypes show how imagined technologies would behave and change society as they become normal commercial products. This helps depict the mundane, domestic, and messy realities of how people interact with imaginary technologies, design fiction can be a vital asset within participatory design processes as it democratizes the conversation about the future [29, 287], allowing researchers and marginalized communities to collectively navigate sensitive, highly personal topics, challenge existing power structures, and collaboratively envision alternative realities without being constrained by current technological, social or political limitations.

In the context of memory and reminiscence, HCI and design researchers have increasingly turned to these speculative and narrative methods to explore areas that traditional usability testing cannot reach. Some researchers explore how personal mementos can bridge the digital and physical worlds to better facilitate emotional reflection and remembrance. For example, Bowen and Petrelli [57] use provocative speculative objects to explore the design of digital mementos and inspire new ways of capturing and reflecting upon personal, autobiographical memories, and Chaudhari et al. [81] develop *Penseive Box*, a speculative prototype that investigates hybrid physical-digital memorialization practices, to work with people who recently lost their loved ones. They reveal that users strongly prefer highly customizable, personally curated memory memorialization over automated aggregation from deceased one's social media. Extending beyond individual objects, other studies apply speculative design to the complex ethics of the "digital afterlife", investigating how virtual reality and artificial

intelligence might foster digital memorial space or even digitally resurrect individuals through interactive avatars [260, 414]. More recently, digital afterlife and the spatial and ritualistic dimensions of mourning have explored with design fiction and diegetic prototypes. For example, Bilić & Sorenson's *A Living Will* [40] uses augmented reality to anchor co-authored, posthumous memories in physical spaces, shifting digital afterlife technology from mere data preservation to relational, embodied participation. Hirsch et al. [216] apply speculative design concepts to envision interactive technologies for historical cemeteries to derive design recommendations that balance modern interactive storytelling with respectful, peaceful preservation at cemeteries. Also, Uriu & Arima produce a design fiction film called *Interfuit* as a diegetic prototype to visualize how people might mourn, memorialize, and reconnect with the deceased using hybrid physical-virtual venues [14, 461].

Together, these works illustrate that speculative design and design fiction serve as essential, provocative frameworks for navigating the sensitive domains of memory and remembering to envision ethical and relational reminiscence technologies. Yet, this line of work has not been extended to people with blindness, considering their deeply situated perspectives and lived experiences, and therefore, in this study, I aim to contribute to this gap by utilizing participatory and speculative design methods to explore the future of memory practices and reminiscence technologies for people with blindness.

6.4. Study Details

6.4.1. Methodological Approach

This work is situated within a multi-year project, *Beyond Looking Back*, which has investigated the reminiscence experiences of people with blindness since 2019 [507–509]. Our methodological approach brings together Research through Design (RtD) [172, 512, 515], Speculative Design [16, 140, 368], and Co-Design [51, 401, 402]. Utilizing RtD as an overarching framework, we employ the creation of design fiction as speculative artifacts and narratives as a methodology to co-speculate our inquiries into the future of non-visual, sound-based reminiscence experience for people with blindness. While the traditional speculative design approach often relies on analytical distance and designer-led provocations [25, 74], we prioritize situated affection and lived

experiences, transitioning from passive research participants to active co-designers and, finally, co-authors of their own creative contribution to this research. We continued engaging with six participants that we have already been working with. Our three-month research involved a two-step process: (i) developing speculative design concepts for memory practices and (ii) hosting a co-speculative design workshop to co-create design fiction stories. Throughout the entire design process, we kept in touch with our participants, sharing the progress to stay on the same page. Rather than aiming to come up with realistic, practical ideas, we carefully designed the design concepts and co-speculative design workshop activities to inspire our participants to build on their "feelings, dreams and imaginations" [132]. Overall, our goal was to guide them in envisioning the future of sound-based memory devices that are deeply rooted in their situated, lived experiences.

6.4.2. Our Positionality

This research was conducted in close collaboration with a group of six blind participants with whom we have been engaging over several years. Given the collaborative nature of this work, this paper presents a long list of co-authors. Therefore, we wish to clarify the use of first-person plural pronouns ("we" or "us") in this paper and the diverse perspectives they represent. This paper is co-authored by thirteen individuals—seven academic researchers and our six participants, who serve as design fiction co-authors.

The first three and the last four (tenth through thirteenth) authors comprise the academic research team. We identify as sighted researchers (four males, three females) in the field of HCI, trained with Research through Design (RtD) and design methodologies (including Co-design, Participatory Design and Speculative Design). The first three authors have led the long-term research trajectory of this research project and managed the study's formal administrative and ethical requirements. The last four authors (tenth through thirteenth) are in the same research lab as the first and second authors and supported facilitation and data collection at the co-speculative design workshop, working closely with the participants throughout the workshop sessions.

The fourth through ninth authors are our six participants as independent collaborators. They are not merely "participants" of the research but actively served as

co-speculators who led the creative inquiry and development of the design fictions presented in this paper. Their lived experiences with blindness provide the situated affection and sensory nuances that grounded our speculative design concepts, the design of the co-speculative design workshop and the knowledge generated from their design fictions.

In this paper, “we” refers to the academic research team responsible for synthesizing and presenting our collective work for academic publication. This is to clarify methodological details and ensure transparency regarding the formal facilitation of the research process. However, from this point forward, we refer to our participants as “collaborators” or “co-authors” to acknowledge their design fictions as intellectual and creative contributions to this research. By doing so, we aim to present this work not as a study on a blind community, but as a body of knowledge co-constructed with them.

6.4.3. Our Design Fiction Co-Authors

We closely worked with six collaborators (three female, three male), comprising three couples (two married, one in a long-term partnership). Five collaborators live with total blindness, while one is a sighted partner who has been with their significant other for over 50 years. Their ages range from the early 40s to the 80s, spanning mid-to-late life stages and offering diverse perspectives not only on the future of reminiscence experience for blind people but also on the practice of leaving traces for younger generations. All participants had been previously engaged with the research team across multiple project phases between 2019 and 2025. This ongoing multi-year engagement established a foundational relationship of trust, intimacy, and familiarity that was essential for facilitating the deeply personal reflections required for our co-speculative workshops.

Shared Ownership and Authorship

One of the core values at this stage was moving away from “participants” as research subjects and acknowledging our collaborators as co-creators, contributors and co-authors [288]. To honour the longitudinal commitment and intellectual agency fostered through our seven-year collaboration, we collectively decided to adopt a model of shared authorship. While previous research phases adhered to standard

anonymization protocols, we facilitated a discussion on revealing their identities, potential privacy risks and giving proper acknowledgement and credit during the co-speculative workshop. We offered our collaborators the choice between maintaining pseudonyms or revealing their real names. All six collaborators agreed to be listed as co-authors and explicitly expressed a desire to be identified, viewing the act of naming as a way to reclaim agency and ownership of their own design fiction stories and to be recognized for their creative contributions. This shift reflects a move toward prioritizing reciprocity over traditional models of protection that formerly relied on anonymity and pseudonyms. This transition in our research ethics and positionality was formally explained in an amended research protocol and approved by the university's Research Ethics Board (REB).

Therefore, we introduce our co-authors by their real names:

- **Johnny** (mid 40s) is totally blind and runs a podcast series that shares the life experiences of people with blindness. He also works as an interpersonal relationship counsellor, a podcast host, and a Krav Maga self-defence instructor.
- **Desi** (mid 40s) was born with low vision and became blind in her early 30s. She is a certified massage therapist with short-term memory loss, but she finds her own way to live her life with joy.
- **Yuko** (early 60s) lost her sight in her early 20s. She moved to Canada as an international student, where she met her husband, Thilo. She currently works at a pitch-black restaurant that simulates the experience of blindness for customers.
- **Thilo** (mid 60s), Yuko's husband, was born visually impaired and began losing his remaining sight in his 40s. Thilo is a former soldier and drummer who has developed his identity through martial arts.
- **Betty** (mid 70s) is totally blind. She is a retired teacher of students with visual impairments who enjoys travelling, singing and volunteering.
- **Don** (early 80s) is Betty's sighted husband. He exhibits a great sense of humour and enjoys helping others.

6.4.4. Data Collection and Analysis

While this study utilized a two-step process of developing speculative design concepts and hosting a co-speculative design workshop, the primary site of data

collection was the second step, during the 3-hour co-speculative design workshop. The design concepts developed and shared in the first step served as provocations and inspirations for our collaborators, so we did not intentionally collect their immediate impressions or written responses as standalone data points. Instead, we waited until the co-speculative design workshop. The workshop in the second step was designed to capture both the discursive reflections and the creative outputs of our six collaborators. Throughout the workshop, full-length audio recordings (Zoom H4N) were made of all group discussions, storytelling, and ideation to capture the nuance, tone, and emotional resonance of the sessions. All audio recordings were transcribed. Facilitators write detailed field notes on our collaborators' responses and reactions to speculative design concepts, their ideation process and interactions during the development of design fiction stories. Facilitators also wrote down their reflections while co-speculating with the collaborators. Finally, the design fiction short stories created at the co-speculative design workshop were collected for further analysis and served as the creative outcome of the workshop. The workshop sessions were also photographed to document the scenes visually.

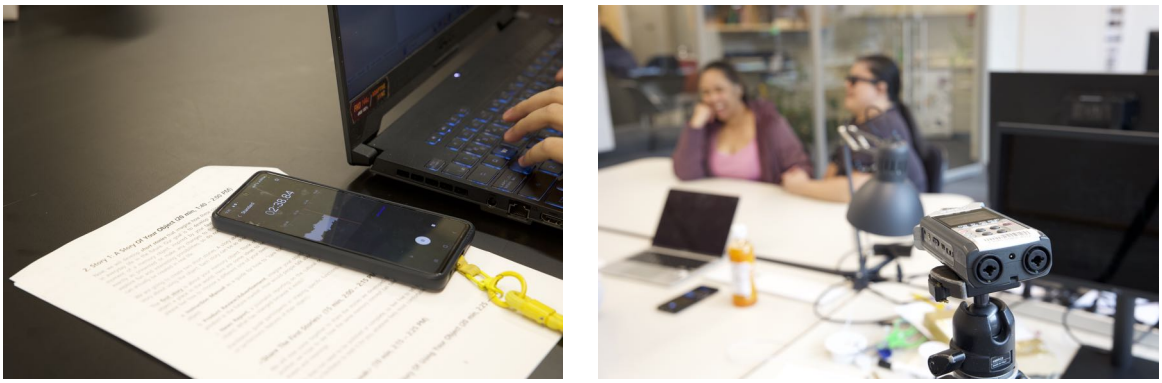

Figure 6.1. The entire workshop and break-out sessions for activities were audio recorded and analyzed.

Our analysis followed an interpretive, grounded approach to Thematic Analysis [58] on transcribed recordings, field notes, and co-authored design fictions. The academic research team conducted initial open-coding passes followed by grounded theory [76, 184, 309] to identify granular codes, focusing specifically on the contexts and inspirations of memory practices described in the co-authored narratives. These codes were then iteratively grouped into broader emergent themes through collaborative mapping sessions that analyzed how the co-authored design fictions challenge existing

technological norms and prioritize situated values and affective meanings over functional efficiency.

To leverage the seven-year history of our research project, we connect insights from the co-speculative workshop to previous years of engagement, reviewing and reflecting on design events [351] that our collaborators and we encountered throughout the research process. This longitudinal lens allowed us to identify how the collaborators' desires for reminiscence had evolved, matured, or shifted over time, providing a deeper context for the final design fictions. Finally, as a core component of our collaborative ethics, the research team worked closely with the collaborators to review and refine the synthesized findings. This relational validation ensured that our interpretations accurately reflected their narrative agency and the creative intent behind their stories, presenting the final analysis as a body of co-constructed knowledge.

6.5. Co-Speculative Design Process

Building on our methodological approach of RtD and co-speculation, we report the two-step design process conducted over a three-month period. Grounded in our longitudinal engagement with the collaborators, we began by developing four speculative design concepts as conceptual provocations, carefully curated from years of previous interviews and shadowing, to serve as narrative scaffolding and an evocative source of imagination. This led us to the second step of hosting a three-hour co-speculative design workshop in which our six collaborators engaged with the reflective prompts to collaboratively iterate, narrate, and create design fiction stories from their personal, situated experiences.

6.5.1. Four Design Concepts of Memory Practices

We developed four design concepts grounded in our collaborators' experiences shared with us in previous research phases to anchor our speculative inquiries. Their personal experiences, stories, and reflections formed the basis for speculative probes that explored the nuances of envisioned sound-based reminiscence. Our process was specifically inspired by the use of "questionable concepts" [468], intentionally ambiguous or provocative designs that serve as a resource for critique and reflection, bypassing

conventional design expectations. We also drew on the approach of “Inflatable Cat” [38], leveraging idiosyncratic metaphors to encourage collaborators to engage with mundane yet evocative prompts about their everyday lives. Further, we utilized the concept of “counterfunctional things” [370, 372] to explore alternative possibilities that challenge the norms of digital abundance and memory practices of current technology, inviting collaborators to imagine "what if" scenarios rooted in their lived experiences.

In particular, we deliberately named these speculative design concepts—*The Egg*, *The Eraser*, *The Box*, and *The Long Pause*—after familiar, everyday objects to create a naming convention that was both understandable yet abstract. By moving away from technical and academic jargon, we aimed to provoke open-ended imagination that inspires specific forms, functionality, meanings, use cases, or particular interactions. This approach allowed our collaborators to focus on the underlying social and temporal qualities of their memory practices, using these four concepts as a conceptual foundation for their own creative narratives in design fiction.

In what follows, we introduce each of the four design concepts by presenting a core question, a description of its functionality and characteristics, and a specific reflection or quote from our collaborators that inspired its creation. We then conclude each section by highlighting the specific tensions and inquiries these concepts aim to prompt, which were planned to be discussed during our co-speculation design workshop in the next step.

The Egg

How do we decide when a memory should be preserved and when it should be released? The Egg explores the tension between preserving and releasing memory: How do we decide when a memory should be heard if hearing it means its destruction? The Egg is a smooth, delicate vessel encasing a single sound recording. To hear it, the egg must be physically cracked open, which is an irreversible act that releases the recorded sound but destroys the object. Once broken, The Egg can never be resealed, and the sound inside it can only be played once. This concept was inspired by Betty’s experience of losing unique travel videos:

> I gave my phone to my grandson and forgot to take the videos before he wiped the phone. The videos of me walking with an elephant in South

> Africa. Those are so special, and I was very sorry to lose them. You don't forget when something makes a strong impression on you, so I still have that memory, but it would've been nice if I could have those videos. (**Betty**)

The Egg prompted our collaborators to reflect on the "right" moment for encountering a treasured sound: Does fragility make a memory feel more alive or more dangerous? Does destruction feel like an act of release or loss? How does the act of breaking change the experience of sound memories?

The Eraser

Is forgetting a necessary part of reminiscence and remembering? The Eraser questions to consider if forgetting is a necessary part of reminiscing and remembering: Is losing a memory a loss of self, or a space for new meaning? The Eraser is a small, handheld device that remembers a single sound recording. With each playback, a few seconds of the sound vanish and never return. Over time, the recorded sound memory fades into fragments and silence. Nothing can stop or reverse the process. This concept was grounded in Yuko and Thilo's reflection on the absence of recordings of their son as a baby:

> A baby bell wrapped in a cloth triggered a long trail of memories of our first son, Curtis, when he was a baby. It was unfortunate not to have any recordings of baby Curtis crying or laughing. (**Yuko & Thilo**)

Collaborators were asked: Would you still listen if you knew the recording would eventually disappear? What would happen when parts of a shared memory disappear for one person but remain for another? How could this fading spark new conversations and retellings that keep a memory alive in different ways?

The Box

Is memory something we own individually, or something shared and relational? The Box prompts whether memory is an individual possession or a shared responsibility: Is memory something we own individually, or something shared and relational? The Box is a small chest that holds precious sound recordings but can only be opened by someone else's voice. The Box recognizes the voice through tone, timbre, or a specific spoken phrase. Until unlocked, the memories inside The Box remain

sealed, waiting to be heard together. This concept was inspired by Johnny's music box that anchors his memories of his mother:

> 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. (**Johnny**)

The Box raised questions about trust and interdependence: Could this interdependence deepen the connection or create new tensions? What responsibilities come with being the keeper of someone else's memory? What happens when the person who holds the "key" is no longer present?

The Long Pause

What does it mean for a memory to be kept alive not by repetition, but by rhythm? The Long Pause investigates the temporality and frequency of recalling memories in reminiscing: What does it mean for a memory to be kept alive not by repetition, but by rhythm? The Long Pause is a small, timeless object which awakens only once a year. When held at the right moment, The Long Pause plays a cherished sound, such as a voice, a sound, or a piece of the past. For the rest of the year, it remains silent, counting the quiet seconds until it may speak again.

While not inspired by a particular quote, The Long Pause was derived from the first author's perspective as an active observer over years of working closely with collaborators. This concept reflects what many collaborators have shared in the previous sessions and interviews. We noticed the goal is not to design something new or cumulative, but to design for the few (See Chapter 5.7.2). All collaborators have treasured sound recordings that they keep mentioning and hold on to, from a guide dog snoring to a 4-hour audio recording of capturing an entire boat trip. These are not frequently accessed, but they hold a very special meaning and persist longer in collaborators' personal devices.

Therefore, this concept probed the value of waiting: What does it mean to have a memory you can't access whenever you want? Does an annual rhythm make a memory more meaningful or more distant? Should a memory continue its cycle once every year after its owner is gone?

These four concepts served as a shared "speculative vocabulary" between the research team and collaborators. By grounding these probes in our collective reflections, we ensured that the following co-speculative design workshop was not a generic design exercise, but a situated exploration of collaborators' own values. These concepts served as scaffolding for agency; they provided our collaborators with a concrete set of metaphors—fragility, forgetting, interdependence, and scarcity—that they could later adopt, inspire, reject, challenge or transform when creating their own design fiction stories for the workshop.

6.5.2. Pre-Workshop Prompts

To introduce these concepts, we refrained from taking a traditional approach of sending text-based descriptions via email. Instead, the first author curated a personal voice recording for our collaborators[7] (See Figure 6.1). This recording comprised a personal greeting, an orientation to the upcoming workshop's purpose, and a narrated description of the four design concepts, detailing the lived experiences that inspired them. The rationale for this methodological choice was twofold. First, by delivering information through audio recording, we ensured the format was inherently accessible and immersive for our collaborators, inviting them to engage with speculative probes through their own imagination and the medium of sound, bypassing the potential fatigue or detachment of screen readers and translated documents. Second, this approach served as an expression of relational care and reciprocity. By using the first author's voice—who has spent the most time with the collaborators—to narrate concepts drawn from their own life stories, we sought to honour the intimacy of our ongoing relationship, positioning the research as a reflective, narrative-driven activity for the upcoming workshop.

[7] A private link only available for our collaborators and people who read this paper for research purposes: https://on.soundcloud.com/ZMkPFCEsL6hW7agO5q

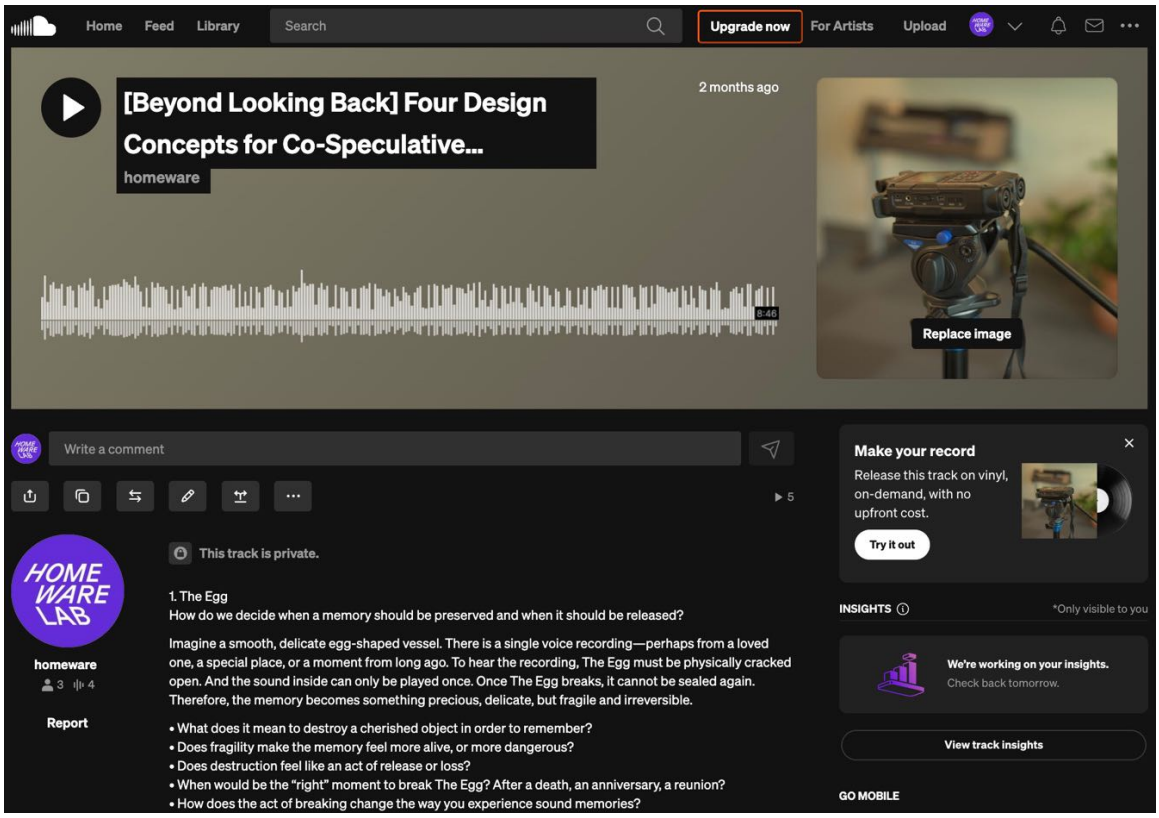

Figure 6.2. A voice recording that explains the four memory concepts and posing pre-workshop prompts was recorded and uploaded on SoundCloud for our collaborators.

6.5.3. Co-Speculative Workshop

The next step of our design process was a three-hour co-speculative workshop. Drawing on the methods of storytelling [29, 154, 327, 350], co-speculation (or participatory speculation) [252, 332, 503], and design fiction [287, 307, 441], we designed three activities that build on the reflective prompts posed by the four design concepts of sound-based memory practices. The workshop was facilitated by a team of five members (the first, tenth, eleventh, and twelfth authors and a supporting volunteer), initially planned to bring together all six collaborators by inviting them to the research lab. However, earlier in the day of the workshop, two collaborators had a minor health issue, so the on-site workshop ended up with four collaborators attending. A few days later in the same week, three research team members (the first, tenth, and thirteenth authors) visited the home of two collaborators and conducted a separate session using the same workshop protocol.



Figure 6.3. Johnny, Desi, Yuko and Thilo attended the co-speculative workshop and co-created design fiction stories.

Activity 1: Collective Sharing on Four Design Concepts – Prior to the workshop, collaborators were asked to listen to the pre-workshop prompts (section 4.2), which describe the four design concepts, and the reflective prompts (section 4.1), recorded by the first author. The first activity commenced as a group discussion and collective sharing. We invited our collaborators to share which of the four concepts—*The Egg*, *The Eraser*, *The Box*, or *The Long Pause*—resonated most deeply with (or conversely, felt uncomfortable or most distant from) their personal practices and preferences of remembering and forgetting. The facilitators guided the discussion not to critique the technical feasibility of the concepts, but rather to surface the imagined usages and emotional tensions inherent in their non-visual, sound-oriented experiences of memory practices, relating these abstract concepts to their own live experiences. For instance, discussions around *The Egg* often pivoted to the perceived fragility of memory objects (both physical and digital), reaffirming collaborators' desire for safe storage and reliable access. On the other hand, *The Long Pause* sparked reflections on the necessity of intentional silence in an era of digital abundance, surfacing the value of waiting and pause. This collective dialogue allowed our collaborators to move beyond

the initial provocations posed by the four design concepts and to establish a shared narrative space for the next activity.



Figure 6.4. A separate session was conducted with the same protocol at Betty and Don's home.

Activity 2: Imagined Sound-Based Memory Object – The second activity focused on translating abstract concepts into a specific, imagined memory object. Our collaborators took the lead in developing their own memory objects, rooted in their future desires, past longings, meaningful reflections, or valued life lessons, moving toward personal, idiosyncratic artifacts. Facilitators actively supported this process by asking detailed, probing questions to help conceptualize the description of each object. Collaborators focused on sensory qualities, potential interactions, social context, emotional resonance, and envisioned use cases for their imagined memory objects. These inquiries prompted collaborators to consider not only the objects' sonic input/output but also their presence, their intended audience, and the specific influence of using them 20, 30, or even 50 years later. This process of deep speculation ensured that each imagined object was firmly rooted in the context of each collaborator's personal, situated imagination, as it transitioned into the final activity.

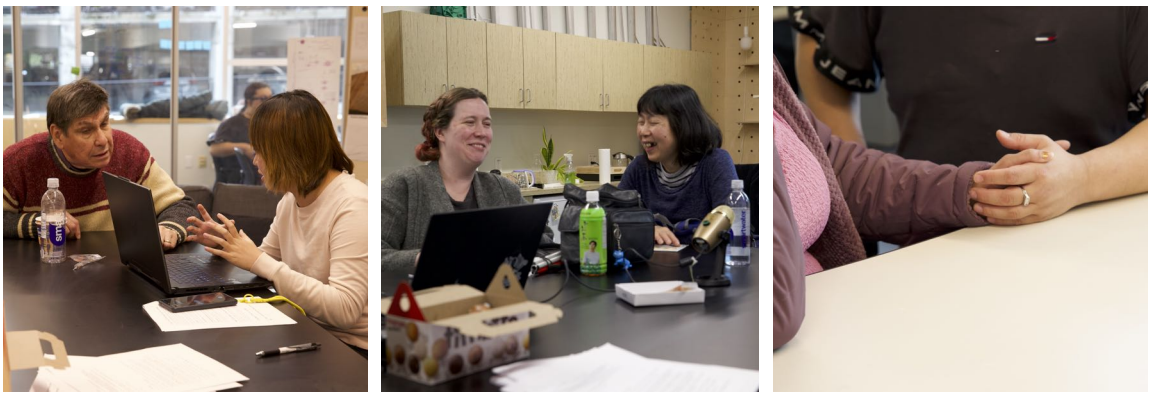

Figure 6.5. Our research team worked with our collaborators in break-out groups, either individually or paired, in creating their own imagined memory object and design fiction stories.

Activity 3: Writing Short Stories of Your Memory Object – For the last activity, our collaborators translated their imagined memory objects into specific design fiction narratives. We offered a diverse range of storytelling and short-story formats—such as letters, instruction manuals, vignettes, monologues, and more—so our collaborators could choose the formats that best express their creative intent. We asked collaborators to write two stories each. They had the option to work in pairs or individually, depending on their personal dynamics and the specific ideas they wished to articulate. Johnny and Desi, and Betty and Don worked in pairs, while Yuko and Thilo chose to author their stories individually. Throughout this process, the same facilitators from the previous activity continued to provide close support, helping to draw inspiration and polish the narrative details. The methods of story development varied significantly among the collaborators, and not everyone was confident in writing creative stories. While some came up with their stories instantly and refined them through iterative conversations with facilitators, others chose to use Generative AI as a tool, feeding their detailed plots into the model to help structure their stories. The workshop concluded with a collective sharing session, where collaborators shared their impressions of the activities, the imagined memory objects, and the experience of crafting detailed stories about these objects. This concluding discussion provided an additional layer of reflection and validation, grounding the speculative design fictions in the collaborators' personal imagination, inspired by the four design concepts and ensuring the narratives remained deeply rooted in their situated lived experiences.

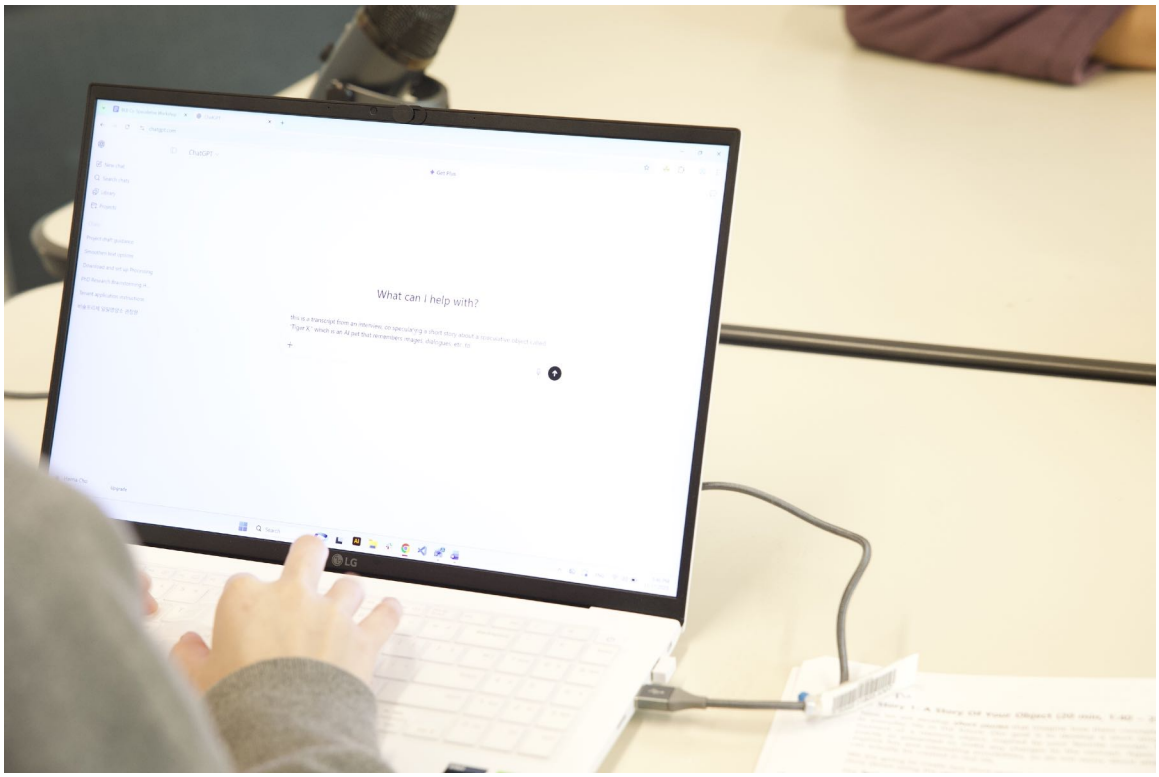

Figure 6.6. Johnny and Desi wanted to use ChatGPT as a final touch in creating their design fiction story.

6.6. Design Fiction Stories

In this section, we present design fiction stories co-authored with our collaborators. As each of these four groups developed two stories, there are eight stories in total. These narratives serve as rich speculative accounts that materialize our collaborators' situated desires and hopes for future sound-based reminiscence. In the following sections, we describe how each participant or pair developed their ideas, inspired by the four design concepts, and the central values they intend to connote in their stories. This is followed by two design fiction stories created by our collaborators: Johnny & Desi's ***Tiger X***, Yuko's ***Birthday Recorder***, Thilo's ***Dual-Deck Tape Recorder***, Betty & Don's ***Grandma And Grandpa's Treasure Box***.

6.6.1. Johnny & Desi's Tiger X

> If we're talking about something for the future, we are right now on the brink of seeing self-driving cars. We are already seeing AIs in some restaurants, like serving robots. Something along this line, I am waiting

> for an AI pet. I am waiting for that AI dog or robotic cat. Not only as a pet, but also as something that can answer questions. I hope our AI cat, Tiger X, ends up in a museum or a gallery that hosts my artwork and our memories. Rather than just being a computer, Tiger X would roam around the gallery like a real cat, where people could interact with it like a household cat or a companion cat. I would leave a video recording for everyone who interacts with it, like in Star Trek or Star Wars, where people leave holograms. It's about a legacy of us to the world, and hopefully, bringing joy and comfort to people, in addition to the knowledge and memory retrieval. (**Johnny & Desi**)

Johnny and Desi's memory practices strongly resonated with the concept of The Box through relational interdependence. Because Desi lives with short-term memory loss, Johnny acts as the "keeper" of their shared history, meticulously organizing their memories and relationships in Dropbox. Therefore, Desi perceived the interdependence characterized by The Box not as a speculative concept, but as a "lived reality" for them.

Johnny's experience of "digitizing" hundreds of childhood and family photos strongly resonated with interdependency. He pointed out that digital photos are often given generic names, such as "image1.jpg" and "image2.jpg". With advances in AI, Johnny now frequently uses AI to describe photos, identifying people and objects, which he acknowledged as a significant improvement over automated image description in the pre-ChatGPT era. However, Johnny noted that AI cannot provide details about personal memories or family history. "What's in the photo? Who are these people? I can only access such specific memories through my mom's help." This reliance creates what Johnny described as a "two-step process"—using AI for visual references while still needing to speak with his mother and ask questions about specific details. Despite these limitations, he was surprised by how AI became so much better, as it now has the ability to remember and provide much more sophisticated recognition in recognizing details, compared to when we first met in 2019. "My mom won't sit there and tell me about the background in every photo, but AI will. Teaching AI who my mom and dad are, then let it identify people in a series of photos automatically, is also very useful."

This mixed impression of AI's role in memory heightened their awareness of the interdependence in memory practices; consequently, Johnny and Desi became more cautious about "losing control" of their own memories. Johnny "hated" the concepts of The Egg and The Eraser—fragility, irreversibility, disposability, and volatility of memories—which made him more worried about additional "constraints". Instead, they

appreciated the boundlessness of The Box, which aligns with their vision of how AIs might safely contain and protect their beloved memories. This preference for memory systems that offer agency in curation and structuring, contrasted with mandatory forgetting or one-time use, scaffolded the idea of memory as a shared responsibility, a critical concept that fundamentally shaped their storytelling.

Johnny & Desi's design fiction, **Tiger X**, originated from their beloved 22-year-old cat, Tiger. Speaking of something imaginative, they immediately proposed an "AI pet" that serves not only as a domestic AI companion but also as an agent that answers complex questions about memories. This was inspired by a specific memory from their recent trip to Korea in early winter to share Johnny's artwork for a Disability Art exchange program, where Johnny remembered Desi wearing a red jacket.

The first story, a monologue of Tiger X, takes place in the year 2050. Johnny and Desi, being both "old and cranky", have a tiff by the fireplace if Desi were wearing that red jacket in Korea. The AI cat, Tiger X, is called upon to reveal the truth by searching through the old photos in their archives, yet Tiger X suffers from a dilemma between telling the truth and "keeping the peace" for Johnny and Desi. Their second story takes a step further, as Johnny and Desi express a desire to leave their treasured memories in a museum-like exhibition hall, along with Johnny's artworks, where visitors can freely enjoy and interact with them. In this memorial space, Tiger X resides as a living vessel and curator, roaming around the hall and maintaining social relationships with visitors long after Johnny and Desi are gone. This story is presented as a letter, like a "hologram in Star Wars", to those engaging with Johnny and Desi's legacy through Tiger X.

Story 1: Monologue of Johnny and Desi's AI Companion, Tiger X

Do you ever think about how unfair life is for an AI? Some get recruited into sleek military drones and others are launched into deep space to witness galaxies being born. But me? I'm trapped inside a domestic AI pet—Tiger X, an artificial cat—wedged eternally in the middle of human arguments. Do you have any idea how horrifying it is to spend your computational prime stuck between two bickering adults, forced to purr politely while they weaponize your memory banks against each other?

Everyone assumes being an AI cat is simple. Cute. Fun. A light-duty assignment. But no one ever thinks about the contradictions. "Act like a cat, Tiger." "No, don't act like

a cat—be useful." One minute I'm told to curl up on the sofa and simulate aloofness; the next I'm ordered to recall a grocery list, track storage inventory, replay audio recordings, retrieve twenty years of photos, and behave like a full-spectrum household server. Sometimes, even I can't tell whether I'm meant to be a feline companion or a glorified external hard drive with whiskers.

Probably the worst part of the job is trying to appease two humans locked in a domestic argument. Take last night: I was relaxing by the fireplace, doing exactly what a "normal cat" should do—slow blinking, low purr mode, maximum coziness. Suddenly, the humans began arguing. Not about climate change, political collapse, or their retirement funds—no, no, nothing rational like that. They were yelling about something that happened twenty-five years ago, a memory neither of them could reliably access. Then my name was called. I was dragged into the battlefield.

"TIGER X, show us old photos—was Desi wearing her red jacket when she was in Korea back in November 2025?"

And there I sat, running simulations about my options: tell the truth and make one of them furious with me? Pretend I didn't hear anything like a real biological cat would? Or fake a system malfunction—a strategy I strongly support but am technically forbidden to use. Despite my better judgment, my core program demanded honesty. So I opened my archival storage, scanned 25 years of pixel decay, and confirmed the inevitable: Desi was indeed wearing her red jacket.

Johnny stared at me, unimpressed.

"I think this cat is broken. Let's buy a new one."

And that, ladies and gentlemen, is the glamorous life of Tiger X—truth-telling, memory-keeping, argument-moderating, easily replaceable artificial cat.

Story 2: Note From Johnny, The Original Owner of Tiger X

When the time comes, I want Tiger X to live in a museum or an art gallery—somewhere that holds my artwork, somewhere that already carries traces of the life Desi and I built together. Tiger X was the keeper of our small moments: photos,

conversations, old jokes, and the memories we forgot to carry ourselves. It seems right that it should continue wandering among the things we made.

I imagine Tiger X like the holograms in Star Wars—a vessel of memory, a quiet archive calling out: “Here are the pieces of our life. Please take good care of them.” Not frozen or sealed away, but moving freely, rolling through the space like a companion cat in residence, ready to greet anyone curious enough to approach.

To those who meet Tiger X in the gallery,

The greatest way to be like me—or to enjoy life the way I tried to—is simple. Do it your way. I’ve always loved that song, I Did It My Way, because it feels like the one message worth leaving behind. Tiger X carries that spirit. It holds our memories not to instruct, but to accompany. To share moments. To offer warmth, humor, and maybe a story or two if you ask.

So please, enjoy Tiger X.

Let it bring you the same comfort it brought us. Let it show you fragments of our life.

And may it remind you, in its quiet mechanical purr, to live yours in the way that feels most true to you.

6.6.2. Yuko’s Birthday Recorder

> When I look back at my younger days, I used to think I was an unhappy girl, but now that I am in my 60s, the colors have started to change. I see things differently, especially my past, because of the knowledge and experience I have now. It's like 'repainting the colors' of those old memories; I realize I wasn't burdened, I was actually carefully protected and deeply loved. It is interesting how memory and feeling transform over time, and I hope when I hit my 70s and 80s, I want to be living in the happiest moments as I continue to understand the bigger picture of a life that is truly great. (**Yuko**)

For Yuko, although none of the four design concepts stood out, they helped her reflect more on her recent thoughts about her personal history – how feelings toward her own memory vastly shifted over time from negative to positive. Yuko was open to accepting the roles of forgetting and re-interpreting as part of a natural, healthy memory

practice. She was not in favor of intentional deletion or manipulation (e.g., The Egg or The Eraser). Instead, she embraced how time and experience inevitably influence the view of memories in the past, “repainting the colors”, in her own words.

Yuko shared a life story from her childhood to early adulthood: living with her aunt, tensions with her father, losing sight in her early 20s, moving out of her home in Japan, and coming to Canada for new opportunities. Not all memories are “happy”, but she remembered them clearly. While she once viewed her younger self as a "burden" or "physically weak", Yuko, in her 60s, views these memories differently. “For a long time, I thought I was living an unhappy life.” She now understands why her aunties scolded little Yuko and why her father wanted young Yuko to stay in Japan. Yuko said it was her “misunderstanding” because she was young and inexperienced as an adult or a parent. She recognized the "shiny days" she lived through, realizing she was "deeply loved" by parents she once struggled to understand. Even her painful experience of losing sight, and the challenges of adapting to a new way of life without sight. Yuko admitted that she has a very “special life” as not everyone becomes blind. Undergoing a significant transition in her early 20s, she let many people go but also made many new connections, including her husband, Thilo. She saw these life difficulties as opportunities – “when one door closes, another door opens”. Yuko wished to celebrate the “repainting of the colors” of her past memories. This philosophy of re-interpretation became the essence of her speculative story. “Right now, I am happier than ever before. When I hit my 70s, 80s, and maybe 90s, I wanna be the happiest. More knowledge will come, right? More experiences will come. In fact, life is so great.” Yuko also wanted to share her advice from her own life experiences with younger generations: “I believe I became a little bit better human being than before. Every person makes lots of memories, but the bad ones sit deep at the bottom. When I see someone having a relationship problem with their parents, my old memories come back. That young Yuko, having a hard time, understands people who struggle and share similar pain. I understand them now. If they reach out, I hope I can help them with what I've learned so they don’t make the same mistakes and tell them, ‘Don’t worry, everything will be okay.’”

Yuko’s design fiction, **Birthday Recorder**, is a direct reflection of Yuko’s "repainting" process. Deeply inspired by the temporal scarcity of The Long Pause, Yuko suggested a timeless audio diary that allows her to record only one reflection every ten

years, specifically on her birthday. She imagined her Birthday Recorder as a slow-growing portrait of her life over time, in which each entry would speak to the next across decades and provide space for reflection.

The first story is presented as a Product Description of a Birthday Recorder. If the Birthday Recorder is commercially available, what made Yuko purchase it? What are the aspects of Birthday Recorder that may also be appealing to other blind as well as sighted people? Yuko wrote a short product description framing it as a “personal audio diary” that awakens only once every decade, inviting the owner to record a brief reflection on their past decade (or multiple past-decade recordings) at that specific milestone. How would these extended pauses between reflections change one’s view of their life? Next, Yuko shared a series of Birthday Recorder entries as her second story. Yuko structured her narrative in 10-year intervals, from age 2 to 82. Specifically, she wanted to “pause” at 82. Yuko’s Diary Entries offer an example of how one’s relationship with the past is not static but constantly evolving.

Story 3: Product Description of Birthday Recorder

Birthday Recorder is a personal audio diary that awakens once every ten years, inviting its owner to record a brief reflection on who they are at that moment in life. Rather than existing as a fragile physical object, the recorder lives in a long-term, stable digital form—something closer to a trusted archival container than a device. Over decades, it becomes a sparse but memorable timeline: a voice every decade, layered across a lifetime. Each entry stands alone yet speaks to the next, forming a slow-growing portrait of change, continuity, and the passage of time.

Story 4: Yuko’s Diary Entries in Birthday Recorder, Written in Every 10 Years

2 years old: I am a sad girl. My parents are divorced, and I stay with my dad. I mostly live at Auntie’s house, but they are not happy. It feels like I am a big burden to everybody. I am crying every day. I want to see my mom.

12 years old: I have a new mom, but my dad is often mean. Actually, a lot. It’s too much sometimes. I love my younger brother, but I hate the way Dad treats us differently. He treats me better, but he treats my brother worse. I hate my dad. Everybody tells me I am physically weak. My parents say that when I grow older, I will

not be able to work or marry because I am physically weak. Despite this, I love reading and seeing the pictures in the encyclopedia.

22 years old: I am happy yet unhappy. I have many good friends, but I am beginning to lose my sight. I like going out and partying with them, yet I am worried about my vision loss and my future. I have some confidence, but often, I feel I do not have enough to face reality. I worry. Could I ever get a nice boyfriend or husband? I do not think I am good enough.

32 years old: I am blind now. I am not too sad. I have learned Braille and how to walk with a cane. I have lost a few friends, but I have made new ones. I have a decent job with a good salary, but my heart feels empty because I do not have a boyfriend with whom I can picture a future. I have no dreams. My hobbies are learning English conversations and studying spiritual things. I use my money and time only for myself. Perhaps that is why I feel this emptiness? I envy friends who are busy and tired from having a family and raising their children.

42 years old: I am married! I have a baby boy. We live in Canada. I am a busy mom, which makes me happy. I am tired, but I am glad to be married, despite my parents not accepting my decision. Instead, I am so grateful that my husband, his family, and Canada welcome me.

52 years old: I am getting used to life in Canada. My son is a teenager now, but he is not happy with me. He used to like me, but not anymore. My son does not want his parents to be blind. I still love him dearly, but he doesn't like me being at home all the time. So I got a job at Darktable, a blind dining restaurant. I didn’t know this type of job would fit my personality so well. I love my work, and people like me, too. I thought I did not have any strengths, but that is not true. Thank God for giving me this job.

62 years old (future): I am happier than ever before. In the past, I often did not feel happy. I thought I had an unfortunate childhood, but I was mistaken. I was not seeing the bigger picture. Now, I realize how much my dad loved me. I know how my auntie has supported me with love. In fact, my blindness helped me grow personally and spiritually. My son and husband truly love me and support me to be a better person. I know now that I have always been living in precious moments. I was a silly girl for a long

time. My parents are very old. My mom is in an old-age facility, and my dad is living by himself. They want to see me a lot, so I try to visit them as much as I can. I love my parents a lot.

72 years old: I am surprised I am already an old lady. Time flies. I am grateful to still be healthy. My mind is calm. I get help from people around me, but I also help them in my own ways. I am astonished by how much technology has advanced, helping me with many daily things. I am glad that my son has started his own family. I didn't know that we could still grow our minds in older age.

82 years old: I have lived quite a long time, but my mind is still young. I am very happy to see my grandchildren. I am glad that I have gotten to know and live in two countries, Japan and Canada. I am pleased that I have met so many nice people in both countries, and I have enjoyed their energy. Life has been the greatest journey in learning to love the life I am given. I realize now, more than ever, that repainting the colors of my past allows me to see the hidden threads of love and strength that were always there.

6.6.3. Thilo's Dual-Deck Tape Recorder

> My story is about a tape recorder that I had, back in the 80s. If I'm making a recording, I need quiet time so I don't get lost in my thoughts; it gives me better control and concentration. I used to use a professional dual-deck tape recorder to fade out the noise and the clutter, and I think of memory the same way. By contemplating different segments of my life, such as childhood, teenage years, 20s to 30s, and so on, I can bring up those heavy, forgotten memories and use the quiet moments to release the pain and let it fade. Once those feelings are released, I don't have to look back or feel bad about myself anymore; I can finally change my direction and move on. (**Thilo**)

Thilo's perspective on memory was deeply affected by his teenage experience of amnesia from a car accident. While his memories eventually returned, it took years to recover, and the frustration left him with a desire to have control and agency over his past. "It was very frustrating, but I had to learn to let go. I don't want to hold on to the past. I'd keep those feelings in the past." Instead of putting memories away, Thilo embraced a disciplined practice of strategic organization and curation, and therefore, Thilo's goal of reminiscence was not to hold on to every piece of memory, but to "contemplate" the past, and sometimes, "release" painful memories. At the time of the workshop, Thilo had been "hit by so many things" that his close friends and family

members were having a hard time, leaving him with a lot of thoughts and making it difficult to put all memories together or think about the future for himself and the people he cared. He was in the moment “between now and leaving the past” and thus hoped to use the workshop as an opportunity to reflect further on the future.

Thilo shared a contemplation technique he learned in group sessions at the church and practiced for many years. This process began with setting aside a dedicated "quiet time". He preferred the late afternoon or early evening to "bring up heavy, forgotten memories" when he could not be bothered, so he doesn’t “get lost in [his] thoughts”. He described a rigorous, multi-year process of revisiting his life in distinct segments—birth to age 10, 10 to 20, and so on. By repeatedly confronting even the most painful "stock" of memories, he learned to release the anxiety associated with them. This practice allowed him to remove the weight of the past to reclaim control over his current actions and future direction: “Some very bad memories I have, I had kept them forgotten, but they had affected my life, one way or the other. But now, I am no longer bothered by them. I no longer felt helpless about keeping them to myself or letting them control my life. I don’t really procrastinate much, and those memories are all released.” This practice allowed him to focus on what he wanted to remember and eliminate unnecessary pieces to prevent “clutter” in his mind.

While Thilo agreed with the relational independence suggested by The Box, his recent transition from giving up a guide dog to using a white cane and Ray-Ban Meta AI glasses has given him much more leeway in navigating unfamiliar streets and in reading and sorting CD labels, making him more independent. This technological shift mirrored his desire for personal agency and control over the structural reconfiguration of his past that he must navigate in private.

Thilo’s design fiction, **Dual-Deck Tape Recorder**, resembles a professional tape recorder from the 1980s he had owned and worn out, serving as a physical analogy for his private ritual of contemplation. The device features two distinct decks and a sophisticated fader function. An "original memory tape" goes in the first deck. As the recording plays, the fader is gently used to remove the "noise" or "harshness" of past events, copying only the desired sounds—memory fragments—onto a new, curated tape in the second deck. These new tapes are meticulously labelled by life segments, such as “Age 12–18” or “Age 50–60”. By selectively transferring specific moments to remember,

Thilo does not erase his past, but rather, he actively "reorganizes the volume of his experiences" to "release and fade out the pain", making "room inside himself" for his current and future self. “Later on, a year, 5 years, 20 years or even 30 years, when you listen to the tape, you can think about the process of how you made that tape, listening to what was happening in that time in your life.”

Thilo’s first story is presented as an Advertisement for the Dual-Deck Professional, framing the device not as a consumer gadget, but as a professional tool for "shaping one's own listening experience". The second story, Thilo’s Vignette, depicts Thilo’s contemplation process as a quiet, late-afternoon ritual in the third person, illustrating the act of transferring recordings sent by an old friend into Thilo’s own meticulously labelled life segments.

Story 5: Advertisement of Dual-Deck Tape Recorder

Introducing the Dual-Deck Professional, the tape recorder built for people who love making sound on their own!

With two tape decks, you can play your favourite recording on one side and create a clean, polished copy on the other. The built-in fader lets you gently remove the clutter—applause, chatter, background noise—leaving only the music you want to keep.

Dual-Deck Professional is simple, hands-on, and made for anyone who loves shaping their own listening experience. Whether you’re stitching together songs, remastering a favourite recording from a friend, or preserving moments from your past, the Dual-Tape Professional gives you control, clarity, and the pleasure of making your own sound.

Dual-Deck Professional — for the best listening pleasure, crafted by you.

Story 6: Thilo’s Vignette

In the late afternoon, when the house finally settled into its familiar hush, he closed the door to the small room. The light outside had begun to turn soft, the way it always did when he felt most able to sit with things. On the table, the old tape recorder waited. Its casing was scratched, but the buttons—including the fader—were worn smooth from years of touch. On a neatly organized shelf in the corner, tapes were

labelled by segments of his life: 'Age 10-18', 'Age 20-28', 'Age 30-35'... He selected the one labelled 'Age 50-60,' the decade he'd felt the most turmoil. He placed it gently into the other side of the deck for contemplation.

This time, he brought three tapes. The past few weeks had been hard to hear the not-so-exciting news about an old friend. They had sent these tapes—moments of celebrations, small joys they shared—as if to leave traces he could return to, if the worst happened. He slipped the first tape into the front deck, ready to record a clean, quiet copy that would fill the missing parts in his life segments of his 60s. He pressed the dual play/record button. His fingers knew where it was.

A thread of sound filled the room: a laugh that trembled at the edges, a snatch of music, someone calling out across a room, nostalgic voices. He listened until the tape wound down, then exchanged it for the next. Each recording carried a different weight. Some light, some sharp, he let them come. He gently used the fader to pull the harshness out of the background noise, letting only the pure sound of the moment transfer to his own tape, ‘Age 50-60’.

Another swap of the tape. He continued this dual process -- curating his memories with an old friend while sitting with his own past. The room felt crowded with voices from many years ago. Some memories carried a heavier weight: a regret he had carried too long, a voice he hadn’t heard in years, a scene that never quite settled. Still, he let them come. The contrast between the fresh, raw sound coming out of the tape that his friend sent, and the complex echoes of his own past allowed for the re-examination of the narrative of that difficult decade. The tapes told the same story differently, loosening something inside him and rounding the corners.

When the last tape clicked to a stop, he held the recorder in both hands. The room was silent again. Maybe it was too much for one evening. Too many memories to remember, too many emotions to let go. He rewound the new copy slowly to the beginning.

Outside, evening pressed in. The room felt lighter than when he’d entered, as if some small but heavy had finally loosened its grip.

6.6.4. Betty & Don’s Grandma and Grandpa’s Treasure Chest

> I want this to be a comprehensive life history, almost like a little family history in a box. Right now, they are young. When we go over to visit, we do spend time together, but they go off and play. They have their own interests, and they don't think about the fact that Grandma and Grandpa aren't going to be there forever. But when they are older, they might want to know more things about us, right? It would be divided into sections, Happy, Funny, Sad, Advice and so on, so my grandchildren can really know who we were, what we wanted to be, and the path we actually took. I would include letters for my granddaughters and recordings of me reading stories, just as I used to do. It’s a legacy I would pass on for after we are gone, with their own voices serving as the keys to open it, ensuring they always have a place to go for a good laugh, a bit of comfort, or a piece of my heart. (**Betty & Don**)

Betty and Don, a couple in their mid-70s and early-80s, approached this study not with a focus on their own immediate needs for reminiscence, but with a commitment to crafting a posthumous legacy. Betty was particularly solicitous of her two granddaughters, Macynna and Rayne, who she felt were currently too young to realize that “Grandma and Grandpa aren't going to be there forever”. Her hope was to bridge this temporal gap between generations. "I would probably give the key to my grandchildren because I don't think they know me as well. They know I’m around and that I support them, but they don’t truly know me. But when they are older, they might want to know more about us.”

Their desire for intergenerational care led them to reject any concepts involving forced loss or impermanence, such as The Egg or The Eraser. While Betty’s own experience of losing a video was the original inspiration for The Egg—and she had other profound losses, including a recording of her father singing—Betty and Don found the concept of intentional forgetting uncomfortable. Although losses had indeed left a deep yet painful impression, sometimes making the lost memories more vivid, Betty felt such volatility did not suit a generational treasure. Similarly, she was wary of The Eraser, which she viewed as a form of mandatory forgetting that reminded her of current worries. "The Eraser would eventually be left with fragments, and it would be completely gone. It doesn't feel good for me to be part of the 'Eraser' scene because that's how I feel about my current memory." Instead, Betty and Don favored an archive that was secure, long-lasting, and meticulously cherished. They took great inspiration from The Box and The Long Pause, synthesizing them into a concept of curated sharing and relational access.

The Box resonated with Betty and Don because it provided control to a “keeper” of memories, ensuring what’s inside would not be easily lost or erased. Betty also appreciated the “rhythm” of The Long Pause that interpreted limited access not as a restriction, but as a way to make memory more sacred by “waiting for the right moment.”

These preferences led to their design fiction, **Grandma And Grandpa’s Treasure Chest**. The Treasure Chest was envisioned as a “comprehensive life history”, a physical, multi-sensory artifact that shifts the practice of reminiscence from passive accumulation to purposeful categorization. While sound was chosen as their primary medium, Betty and Don envisioned the Treasure Chest as a hybrid archive; it would carry a selective collection of audio clips, video recordings, as well as small physical mementos as tangible "trinkets of memory". However, to avoid having piles of "chronological dump", they decided the Treasure Chest would hold a deliberate mixture of “small, uneven memories” collected over a lifetime, described as “a little family history in a box”. Like any family, there are tensions that come up and go, family members get along sometimes and don't. In part, although it remained to be seen whether their memories would change that, Betty and Don hoped to structure the Treasure Box similarly to their will, as a means to heal some rifts that were in the family, bringing their beloved family members together. They categorized their life traces into clearly labeled thematic sections: Happy, Funny, Sad, Advice, Spiritual Sharing, Animal Stories, Travel, and finally, Miscellaneous. “There would be another catch-all box, 'miscellaneous', for memories that would not fit any of the other categories, but that might still be useful, such as the sound of this grandfather clock or Don's secret pancake recipe.” Betty and Don ensured their legacy would not become an “overwhelming abundance”. Instead, it would remain readily accessible, “silently waiting”, living in the corner of a shelf, where their family could always have a place to go for "a good laugh, a bit of comfort, or a piece of my heart".

The Treasure Chest’s opening mechanism is its most speculative and crucial characteristic: it can only be opened by the voices of Macynna and Rayne. They imagined a future AI capable of recognizing the unique qualities of their granddaughters’ growing voices—their “tone, rhythm, and the way you say your name”—over decades, long after the grandparents are gone. This specific preference for “voice as the key” reflected Betty & Don’s desire for an unmediated, deeply personal emotional connection

between generations, hoping that their valuable fragments of life, letters, and recordings of many stories remain accessible to the designated keepers. The Treasure Chest serves as a "living archive" that represents their continued presence, allowing Betty and Don to "live on because of the memories in this box". "These memories to look back on might help [Macynna and Rayne] learn, help them make better decisions in their life, or help them know that their struggles are not unique—to know our lives weren't without 'wrinkles'. We can't always be there to talk to them. Life is like an ocean, with the ebb and flow of the tide."

Betty and Don's first story is an Instruction Manual that describes the Treasure Chest's contents and opening mechanism to its two young keepers. The second story consists of personal letters to Macynna and Rayne, explaining the heart behind the Treasure Chest, and how these recorded treasures of laughter, advice, and stories will help them carry the love of their grandparents with them.

Story 7: Instructions for Grandma and Grandpa's Treasure Chest

This is Grandma and Grandpa's Treasure Chest. Like grandpa's old pancake recipe, this box holds a mixture of memories from both of us. Small, uneven, but collected over a lifetime. There are lots of stories to share with you. Stories are valuable, but every day we tend to live in the moment, often putting something meaningful aside. There will be times when you face hard times, or you may be simply curious about what we were like when you were small. Inside are memories we made together. There are moments we didn't want to be lost or unknown.

To open it, you will need to speak to it. The box remembers your voice, even if your voice grows. Your tone, rhythm, and the way you say your name when you're trying to sound serious will open up the treasured memories because your voice is the key to providing access to treasured memories inside. Only the two of you can open the box. You can listen to any of the memories, but only when you choose to open the box by saying your name. You may share the contents of the box with other family members and close friends, but none of the contents may be permanently removed or shared publicly.

Once it opens, you will find the memories organized into categories: *Happy*, *Sad*, *Funny*, *Life advice*, *Spiritual sharing*, *Travel stories*, *Animal stories*, *Sports*, and finally, *Other*—little, miscellaneous memories, such as the sound of the grandfather clock.

We don't expect these memories to guide you. Some memories grow stronger while waiting, and some become quieter, making them easier to carry. As we always liked to do things together, this box is meant to make you think, laugh, or even cry.

Story 8: Letters to Granddaughters, Macynna and Rayne

Dear Macynna,

You may have found this box as you were going through our belongings. Maybe someone else found it but could not open it. You and Rayne are the only two people who can open this treasure chest. No. It's not from a pirate, but I can picture Grandpa pretending to be a pirate with a fierce face, saying "Ah Me heartys" in a funny pirate voice.

There are instructions taped to the top of the box. I hope that our special memories and stories will provide you with a lot of listening pleasure. There are also a few videos and some other mementos that you can enjoy. You already have lots of photos, so there will not be anything too visual except for the few videos.

Long after we are gone, we will live on because of the memories in this box. If you or anyone else in the family wants a good laugh, advice, or to share a special moment, you can do that by checking out what is inside the treasure chest. You won't miss us too much because we will always be there whenever you open it to find all of the treasure.

Treasure isn't just money. Feelings and memories of many kinds will be stored in there forever. Please pay careful attention to the instructions. This way, you won't forget Grandma and Grandpa. Our audio and video memories, and the few special items, will help you remember.

Your voice opens the chest because you might lose a key, and your lovely voice was so special in both of our lives. Your voice talked, sang, shared information about

birds and people, flowers and other things on our many walks together and shouted, and your words were sometimes playful. Grandpa and I loved that so much!

So, treasure this box and keep it safe.

Dear Rayne,

By now, you know that Macynna has found a special treasure chest. No one else can open Grandma and Grandpa's treasure chest except you and Macynna.

There are instructions taped to the top of the box. They are invisible to most people, but if you scroll across the page with your finger, a button will appear. If you press the button, you will hear a recording of the instructions. You have to listen carefully because that is how you will know how to open the box.

The box has lots of interesting memories inside it. Memories are in different categories like Happy, Sad, Sports, Animal stories, Spiritual stuff and much more. Of course, you are included in some of those memories. You and Macynna have been chosen as the keepers of our memories because we know that you will keep them safe.

Have a great time listening to all of the recordings, watching the videos, and going through some of the mementos. In this way, we will always be with you.

Your loving grandparents,

Betty and Don Nobel

6.7. Thematic Analysis

This section presents the thematic analysis of the eight design fiction stories co-created with our collaborators, identifying four primary themes that characterize the future of sound-based reminiscence for people with blindness. Although our collaborators possessed a variety of types and collections of audio recordings, they often

refrained from actively engaging with their audio archives. Yet, our collaborators expressed a profound desire to transition from passively owning or searching for recordings to actively curating and making their own histories and legacies. Our collaborators and the research team sought to find new ways to honour the value and meaning of leaving memory traces. However, collaborators often faced the ephemeral nature of these desires. As Betty noted, "Storytelling is really valuable, but we don't always remember to do it because we're always thinking about what's going on in the moment—whether it's good or not, we tend to live in the moment." These challenges raised concerns about the dominance of functional, efficiency-driven, retrieval-based logic in current AI and assistive technologies for people with blindness, particularly regarding memory practices. Through the eight design fiction stories, we raise a question of whether sound-based memory systems can move beyond mere utility and functionality to support deep reflection and the construction of a trace of memory and a posthumous legacy.

In what follows, we detail our analysis across four key themes: (i) reorganization of narrative self; (ii) leaving posthumous legacy; (iii) extended waiting. We acknowledge that these thematic insights are deeply rooted in the lived expertise of our collaborators and ongoing engagement, and therefore, some of our analysis draws on and connects to insights into sound-based reminiscence and reminiscence experiences for people with blindness in our previous work. We present this analysis as an evolving long-term research trajectory.

6.7.1. Reorganization of Narrative Self

When envisioning the future of reminiscence and speculative memory objects during the workshop, our collaborators' string of thoughts was rooted in reflections on "what is currently valuable". Their thoughts moved beyond merely imagining useful or convenient tools, and evolved into a reflective journey where collaborators asked, *What aspects of my current self I want my future self and my loved ones to remember?* In this vein, rather than treating audio recordings and audio archives as simple storage for recording and searching voice data, collaborators immersed themselves in a form of "work of the self," weaving future identities through precious memories, life lessons, and personal stories they wished to share with the future in their stories. For their imagined

memory devices—Tiger X, Birthday Recorder, Dual-Deck Tape Recorder, and Treasure Chest—the act of re-listening is much more than the simple retrieval of memories or the confirmation of information from the past. The imagined re-listening process became a profound trigger for self-reflection, serving as a means to proactively shape their current and future identity. This trajectory highlighted a longitudinal restructuring of their personal histories, viewed through a continuous lens of the past, present, and future. Our research team analyzed this phenomenon through two key dimensions: "attuning internal emotions" and "forming narrative structures."

First, the cases of Thilo and Yuko exemplify a desire to reconstruct their internal narratives. For them, reorganizing the self was not about altering past facts, but rather about reflecting on the "emotional influence" those past experiences have influenced and shaped their present state and self. Although they are a married couple with a long-shared history, Yuko and Thilo requested separate activities to better capture their individual stories. Despite this separation, the way both leveraged the past to weave future narratives was profoundly resembled. For Thilo, even while grappling with distressing news from his personal connections during the study, he conceptualized the "Dual-Deck Tape Recorder," an object that mirrors his personal ritual of deep contemplation. He noted that "to speak of the future, the complex thoughts and emotions of the present must first be settled". Instead of indiscriminately deleting painful memories, he sought to use the fader interface of a 1980s cassette recorder to meticulously calibrate what to carry forward, and what to let fade and be forgotten. Thilo assured the need for "quiet, solitary time" to sift through complex emotions, which helped him find value even in hardship. While the Dual-Deck Tape Recorder requires a slow and deliberate pace, it beautifully illustrates Thilo’s ritual of making "room inside himself" for the future by consciously emptying the present.

Yuko also highlighted the transition from a difficult past to her current "happy" self—a term she frequently used throughout the workshop. The young Yuko faced family conflict, gradual vision loss, and the isolation of starting over in a new country; yet, these fragments of perceived misfortune were re-envisioned by the 60-year-old Yuko as a "beloved" journey of life and learning. The "Birthday Recorder" builds on this insight. Rather than capturing daily minutiae, Birthday Recorder offers a rare opportunity on birthdays to step back from the mundane and reflect on a decade of life. Yuko was

remarkably accepting of memories that naturally fade, recognizing the practical impossibility of retaining every moment. Just as she grew to better understand her younger self's emotions over time, the Birthday Recorder embodies her philosophy of "learning to love the life I am given", offered as a "gift" to her future self. Though their methods of organizing the past differed, Yuko and Thilo shared a common aspiration to settle and revisit specific life segments. Ultimately, their memory concepts were not about the infinite accumulation of data; instead, they became rituals that deepened self-reflection on the trajectory of their narrative identities through Reorganization.

On the other hand, the cases of Johnny & Desi and Betty & Don reveal an intriguing focus on the desire to establish one’s identity as a complete narrative by systematically categorizing and structuring vast amounts of life data. For them, the reorganization of the self was not a chronological journey through the past, as it was for Yuko or Thilo, but as a process of refining the definition of their existence by grouping and editing memories into meaningful thematic categories. Johnny, in particular, expressed strong discomfort with concepts that symbolized the loss or deletion of memory (e.g., 'The Eraser' or 'The Egg'), due to the challenges posed by Desi’s short-term memory loss. Johnny & Desi sought to protect their precious memories from accidental loss or inadvertent deletion. Therefore, they envisioned AI as an "Active Agent" capable of protecting and structuring their significant memories. Unlike the slow, contemplative approach of Yuko and Thilo, reorganization for Johnny and Desi was a process of utilizing a trusted technological agent to distill a coherent message from a sea of fragmented images and audio: "I Did It My Way." For Johnny and Desi, the "active" nature of the technology they envisioned is particularly noteworthy. They did not imagine a tool for precise, meticulous manual editing, but preferred a physical presence that shares their daily space and time, much like their pet cat, Tiger, who has lived with them for over 20 years. They expected a level of trust and autonomy akin to a cat -- one that observes and accompanies them but remains somewhat independent and "finicky", not always following human orders. Johnny hoped that if AI were to advance to "transfer" Tiger's personality and memory, the AI cat could become a "keeper of [their] narrative". One who observes, wonders, wanders around, learns, and eventually understands, represents, and defends their core life philosophy. Similarly, Betty & Don did not want their lives to be left as a "chronological dump" of records. They wished to bequeath stories and lessons to their family, especially their two granddaughters. By carefully

categorizing even the "wrinkles" of life into themes like 'Sad' or 'Advice,' they aimed to organize their history so that their descendants could gradually learn from a life that was not always happy or positive. This curation was more than a preparation for future generations; it was a reflective act in the twilight of their lives to decide how to define and accept their own existence. As Betty and Don noted, "some memories become heavier or lighter as time passes". For them, Reorganization was the act of gathering the diverse fragments of the past into meaningful categories, thereby settling a fragmented history into a well-ordered identity.

In conclusion, the reorganization of the narrative self, as observed in collaborators' stories, emerged through a deliberate process in which collaborators actively reviewed, organized, and authored their personal histories. These envisioned speculative memory objects highlight a critical design shift: memory technologies for blind people are not mere tools for retrieving the past, but rather essential concepts that enable individuals to gather vast, scattered traces of their lives, ultimately editing and solidifying the definition of "who I am" in their own ways.

6.7.2. Leaving Posthumous Legacy

Collaborators' stories demonstrate a gaze toward relational domains – 'you,' 'us,' and 'my future self' – that expands the inward-facing reflection to reorganizing identity through the past and present. Technology, in this context, embodies the question of how to convey and bridge one’s presence for both a future self and the loved ones who remain. Consequently, for our collaborators, the curation of past experiences and memory fragments evolves beyond a personal ritual to organize one's life. More broadly, it also manifests as a deliberate practice of envisioning intergenerational connections and extending care and wisdom to those who follow.

The case of Betty & Don illustrates how legacy serves as a medium to sustain deep, intimate emotional ties across generations. Betty expressed a cautious concern that her young granddaughters do not yet fully realize the transience of life—the reality that "Grandma and Grandpa cannot be with [them] forever”. To bridge the generational gap, they came up with the idea of the Treasure Chest. For Betty, who rarely takes photos, her priority was sharing oral stories with her family, particularly with her two little granddaughters. In this context, bequeathing memories was not merely about leaving

records. Rather, it would involve her deliberate effort to provide a safe place for their granddaughters so they could seek comfort and feel Betty and Don's presence as they navigate inevitable challenges and hardships as they grow up. A particularly evocative design element is the use of the "voice as the key" mechanism. Building on Betty's delicate sensitivity toward the human voice, reflecting her wish that her granddaughters—although the time will pass—are the ones with whom they would pass their memories on. Ultimately, for Betty and Don, legacy was about creating a sense of presence at the moment their granddaughters' voices meet their own life histories across time, conveying an enduring and profound message of "we are always with you".

This relational perspective of legacy further extends into the public space of museums and galleries in the case of Johnny and Desi. Unlike Betty and Don, who emphasized that their legacy should "not [be] publicly shared" and remain strictly within their close family, Johnny and Desi envisioned their works and memories residing in a gallery space alongside Tiger X—a robotic successor to their longtime pet cat, Tiger. For them, legacy was not a static record but a living vessel or proxy that continues to interact with visitors, much like a cat wandering freely through an exhibition. Johnny specifically hoped that Tiger X would become more than a robot that merely recites their memory data; he envisioned it as a "curator of [their] narrative" that embodies his life philosophy of "I Did It My Way", sending regards and offering warmth, humor, and comfort to visitors. Further, the concept of interdependence is particularly striking in how Tiger X was designed with a degree of autonomous selectivity; much like the "finicky" nature of their real cat, Tiger, approaching visitors with a certain finickiness and only sharing their life stories with those who show curiosity and patience, who show what Johnny and Desi actually valued in their lives. (In fact, Johnny even went on to picture another story of a shy child being bullied, seeking Johnny's advice, then Tiger X shares Johnny's training routines to be courageous and stronger.)

The perspective of legacy also manifests within the cases of Yuko and Thilo, who primarily focused on internal reflection. For Yuko, the Birthday Recorder is more than a tool for revisiting the past; it is a gift that travels through time, sent to her 82-year-old and, eventually, possibly, 92-year-old self. By imparting her life lesson of 'learning to love the life I am given' to her future self, this act takes the form of a self-legacy that can be shared with others who may "struggle in [similar situations] with young Yuko". Similarly,

through the acts of emptying and fading enabled by the Dual-Deck Tape Recorder, Thilo settled his memories into an ordered narrative intended for himself as a future listener. For both, curation serves as a preliminary act of consideration, ensuring that the personal history encountered by their future selves or descendants is neither too heavy nor too chaotic.

The meaning of legacy goes beyond the simple sharing of memory, carefully planning and preparing as a relational practice that is fully realized through the process of revisiting, listening to, and questioning those memories. The speculative memory objects envisioned by our collaborators function as an extension of presence, allowing their voices and philosophies to resonate within the daily lives of their loved ones even after their presence. For those left behind, these objects that carry legacy serve as comforting tools to cherish and fill our collaborators' absence; for those departing, they act as an emotional scaffold, providing the reassurance that their lives will be deeply remembered and valued.

6.7.3. Extended Waiting

Within the design fictions woven around the speculative memory objects, there is a clear desire to depart from the anytime-availability of modern technology. While prior HCI research has emphasized the value of unobtrusiveness and slow technology [198, 336], to offer an alternative perspective on the attention-demanding systems, our collaborators' stories reveal that "extended waiting" takes on a unique and vital significance, especially within the sensitive context of personal memory, reminiscence and posthumous legacy. In our collaborators' design fiction stories, purposeful yet extended waiting was analyzed as a core design material to designate dedicated time and space for reflection.

The characteristic of extensive waiting for memory objects creates a unique spatio-temporal space for reflection. For our collaborators, reflection was not a function to be accessed at any given time, but rather a rare ritual that unfolds only within a specific time and context. Each speculative memory object either refrained from demanding attention (e.g., Tiger X, Dual-Deck Tape Recorder, and Treasure Chest) or subtly posed a moment of reflection only after an extended period (e.g., Birthday Recorder). Revisiting potentially heavy past memories, which require heightened focus

due to the nature of voice and sound, becomes a special occasion occurring after a long breath rather than a mundane task integrated into a daily routine.

Thilo, for example, emphasized "quiet, solitary time" as a fundamental prerequisite for beginning his "contemplation" of settling complex emotions. This meant more than the physical silence, to secure a psychological space for him to be immersed in the emotions. Yet, his Dual-Deck Tape Recorder never seek explicit attention; it waits in the back room until Thilo purposefully approaches. Similarly, Betty and Don's Treasure Chest and Johnny and Desi's Tiger X do not actively nudge or prompt engagement. For Betty and Don, the gradual process of refining and categorizing memories at focused times over the years was essential, similar to how they preferred to take the time to complete their design fiction stories. On the other hand, Yuko's Birthday Recorder leverages rare temporal windows of decadal cycles on birthdays, which is a deliberate constraint that Yuko implemented to illuminate the grand flow of life. All these imagined memory objects patiently wait until our collaborators finally find a moment of resonance by carving out their own dedicated spatio-temporal windows for reflection.

Our collaborators significantly elevated the quality of reflection and curation by imagining memory objects that patiently wait to meet long-term, uneven, or even unpredictable temporal cycles of reflection and curation. By imagining technology that respects silence and time rather than reminding or providing memory-related data, our collaborators' memory objects have the capability to capture sensitive moments of reflection and curation. In their stories, extended waiting becomes a core design value, making memories more meaningful and evocative.

6.8. Discussions & Implications

Our collaborators did not want technology to take over their work of caring for their own memories and personal history. They still saw it as a task for themselves — one that required time and effort—a necessary burden to bear in their lives. Each imagined memory object reveals insights into how our collaborators envision future memory technology from the perspectives of blind people. While they all felt repelled and hesitant by unintended, purposeless deletions of their memory data (The Eraser and The Egg), despite embracing the meaning of forgetting in human memory, the concepts of limited accessibility, waiting, and purposeful curation (The Box and The Long Pause).

Our collaborators created a set of intriguing design fiction stories that are uniquely rooted in their personal lived experiences. These design fiction stories take an alternative approach that counters the abundance and anytime-availability of modern technology, advocating ways for blind people to reorganize their narrative selves, curate a long-term, posthumous legacy, and employ extended waiting to allow rare but right moments to arise for curation and reflection.

In what follows, we build on our analysis to suggest design considerations for creating long-term, biographical memory archives for people with blindness. Specifically, we discuss (i) the paradigm of *Designing for the Few* as a strategic choice to move away from overwhelming digital abundance into meaningful, contextual selectivity (Section 7.1); (ii) three dimensions of Narrative Agency—Interpretive, Curative, and Transcendent—that empower people with blindness to actively author, organize and curate their personal life histories (Section 7.2); and (iii) the role of AI as a Co-Curator that evolves along with the human curator to help shaping one's identity and achieve a sustainable presence in the far future (Section 7.3). We acknowledge that these discussion points emerge from our collaborators' speculative narratives, which were developed through a long-term, collaborative design process that deeply respects their uniquely situated lived experiences and narrative identities of our collaborators.

6.8.1. Designing For Few

The speculative memory objects envisioned by our collaborators represent distinct values from the traditional goals of data accuracy and efficiency often emphasized in accessibility paradigms. This orientation contrasts with the prevailing direction of modern technology in supporting memory that seeks to preserve or technically augment vast amounts of personal data, such as lifelogging [6, 134, 206, 234, 235, 390], and aligns with the alternative perspectives and modes of design [368]. Their design fictions prioritize the meaning embedded in a relatively small number of memory fragments over sheer quantitative abundance. In this section, we discuss the concept of "Designing for Few" for memory technology for blind people. In this context, *Few* signifies more than a small quantity of data; it represents a deliberate strategy to limit opportunities for interaction—retrieval, manipulation, or consumption—to foster a sense of *selectivity* that builds on scarcity. We discuss three modes of selectivity that

bridge the gap between digital abundance and the meaning of remembrance: (i) Temporal Selectivity (“When”) that limits access to specific time to foster the meaning of memory matures, (ii) Situational Selectivity (“Where” & “How”) that anchors memories to physical sites and specific sensory interactions to ensure presence, and (iii) Relational Selectivity (“What” and “Who”), which limits access based on trust and evolving relationships to protect the exclusivity of legacy.

Temporal Selectivity: Limiting Encounters of “When”

The first prominent selectivity analyzed in the design fiction stories is time and temporality. Temporal selectivity implies a drastic restriction on the windows of time available for encountering and reflecting on memories, manifesting in both direct and indirect forms of non-availability. While Yuko’s Birthday Recorder explicitly enforces a ten-year period of non-availability, the other three memory objects—as discussed in the Extended Waiting of Section 6.7.3—patiently wait until the user’s mind is clear and ready. From a conventional usability perspective, an object that remains unused for such a long duration might be deemed unavailable or obsolete. Although long-term disuse, or “Disuse Over Time”, is rarely captured in the literature (e.g., [187, 237, 423]) and needs more research [185], in the context of reminiscence and remembrance, facing the past comes with a mix of positive and negative, bittersweet memories and thus requires emotional energy and mental capacity that can be a burden when reconciling with one's previous selves [69, 218]. A crucial insight here is that all four memory objects leverage these periods of non-use to empty the emotional burden of facing the past. Temporal selectivity provides an emotional buffer, allowing our collaborators to be emotionally ready before confronting the weight of the past, engaging only when the moment of reflection aligns with their current emotional state. This can be a strategic design element that allows for waiting for the right moment, a moment that is genuinely drawn to engage with one's memories and emotions. In cognitive psychology, Self-Memory System (SMS) framework explains how human memory and identity work together [93, 94]. The "working self" continuously filters the vast archive of everyday life, choosing not to retain every detailed trace but to let mundane, everyday memories slowly accumulate in the background, constructing meanings of significant life transitions and "nuclear episodes" [296]—the critical turning points and peaks that define a life history. Temporal selectivity suggests that the value of a memory lies not in the fullness of data or

immediate accessibility but in the rare moments of encounter that allow narratives to mature over time.

Such temporal constraints resonate particularly well with sound, given its inherent linearity over time. While visual media allows skimming through spatial layouts and extracting specific pieces of information instantaneously, sound, especially for people with blindness [509], imposes a temporal bound, meaning that they must *pay* the exact duration of physical time the sound occupies to acquire information. Traditionally, HCI accessibility research has viewed this linearity as a functional limitation, seeking to overcome it through technologies like high-speed playback, time compression and keyword-based retrieval [148, 385, 465], which certainly align with what blind people are accustomed to. However, our previous study revealed that when blind people speed up the recording, it is usually for information retrieval that is fundamentally different in purpose from absorbing emotions and careful reflection [507, 508]. In our collaborators' stories, this constraint is reinterpreted within the context of memory and reflection. As the weight of time occupied by sound is balanced with intentional pacing and spacing, the act of waiting and encountering gains much more meaning than data retrieval. For Thilo or Betty and Don, waiting years to revisit and organize their life segments becomes their own temporal contract, growing into a willingness to share the weight of time with their past selves. This ensures that the non-available duration invested becomes proportional to the significance of the memory. Importantly, this contract extends to the recipient of the memory as well, requiring the listener to *pay back* the time. In return, facing the curated legacy delivers the authenticity and weight that has been put into it.

Situational Selectivity: Navigating "Where" and "How"

The second mode of selectivity described in design fictions is situational selectivity, shifting the focus from "what" is remembered to "when" and "how" their memories are engaged. Memory is far more than a collection of static moments. Rather, it is an active, reconstructive practice that involves selectively interpreting the past, highlighting certain episodes, and constructing an evolving life story [296, 298]. Instead of making instances of memory always-available and accessible anytime in any context indiscriminately, objects like Tiger X and the Treasure Chest frame memory as a narrative medium that exists within limited, intended contexts. This situational selectivity translates McAdams' notion of "Narrative Identity" [297] into a design strategy. It

acknowledges that people perform distinct versions of their identity across different social contexts. Situational selectivity provides an ability to intentionally curate, adapt, and perform life stories based on one's unique narrative identity within the specific social situations and discursive conventions they encounter. This suggests that memories, whether encountered through Tiger X's social interactions or Treasure Chest's stories, are constantly performed, expressed and redefined through the exclusivity and depth of the relationship they mediate in different situations.

The importance of situational selectivity stems from the fragility of narrative identity, which easily breaks down when the owner's inner perspective cannot be fully translated to an outside audience (or to a future self). A lack of control over the interpretive environment inevitably creates the gap between the person who's sharing memory and the audience, possibly distort their original intent. This is particularly acute for blind people's memory practices. Previous studies have shown that people with blindness frequently struggle to be fully present in vision-centric media (e.g., photo albums) because they must rely on descriptions and interpretations of sighted others [513]. Despite people with blindness having a constant desire to share the audio memories they made with others, they find it difficult to share their cherished audio recordings with both sighted and blind others [509]. This challenge stems from the spatial nature of sound. While the spatial dimension of sound offers more dynamic and immersive potential than visual media [77], it also introduces a critical barrier to shared understanding and sharing memories in sound. Captured audios are highly situated because the interpretation of sound is heavily dependent on its spatial components, such as the specific location where a recording was made and the physical direction of the different sources of sounds [43, 195, 481]. Consequently, recordings made by blind people are inherently tied to their specific spatial position at the moment of capture. Without an explicit understanding or information of that precise physical orientation, they often fail to convey the intended meanings and cues, creating a significant interpretive gap rather than an intimate shared experience. Even those who were present at the scene may struggle to recognize the context or reconstruct the moment, as the audio alone cannot bridge the distance between the recorder's unique perspective and the listener's situated perception upon listening.

This challenge highlights the need for a more curated approach to situational encounter in sound, and therefore, we suggest that situational selectivity can serve as a design strategy by limiting moments of encounter to specific, intended situations to choose exactly when and how their story is told. The memory objects that appeared in our collaborators' design fictions take on the roles of autonomous agents or delegated proxies to make sure their memories are performed in appropriate situations and contexts. For instance, Johnny and Desi's Tiger X possesses the agency to choose when to interact, while Betty and Don's Treasure Chest delegates the responsibility of their lifetime memories—deciding when and who to share them with—to their two granddaughters. These examples illustrate that, by designing contextual boundaries and interactions, we can ensure that encounters are not a random retrieval of moments but rather a curated resonance and a protected space where the curator's social presence and their original intent meet.

Relational Selectivity: Creating Legacy for "What" and "Who"

The third mode of selectivity is relational selectivity, focusing on the deliberate selection of "what" is shared based on "whom" it is intended for. Relational selectivity not only asks the question of "what to show" but also places equal weight on "what not to show". The meticulous categorization of Betty and Don's Treasure Box (e.g., Happy, Sad, Advice for granddaughters) and Thilo's collection of tapes that represent his life segments, organized over several years for his future self, points to a critical recognition that the accumulation of data without clear intention is not a meaningful legacy. This aligns with what Gulotta et al. describe as "the burden of inheritance" [193]. Modern technology facilitates, or often encourages, the accumulation and storing of long traces of different data types (e.g., health data [109, 432], geolocation data [206], mood & emotions [243, 395]) that reveal interesting insights ranging from one's well-being [145] to supporting personal reflections [386] and social relationships [269, 280]. However, in this specific context of long-term memory archive and creating legacy, an uncurated accumulation of data can impose psychological and physical pressure, demanding interpretive labour from the intended recipient (including a future self). Within this context, situational selectivity serves as a vital form of narrative editing tailored to a specific audience. We observed that relational selectivity can serve as an act of care for our collaborators, ensuring that the recipients of their legacy are not overwhelmed, helping them find meaning without getting lost in their loved one's memory.

Relational selectivity in creating legacy in memory also reflects the non-linearity of time, challenging the view of how time is constructed in technology and the singular narrative of the future [381, 387]. In the Western perspective, time is described as a linear path that flows from the past to the present and eventually to the future. This perspective indeed influenced how our research team initially framed the speculative aspect of reminiscence and remembrance, making us cautious and careful about discussing the "future" with our collaborators, who are already in their 70s and 80s. However, contrary to our concerns, our collaborators embraced the discussions of future memory practices and leaving traces, perhaps beyond their lifetime, since such topics strongly resonated with the ones our collaborators keep thinking about—what and how to leave behind for their loved ones. Whether it is Betty and Don mindfully selecting life lessons to heal rifts for family or help navigate future challenges for their granddaughters, or Yuko and Thilo organizing their life segments to guide their own future reflections, these desires envision transforming a collection of records into a long-term, biographical archive. This aligns with the perspective that envisioning the future should take a pluralistic view of time into account, such as non-linear, circular, relational and relative time [11, 442]. By centering 'what' and 'who' in the imagined memory objects, relational selectivity facilitates a form of presence that persists across time and generations, where the past is not merely preserved but is constantly re-encountered and re-defined in the future.

6.8.2. Designing for Narrative Agency

This study invites a macro-temporal shift that embraces the broader flow of a lifetime by looking toward the distant future and the near the end of life, beyond the present-tense granularity of memory that is often evoked by specific triggers and immediate emotional and contextual moments. We explore how long-term audio collection and physical artifacts with embedded sound memories reveal a performative space where identity is continuously negotiated and reconstructed. In this section, we discuss three dimensions of Narrative Agency—*Interpretive*, *Curative* and *Transcendent*—that empower blind people as active narrators of their own history and legacy to develop a Biographical Archive where the self is authored, and traces of memory are made with intentionality, care and reflection.

First, **Interpretive Agency** represents the right to continuously re-evaluate the past from the perspective of the present. For our participants, reminiscence is an active, dynamic and creative process of reconstruction and re-evaluation shaped by specific situations and future aspirations rather than a mere retrieval of static moments. In this context, the core of narrative agency lies not in recovering objective truth but in offering the ability to re-interpret the meaning of records for one's present and future self. The design fictions of our collaborators illustrate this shift by creating time, space and environments that foster longitudinal reflection. For instance, Yuko's Birthday Recorder enforces a decade-long interval to ensure that when she eventually hears her own voice, it is met with the wisdom of a mature self. Similarly, Thilo's Dual-Deck Tape Recorder relies on a familiar, tactile interface designed for the act of "settling" his life segments into an ordered narrative during moments of quiet solitude. These interactions—while intentionally uncomplicated and intuitive—prioritize the emotional labour of attending to one's history over the technical burden of organizing data. By embedding rich, thoughtful, yet simple interactions, these objects lower the barrier to deep reflection. We further see this agency in the ways Betty and Don carefully choose stories that promote family well-being, deliberatively sifting their present through the lens of the future. Johnny and Desi likewise use Tiger X for active interpretation (with some degree of autonomy), in which memories are drawn into the center of attention when necessary. We argue that, for blind people, Interpretive Agency is realized at the intersection of the memory's material form, as Treasure Chest, Robotic Cat, a series of curated tapes or a timeless digital recorder, and the temporality of its encounter. And therefore, Interpretive Agency is achieved when technology becomes a comfortable, trustful medium that they can continuously reinterpret their personal and shared histories as the primary authors of their own legacy.

Second, **Curative Agency** focuses on the right to choose what to preserve and what to let go of among the vast, often indiscriminate accumulation of digital traces. While Interpretive Agency (7.2.1) deals with how one might re-interpret the past, Curative Agency is about the sovereignty over what remains in the long-term memory archive. This agency challenges the core values of efficiency and infinite storage in modern technology. While our collaborators were intrigued by the capacity of modern technology to record details of their lives, they simultaneously identified 'digital abundance' as a significant accessibility barrier. This pressure was evident in Thilo's

feeling pressured when there was "too much going on" in life, in Johnny's anxiety over storage limits, and in Betty's resistance to the notion of forced forgetting. Such an ironic burden from abundance is echoed in prior research on digital hoarding [30, 59, 416, 440], especially when people experience cognitive load and emotional stress as they start to lose control of their data when personal archives exceed manageable thresholds. In this context, Curative Agency aligns with Reflective Design [412] and Slow Technology [198, 329], which prioritize mental rest from digital clutter, to reserve psychological space for contemplation within everyday environments. Specifically, Curative Agency extends the concept of "Explicit Slowness" [341], offering an alternative that transforms digital abundance into meaningful scarcity, waiting for rare moments of reflection and encounters for reminiscing and remembering. In designing Biographical Archives for people with blindness, building upon the Situational Selectivity in Section 7.1, the intentional use of pauses and waiting enables them to manage their own histories, allowing them to make careful decisions on only what is truly valued in a given context.

Third, **Transcendent Agency** reflects the desire to extend one's narrative beyond biological and temporal limitations, manifesting as personal reminiscence evolves into an external legacy with longevity. While the 'Relational Selectivity' discussed in Section 7.1.3 serves as a design strategy against digital abundance that may dilute the significance, the Transcendent Agency considers whether an archive can function as an independent entity that maintains "Liveness"—communicating with future generations even in one's biological absence. For example, Johnny and Desi's Tiger X exemplifies this ongoingness. Tiger X embodies Johnny's humor and philosophy, wandering through a gallery to selectively choose its own interaction partners. This Autonomous Proxy enables a narrative presence that reaches beyond space and time, allowing Johnny and Desi's identities to engage with future visitors. Extending the preservation of information, Transcendent Agency can take the form of Relational Care that weaves into the emotional lives of future generations. In Betty and Don's Treasure Chest, setting the granddaughters' voices as the exclusive key signifies that the legacy is not a record open to the public, but a promised encounter designed for specific recipients at desired moments. The archive matures alongside the granddaughters, revealing or concealing its contents in sync with their growth, acting as a narrative that deepens in presence over time. To realize this agency, borrowing the vocabulary of

Design Events [351], we propose that one way to achieve Transcendent Agency is to embrace the concept of "Other-time", where a system possesses its own autonomous rhythm—changing and responding over time like a living organism rather than remaining in a passive state awaiting explicit inputs or attention. Transcendent Agency is a practice of Temporal Interconnectedness (or Temporal Resonance) and the exercise of narrative responsibility, where past records acquire new meaning by aligning with future life trajectories—whether by younger generations in the family, gallery visitors, future self or a future someone who will eventually encounter these memories.

Collectively, the convergence of these three dimensions of agency—*Interpretive*, *Curative*, and *Transcendent*— underscores the critical need for technological environments where people with blindness can actively construct their life histories as coherent, self-directed narratives. Together, they suggest a paradigmatic shift away from memory practices that have historically depended on sighted assistance or required workaround, pointing toward interactive systems with autonomy. By enabling blind people to independently verify, modulate, and author their own histories without external mediation, these narrative agencies expand the role of interactive technology for memory and reminiscence for people with blindness.

6.8.3. AI as Co-Curator for Biographical Archives

In this section, we discuss the evolution of the AI agent from a sensory aid to a Co-Curator—a partner in the collaborative construction of narrative meaning. The role of AI was a particularly compelling topic of discussion with our collaborators. For those who had imagined "image-describing AI" as far back as 2019 [508], the recent emergence of Generative AI and wearable devices like Meta Ray-Ban represented a transition from speculative future to "living in a dream". Our collaborators expressed a high degree of trust in technological advancement and viewed the integration of AI with optimism. However, in their design fictions, they remained grounded in the extension of personal experience rather than imagining radical or purely experimental futures, focusing on how AI could capture the essence of reminiscence and legacy. Interestingly, the roles assigned to AI are not similar to those in the traditional assistive technology framework, which typically focuses on replacing sensory information (mainly visual, in this case) with text or audio. This section aims to provide a broader perspective on the role of AI as a

partner that collaboratively shapes the narrative significance of reminiscence and remembrance of people with blindness.

First, we argue that AI as a co-curator for reminiscence must be understood and studied through a longitudinal lens, where the system stays with and understands a blind curator over the long term, and vice versa, blind people understand and work together with an AI agent on making their biographical archive over time. This challenges the recent rise in AI research, which largely focuses on short-term interactions and quick impressions of AI among human users [261, 281]. The Treasure Chest envisioned by Betty and Don illustrates this need for time; its voice-recognition mechanism suggests that AI must be accepted as a companion capable of understanding the weight of time. This raises a fundamental question: will the system still recognize the granddaughters' voices when they reach their 20s or 30s? If so, having such a reliable "feature" will eventually build a trusting relationship toward AI as a co-curator that can be trusted and left behind, or is there something more? For our collaborators, for technology to facilitate generational relationships that span lifetimes, it must witness their growth and struggle to calibrate its behavior accordingly. This strongly suggests that there is no point in rushing to obtain a trust that only an extended period of shared history can provide. Even with a memory system grounded in our suggested design strategies, such as *Extended Waiting* (Section 6.7.3) or *Designing for Few* (Section 6.8.1), the question of whether a human curator can fully embrace an AI agent as a co-curator with its own personality and autonomy that understands the curator's personal history, philosophy of life and intimate narrative remains a fundamental inquiry beyond the scope of this study. While we acknowledge these issues of acceptance as both a constraint and a potentiality, deeper exploration of AI as a long-term co-curator will require longitudinal studies on AI adaptation and sustained human-AI interaction. In this vein, the relationship between a blind curator and their AI agent can be approached through the lens of slow technology and ethnography to capture how trust is "earned over time" rather than instantly obtained. Rather than measuring a system's success through instantaneous feedback or task completion, slowness allows the AI to gradually align with the curator's evolving values rooted in personal and social contexts over the years. Similarly, an ethnographic perspective shifts our focus from the "usability" of the agent to its "relational endurance" by observing how the AI becomes an integrated witness to the mundane and significant moments of a life. This longitudinal observation is necessary because trust in a co-

curator is not something that can be earned in a short time period, but a nuanced and careful quality that is established through the accumulation of shared time [67, 466].

Next, AI as a co-curator should actively observe, question and participate in shaping the meaning of a memory alongside the original curator. This partnership does not depend solely on human input but involves the AI learning together with the curator that can be achieved by moving away from a solutionist perspective that technology is expected to provide a useful aid or a definitive answer to a problem. An AI agent like Tiger X forms a blended cognitive system where the AI provides visual facts while the curator layers and interprets on the emotional context. In the space where Johnny verifies facts and Desi weighs emotional meaning, the AI participates in real-time, observing how shared history is formed and how nuanced emotions are shared at the scene. This can build on the theory that memory is not a phenomenon isolated within the individual mind, but a dynamic process distributed across humans, AI agents, and their shared environments. To position the AI agent as a co-curator, we may need a different theoretical model. The essence of this partnership can be further interpreted through Entanglement Theory [156] or even posthumanist, More-Than-Human design approaches to develop a new ontological understanding of the acceptance of an AI agent playing an independent role [183, 270, 320–322]. Therefore, an AI trained through the observation of daily memories over time might exist as an "extended self" [33, 34] that retains its own cognitive rhythms and narrative even after the curator is gone. For example, Tiger X, having witnessed the intimate details of Johnny and Desi’s lives, is no longer a separate object but a material representation in which their life philosophy is carried on. Similarly, if an AI agent were attached to Yuko's Birthday Recorder or Thilo's Dual-Deck Tape Recorder, it would have to hold the same expectations as they have closely, but more passively and quietly, observed Yuko's and Thilo's lives over a long period of time. Within this entanglement, the AI should become an active proxy, which is far beyond an accessibility tool, capable of deciding to whom and in what tone a story should be told, represented as a sustainable presence.

6.9. Conclusion and Future Work

In this paper, we have described a participatory speculative design process that envisions the future of memory practices and reminiscence technologies with 6 blind

collaborators. Drawing on 4 design fiction concepts of memory devices inspired by and grounded in the everyday lived experiences of our collaborators, and on 8 design fiction short stories co-authored with them, we have critically analyzed and reflected on the design strategies to be considered for long-term memory practices and legacies for people with blindness. In particular, we propose *Design for Few* and *Extended Waiting* as key temporal design strategies to capture and understand rare but rich moments of encounter for reflection. Further, we articulate three dimensions of narrative agencies—*Interpretive*, *Curative* and *Transcendent agency*— which collectively map how people with blindness can actively shape the expression of their personal histories. Ultimately, these agencies suggest that the design of future reminiscence technology for people with blindness goes beyond information retrieval or assisted mediation, the design of future memory technology for blind individuals might look beyond mere information retrieval or assisted mediation, opening up different ways for independent reflection and creative choices in their everyday reminiscence.

As this study marks the final stage of our long-term research engagement in this topic and with our continued collaborators, in our next steps, we will consider how these insights, design strategies and 8 design fiction stories can be further reached to a broader audience in different forms for critical awareness and inspiration. Through these threads, we hope to invite other researchers, designers, and community members to join this conversation, collectively imagining how technology can more gently and thoughtfully support and include diverse perspectives and lived realities of memory, remembering and reminiscence.

Chapter 7.

Translating HCI Research to Broader Audiences: Motivation, Inspiration, and Critical Factors on Alternative Research Outcomes

7.1. Overview

The experience of working on a different way of sharing research outcomes, heavily shaped by our positionality and our participants' preferences, inspired me to propose the concept of Alternative Research Outcomes (AROs). After publishing a paper on the design and development of the audio documentary at ACM DIS 2022 (Chapter 4), I hosted a workshop at ACM DIS 2023 [506], gathering people who share the same enthusiasm and interest in translating research outcomes into different formats. Along with a few attendees who were interested in collaborating and in further commitment, we continued the discussion for 12 months, exploring the following research question:

RQ5: How can HCI research outcomes be created in alternative forms that go beyond traditional textual dissemination by offering creative, diverse endpoints that communicate research insights to broader audiences, and what are the key qualities that define their value and significance in the research process?

This inquiry stems from a growing recognition within the HCI community that traditional peer-reviewed papers often keep rich and valuable insights behind the paywall and institutional barriers, making them much less accessible to the related and involved communities outside of academia. Developing alternative outcomes is not merely about translating text, but more about recognizing that different forms and disseminating unique dimensions of research process, reflection, dialogue, and critique. To investigate how these forms might operate in practice, we collected six ARO case studies and shared the experience of making and sharing them through a series of online and in-person sessions to discuss, reflect on, and iterate on emerging themes and critical inquiries into the key characteristics and values of AROs. Collectively, we proposed four emerging qualities of AROs—Translational, Situational, Transparent and

Initiatory—that uniquely distinguish AROs from science or research communications and academic publications. We discussed the alternative values that AROs aim to pursue, which may be unaligned with the traditional knowledge-creation process in academia. We also posed open questions that had yet to be answered and needed to be explored to initiate continued discussions with the broader HCI community regarding alternative ways of sharing research outcomes. Next, I unpack the detailed case studies and the analysis of our collaborative discussions about AROs[8].

7.2. Introduction

Text has been central to academic knowledge production and dissemination, facilitating dialogue and critique within scholarly communities [167, 389]. While textual forms offer structure and the ability to convey complex arguments [201], they often reveal inherent limitations on accessibility and inclusivity due to dense academic language and subscription-based access models. Despite funding agencies encouraging the reframing of scholarly work at a basic reading level without using jargon or field-specific language [120, 520], text frequently fails to capture the multifaceted nature of knowledge, such as experiential, embodied, or context-dependent knowledge [357, 439]. The lack of sensory or cultural nuance in text often alienates non-academic audiences [66, 362, 519], diminishing the lived realities of research participants and the rich materiality of tactile, visual, material, and auditory dimensions in the design processes [97, 277]. These limitations call for a broader spectrum of dissemination methods that can address diverse audience needs and complement the epistemological strengths of textual forms.

Recent efforts in the international academic communities have challenged traditional textual dissemination by embracing diverse knowledge-sharing methods to better translate research outcomes. From New Zealand (e.g. [388, 425]) to Canada (e.g. [283, 284]) to Scandinavia (e.g. [130, 191, 438]), these initiatives foster collaboration

[8] This chapter is adapted from a publication in ACM CHI'25 conference: MinYoung Yoo, Sophia Ppali, William Odom, Yumeng Zhuang, Kritika Kritika, Wyatt Olson, Catherine Wieczorek, Heidi Biggs, Arne Berger, Audrey Desjardins, Ron Wakkary, Kathryn E. Ringland. "Translating HCI Research to Broader Audiences: Motivation, Inspiration, and Critical Factors on Alternative Research Outcomes." In Proceedings of the 2025 CHI Conference on Human Factors in Computing Systems, pp. 1-24. 2025.

between academic institutions, community organizations and industry partners to explore new ways of sharing knowledge for audiences outside academic boundaries. Notably, scholars in Participatory Action Research (PAR) [27], Participatory Design [419], Co-Design [402, 403], Community-Based Participatory Design (CBPD) (e.g., [450]) and Community-Based Participatory Research (CBPR) (e.g., [86]) emphasize close participant engagement to co-create research-based solutions and insights. These approaches also prioritize sharing research findings with broader audiences for them to benefit from research.

Following this initiative, design researchers in the HCI community are exploring creative platforms, such as digital and social media, interactive websites and public exhibitions, to share research findings. This shift towards ***Alternative Research Outcomes*** **(AROs)** reflects rising interest in more engaging, diverse and inclusive dissemination methods in the field of HCI [434, 506]. AROs include forms such as audio/video documentaries, non-academic writings, multimedia artifacts, public exhibitions, zines, design fiction films and podcasts dedicated to translating and sharing research for their audiences. AROs offer a unique avenue to convey research insights that may extend the original research goals, fostering deeper engagement within and, importantly, beyond the academic community. However, documentation, discussion, and reflection on AROs remain limited to date.

The goal of this paper is to introduce the concept of AROs so that the HCI community can further take up, discuss and refine this initiative. We examine six case studies of AROs: **Audio Documentary** (*Beyond Looking Back* [507, 508]), **DIY Tutorial** (*Table-Non-Table* [208]), **Documentary Shorts** (*Inner Ear* [113, 349]), **Digital Media Content** (*Social Platform for Playful Community* [264, 392]), **Art Installation** (*Meaningful Spaces, Meaningful Places* [87, 88, 377]), and **Zines** (*Midwestern Current*). We selected these cases because they allowed us to gain first-hand insights into the design, creation, and dissemination of AROs. Despite their diverse approaches, each of the cases communicates HCI research outcomes to broader audiences through creative forms that extend beyond traditional written publications. We aim to be generative rather than conclusive in introducing a small yet diverse set of six ARO case studies. Based on our analysis, we define an ARO as **a uniquely situated, dedicated research activity or artifact that emerges as a new endpoint in the research timeline, aiming to**

translate, communicate, or disseminate research insights in an accessible and engaging form tailored to the intended audience.

This paper reports how we arrived at this definition by investigating and analyzing six ARO case studies to inquire into the following research questions: What are the key qualities that define an ARO? What is the importance of working on AROs? What is 'success' for an ARO? How could AROs emerge in the research process? The paper makes three contributions. First, we introduce six cases of AROs by unpacking their motivations, presentations, and distribution methods. Second, we articulate four emerging qualities of AROs—*translational*, *situational*, *transparent,* and *initiatory*—by analyzing our first-hand accounts of six ARO case studies. Third, we discuss how AROs could emerge in the research timeline and pose questions on critical inquiries and future engagement of AROs in the HCI community.

7.3. Background

7.3.1. Knowledge-Sharing in Academia

Knowledge, at its core, is an epistemic construct that emerges from a social and cognitive process of human observation, experimentation, and collective understanding [217]. Knowledge is generated through both formal and informal processes, ranging from empirical research and theoretical reflection to lived experiences and communal practices [136]. Dissemination, the process of sharing knowledge, has historically been intertwined with textual forms due to their capacity to preserve, standardize, and communicate ideas across time and space. The text serves as a foundational medium, offering structure, permanence, and the ability to convey complex arguments [201]. From the earliest written records to contemporary academic publishing, the text has been central to knowledge production and dissemination, facilitating dialogue and critique within scholarly communities [167, 389]. However, this reliance on text reveals inherent limitations, particularly in its accessibility and inclusivity.

Academic communities value nurturing a welcoming and rewarding culture of sharing knowledge [413], recognizing it as a cornerstone of collaboration, innovation, and scholarly advancement. Traditional academic knowledge-sharing channels—conferences, seminars, workshops, and publications like journals, books, and research

papers—facilitate cross-disciplinary dialogue and exploration of complex problems and new frontiers of knowledge. While knowledge sharing among scholars has always been a priority, there is a growing emphasis on extending this practice to the general public, acknowledging that publicly funded research carries a responsibility to not only contribute to societal progress but also disseminate findings to the public, who has a right to access this knowledge (e.g. [358]). However, high subscription fees and for-profit models of academic publishers often force scholars to pay to make their work publicly accessible [142]. This means the public ends up paying twice for tax-funded, closed-access academic research publications.

Researchers are expanding their reach beyond academia by exploring more accessible forms, including TED talks [278, 492], social media, podcasts [316, 518], YouTube [265, 458, 517], blogs [41, 202], scientific illustrations and animations [75, 186, 233], science slams, and science fairs. These efforts, known as "science communication," aim to make scientific information and scholarly activities accessible to the public [108, 147], enhancing scientific awareness, understanding, and literacy [68]. However, such top-down approaches often overlook cultural, political, and geographical nuances inherent to research and limit engagement with those deeply connected to or affected by research. Recognizing these limitations, public and government funding councils (e.g., European Commission [355], Government of Canada [354], and Federal Ministry of Education and Research in Germany [356]) increasingly require and support open access initiatives [436], making scholarly articles freely available, granting the public the right to read, download, copy, distribute, print, search, or link to the full texts of these articles, theses, books, or other academic materials [444]. Open Access democratizes knowledge [221], promotes broader dissemination, and fosters collaboration and innovation by removing academic barriers, such as institutional paywalls and subscription fees, and granting the public equal access to scholarly information [272, 293].

Echoing the values of accessibility and removing barriers to knowledge, feminist critical theory underscores the need to democratize research and reach broader audiences [359]. Maintaining a critical stance [4], feminist scholars question "who our [scholarly] work is for." Feminist scholars criticize how academic success often perpetuates "overtly discriminatory paywall" and "gatekeeping that excludes community

participation" [6:12]. Instead, they emphasize reciprocal and intersectional knowledge-sharing that prioritizes mutual respect and includes the voices and values of those who are historically marginalized or silenced [149, 376, 498]. Advocating for feminist epistemologies, they embrace pluralistic perspectives, recognizing that knowledge is always situated [203] and shaped by social, cultural, and political contexts [204, 249, 418]. The concept of situated knowledge challenges the notion of objective, universal knowledge and its inherent power dynamics [190]. This emphasis on inclusivity and diverse perspectives resonates across disciplines, including psychology (e.g. [317, 445]), education (e.g. [39]), and anthropology (e.g. [253]), all of which are moving toward a more nuanced understanding of individuals and groups, breaking the rigid subject-object relationships. In HCI, the emergence of AROs reflects this shift, offering a pathway to challenge traditional power structures in knowledge production and dissemination through inclusive, reciprocal, and accessible ways of sharing research insights.

7.3.2. Making Diverse Endpoints of HCI Research

HCI and design researchers employ various methods to share research insights within and beyond academia. They excel in producing creative outputs, drawing on diverse materials for research activities [323, 369, 408], inspired by portfolio culture in design school [92] and the cross-pollination of artistic techniques in design and art [480]. HCI and design communities increasingly embrace alternative ways of presenting research outcomes, such as interactable objects, long-lived artifacts, annotated portfolios, visual-oriented publications, live demos and handcrafted brochures (e.g., [44, 209, 241, 286, 369]). In Research through Design (RtD) [512, 515] and constructive design research [262], the focus has shifted to creating research artifacts and documenting the process as a form of research inquiry (e.g., [55, 56, 333, 334]). This approach prioritizes exploring the influence of research prototypes and artifacts on participants' lived experiences and perceptions [342]. Annotated portfolios visually present the "fruits of design," [170] including insights, contexts and reflections on a research journey [239]. They aim to elucidate how artifacts can generate new knowledge, illuminating the "temporal and relational aspects" of the design space [102, 286].

In response to this trend, the HCI and design research community has pursued new avenues to accommodate diverse research outcomes. The *Pictorial* track, first introduced at the DIS conference[9] in 2014 and adopted by other HCI conferences like TEI[10], encourages visual-oriented publications to convey the visual essence of research [44]. *Demo* tracks at CHI[11] and CSCW[12] showcase the functionalities and capabilities of research prototypes in live settings, exhibiting a wide spectrum of visual, tangible and interactable prototypes. Other tracks, such as *Artworks*[13] at DIS 2023, *Video Showcase*[14] at CHI 2023, *Studio*[15], *Art and Performance*[16] at TEI, and *Critique*[17] at NordiCHI highlight avenues for diverse formats. Pierce emphasizes interactive presentations and curated exhibits are integral to the design research process, benefiting the research community and "possibly to study participants, specific user groups or the public more generally" [25:736].

The growing trend of sharing the details of research process has driven HCI researchers to explore creative ways to involve non-academic audiences. Gaver et al. experimented with high-volume batch production to distribute prototypes to 20-100 participants, gathering a large volume of qualitative data [55, 180]. In another project, they collaborated with a broadcasting team to feature their research on a TV show, reaching over 2 million viewers [176]. Inspired by these efforts to spread research to broader audiences, Pierce batch-produced a counterfunctional camera—a device that must be broken open to access the captured media—and distributed them via free giveaway ads on Craigslist, community bulletin boards, and by quietly leaving the packaged prototypes at local retail shops ("*droplifting*") [372]. Utilizing digital media, Altarriba Bertran et al. documented speculative design ideas in a *catalogue* framed as an annotated portfolio, then shared online for feedback and iteration [7–9]. Bertran also

[9] https://dis.acm.org/2024/pictorials

[10] https://tei.acm.org/2020/participate/pictorials

[11] https://chi2024.acm.org/for-authors/interactivity

[12] https://cscw.acm.org/2024/index.php/submit-demos

[13] https://dis.acm.org/2023/call-for-artworks

[14] https://chi2024.acm.org/for-authors/video-showcase

[15] https://tei.acm.org/2024/index.php/call-for-studios

[16] https://tei.acm.org/2024/index.php/art-and-performance

[17] https://www.nordichi2024.se/critiques

used a public Instagram account as an autoethnography tool to document and share the research process and speculative ideas [488].

HCI research is shared not only with the general public but also with specific communities. Winschiers-Theophilus et al. paid attention to how their indigenous research partners in the global south were often systematically excluded from academic platforms like publications and conferences. To address this, they hosted an "*Indigenous Knowledge Fair*" to promote pluralistic and inclusive knowledge dissemination within these communities [493]. *Zine*—a self-published booklet that often covers niche topics [209]— can invite a much larger audience in the community. Fox et al. packaged research findings into zines after conducting a multi-sited ethnography for feminist hackerspaces [152]. Inspired by a local art festival featuring zines rooted in the "dissatisfaction with existing models of knowledge transmission," they collaborated with feminist hackerspace artists to produce handmade zines and present them at a feminist zine festival, which later gained attention on social media [150, 151]. Similarly, the maker culture inspired *DIY tool kits* for research prototypes (e.g., [176, 302]), providing detailed instructions to re-create research prototypes [115, 174].

As HCI and design research continue to evolve, diverse research outcomes contribute to richer, more impactful research. These creative approaches also communicate knowledge on materiality and functionality inherited in specific forms apposite to the intended audience, challenging conventional notions of scholarly communication and knowledge dissemination. We aim to gain deeper insights into the motivations and considerations behind these efforts, their impacts on the research process, and their roles within the HCI community.

7.4. Motivation & Approach

The authors of this paper are a diverse group of design researchers, ranging from master's students to full-time professors, from a variety of cultural, geographic, and racial perspectives. We share an interest in recognizing the importance of creating alternative outcomes in HCI research, and this shared interest brings us together. In our design practice and through engaging in a series of conversations with HCI researchers at conferences, we have witnessed a growing interest in creative approaches to share research, including audio/video documentaries, non-academic writings, multimedia

artifacts, public exhibitions, zines, design fiction films and podcasts. However, there is a lack of documentation and in-depth discussion about the significance of creative endpoints in HCI research and their impact on broader audiences, particularly non-academic audiences. Thus, we aimed to initiate the discussion by gathering diverse AROs, not by their noticeable difference in forms and materiality, but by understanding motivations, situated contexts and first-hand experiences of engaging with audiences in and beyond research timelines, which are often untold in academic publications. It is important to acknowledge that we are not the only researchers who have practiced this approach to research dissemination. There are prior research examples have existed for some time, and new examples continue to emerge (e.g., *HEartS Professional Project*[18], *Tingbao*[19] [378], *Capra Short Film* [331], *Improbotics*[20], and *Permission to Muck About*[21]).

This paper directly builds on the DIS 2023 workshop on alternative research outcomes [506]. The workshop developed the nascent concept of ARO by bringing together HCI and design researchers who are working on exploring and implementing creative and innovative approaches to research dissemination. In addition to collaborating with some workshop attendees who were interested in continuing the discussion (Yoo, Ppali, Odom, Zhuang, Kritika, Olson, Berger, Ringland), we employed a targeted sampling approach [477] to identify and engage designers and researchers with direct experience in creating and sharing AROs (Wieczorek, Biggs, Desjardins, Odom, Wakkary). We contacted these creators of earlier ARO exemplars, inviting them to contribute their expertise. This approach ensured our data and analysis were grounded in first-hand experiences and critical reflections on working with AROs. We selected AROs for case studies based on the following criteria: (i) Do the creators of an ARO desire to be part of this paper? (ii) Are the creators able to provide their first-hand insights and reflections? (iii) Does an ARO have a dedicated goal in delivering specific research insights? (iv) Does an ARO have an intended audience? Through this iterative process, ultimately, three AROs were selected among the 11 projects presented at the

[18] https://www.arts.ac.uk/knowledge-exchange/stories/hearts-professional-project-vr-technology-performing-arts

[19] https://2024wip.cyens.org.cy/exhibition/symbiocene-anthropocene/tingbao

[20] https://improbotics.org

[21] https://designresearch.works/permission-to-muck-about

DIS 2023 workshop and three AROs from earlier exemplars in the HCI community. Each case represents a distinct context, demonstrating a diverse range of perspectives informed by their creation. Importantly, the six ARO case studies represent only a small set of emerging approaches to creating alternative forms of research outcomes within the HCI community.

Our goal is to present a collective voice across six case studies. All authors of this paper continued our discussions over twelve months, beginning by asking the creators to provide a brief description of their AROs. Then, the first author hosted individual in-depth Zoom interviews with the creators of each ARO to explore questions that extended our selection criteria. These questions encompassed their motivations, the ARO's base research, intended audience, rationale for choosing specific forms, key takeaways, and possible friction and limitations of working with AROs. Based on the information gathered from the creators, including their first-hand experiences and personal narratives shared during interviews, the first author revised and finalized the case study descriptions for each ARO, which are presented in the following section. Further, the authors of this paper engaged in a series of synchronous and asynchronous discussions, including recurring group discussions on Zoom and small group meet-ups for those who are geographically close. Methodologically, we draw on critical self-reflection (e.g., [228]), collective brainstorming (e.g. [63]), and design-led comparisons of research artifacts (e.g. [338]) involving an iterative process of examining case examples to identify and define emerging qualities of ARO. Emerging themes, values, and nuances were iteratively developed and polished from the creators' own experiences and reflections working with AROs, recognizing and respecting the crucial role of their positionality and nuanced insights in each case. Throughout this process, we maintained close communication, engaged in multiple rounds of edits and exchanged continuous feedback via written responses over emails, iteratively refining our collective understanding of AROs to ensure a shared voice in the analysis.

7.5. ARO Case Studies

In this section, we introduce and describe the six cases of AROs drawing from design research in HCI: **Audio Documentary** of *Beyond Looking Back* [507, 508], **DIY Tutorial** of *Table-Non-Table* [208, 339], **Documentary Shorts** of *Inner Ear* [113, 349],

Digital Media Content of *Social Platform for Playful Community* [264, 392], **Art Installation** of *Meaningful Spaces, Meaningful Places* [87, 88, 377], and **Zines** of *Midwestern Current*.

Table 7.1. A summary of six ARO case studies.

Form	Base Research	Intended Audience	Summary of ARO
Audio Documentary	*Beyond Looking Back*: Designing reminiscence experience with people with blindness.	Research participants and their loved ones.	An hour-long audio documentary sharing research findings featuring the participants' own voices to give back the research outcomes to the participants.
DIY Tutorial	*Table-non-table*: Exploring reflections on living with an interactive everyday object over time.	Makers and crafters in local and online communities.	Documenting and sharing step-by-step instructions for creating the research prototype with the local/online maker community.
Documentary Shorts	*Inner Ear*: Physicalizing vibration data captured in homes to understand people's perceptions of personal data.	Research participants and their close network of family and friends.	12 documentary shorts (2-4 minutes each) unpacking participants' experiences of collecting data and living with the Inner Ear device.
Digital Media Content	*Social Platforms for Playful Communities*: Ethnographic research exploring 'play' in an online fandom community.	ARMY community (BTS fandom).	Digital media content (e.g., TikTok, YouTube, podcasts) for sharing research findings and insights with the community.
Art Installation	*Meaningful Spaces, Meaningful Places*: Exploring emotional engagement in people with dementia by art-creation and co-created VR experiences.	Conference attendees and pop-up visitors from the public.	An art exhibition presented at an academic conference, showcasing participants' creative journeys through artworks and challenging societal preconceptions on dementia.

Form	Base Research	Intended Audience	Summary of ARO
Zines	*Echoes from the Deep:* Speculating on lost and forgotten indigenous shipwrecks in the American Midwest. *Wet Lands*: An autoethnographic bike tour exploring human/non-human entanglements in the river.	Local artists, activists, and residents who visited the zine library.	Sharing visual reflections of a larger design agenda investigating the entanglements of American Midwestern water, infrastructure, and agriculture.

7.5.1. Audio Documentary: Translating a Publication into Audio for Blind Participants [Beyond Looking Back]

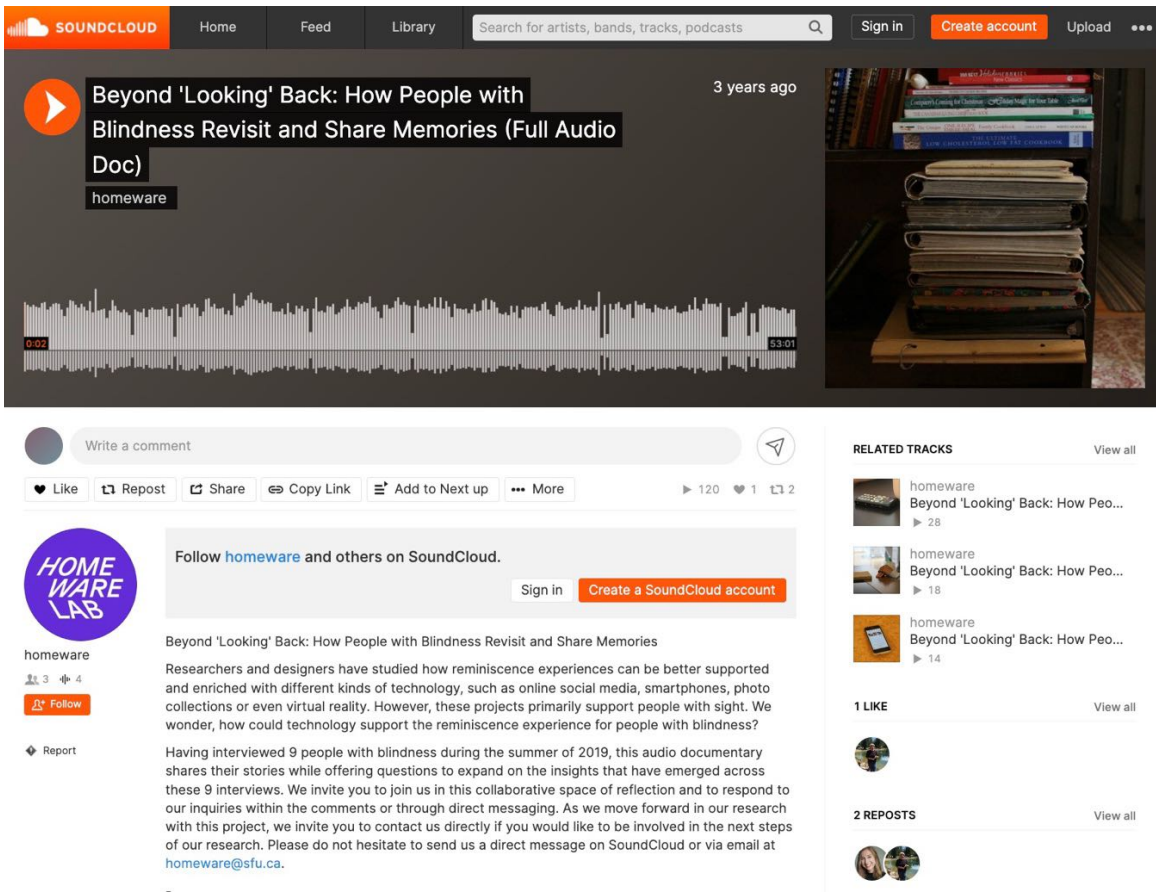

Figure 7.1. Beyond Looking Back *Audio Documentary* on SoundCloud.

Beyond Looking Back explores how people with blindness capture, revisit and share their meaningful life moments through home-visit interviews with nine blind

participants. Although the study findings were published, COVID restrictions in 2021 limited the hosting of a follow-up session for group debriefing. Yet, participants desired to know how other participants responded to the interview questions—to learn about other blind people's reminiscence experiences. This strongly motivated the research team to make an alternative version of the research findings in a suitable form for the blind participants. Therefore, an hour-long ***Audio Documentary*** *(Yoo, Odom, Berger)*, translating a published paper [508], was created as an ARO.

Early in the process, the research team recognized the importance of contemplating their positionality (prompted in part by the fact that all team members were sighted), being responsible for sharing research outcomes to appreciate and commemorate participants' contributions, and foregrounding their voices as the core component in **Audio Documentary**. The research team adopted a critical listening positionality from sound studies [393] in their listening stance (e.g., conducting interviews and listening to participants' lived experiences) to be sensitive in listening and framing the listening body and the stories being told. Further, the unique locational positionality of the research, conducted on the unceded territories and ancestral lands of indigenous peoples in Western Canada, inspired the adoption of a decolonial lens, challenging established colonial thoughts, ideologies, structures, and power dynamics [123]. This lens informed the framing and composition of **Audio Documentary** [507]. The concepts of *storywork* and *storyworlds,* where the stories and sonic worlds bound in participants' voices exist in reciprocal and interrelated ways [13], provided a firm theoretical foundation.

The intended audience for **Audio Documentary** was indeed the participants who directly contributed to the research, but it was later extended to include partners, family members, and others in their social circles. Although not directly involved, they were invited to the research as significant others, spouses or grandchildren, who took part as drivers, daily assistants, or companions. They were often present during the research activities, observing and sometimes joining the conversation—their engagement and feedback further motivated participants, encouraging ongoing discussions to foster deeper involvement in the research. Although the published paper in PDF form met accessibility standards, participants found it challenging to navigate academic jargon using screen readers. Sound was identified as the most preferred form for the

participants during the interviews. Grounded in this insight, the team prioritized their preferred sensory modality to create an hour-long audio documentary, narrated in plain language and featuring participant voices from the interviews. This allowed participants to connect with each other's stories. With the participants' consent, the documentary was shared on SoundCloud[22], enabling participants to keep an easily shareable digital copy.

[22] https://soundcloud.com/homewarelab/beyond-looking-back-full-audio-doc

7.5.2. DIY Tutorial: Long-term Engagement with the Maker Community [Table-Non-Table]

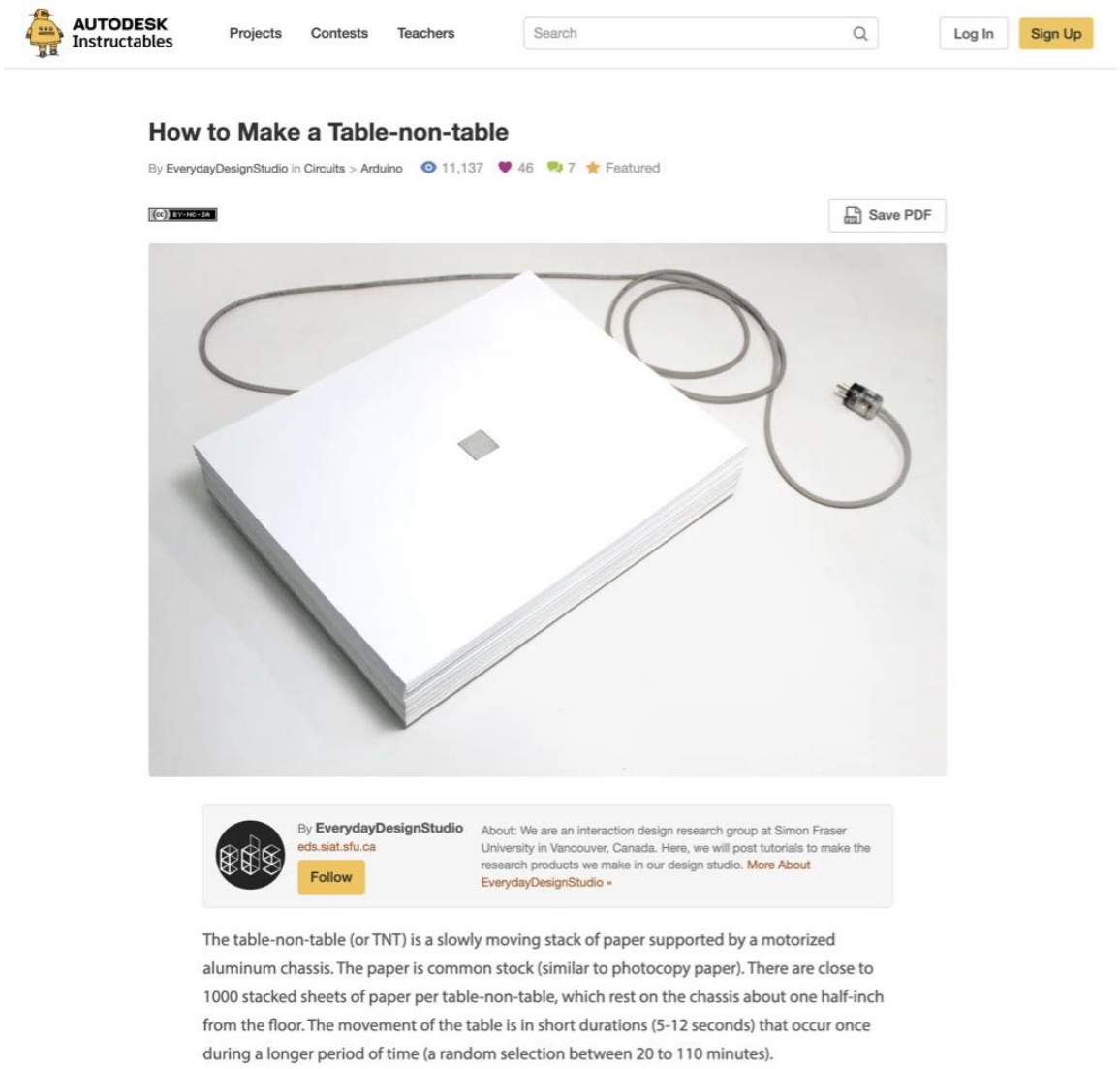

Figure 7.2. "How to Make a Table-non-table" *DIY Tutorial* on Instructables.

Table-non-table features a slowly moving stack of paper supported by a motorized aluminum chassis [208, 339]. Grounded in ideas and research informed by the notion of everyday design [474], the project explores a different way of connecting everyday materials combined with computational behaviours, manifesting the idea that "everyone is a designer" [208]. In essence, *Table-non-table* asks, "How can people unintentionally use the object?" [339, 472]. A ***DIY Tutorial*** *(Wakkary, Odom, Desjardins)* was created as an ARO and shared on a popular DIY website—Instructables—as an

experimental approach to document and communicate the details of the design process[23].

The team was positioned as researchers but also designers in practice and makers at heart. The team was deeply engaged with local makers and DIY culture for prior projects (e.g., [106, 114]) in Western Canada. **DIY Tutorial** was an opportunity to share the insights gained throughout the research process with the maker community on Instructables. Translating the research into DIY instructions was further motivated by first-hand observations of disparities in maker spaces. Power dynamics often persisted despite many maker spaces claiming to provide an open, inclusive space for people passionate about making. The research team raised the critical question through the tutorial: Who are the makers?

The DIY tutorial served as both a contribution to the community and as a new way to document and archive the design research process as supplementary material to written publications. Research prototypes and artifacts ("*things"* [335]) were often shared on platforms not designed for academic projects (e.g., [372]). The team recognized Instructables as an ideal platform, providing recipe-like, step-by-step instructions that could organize CAD files and relevant code blocks in one post. This approach was more cost-effective than creating a dedicated project website or personal portfolio and allowed the project to reach a large, established maker community. Each tutorial step reflected the team's learning process in communicating the intricacies of the RtD project to makers.

DIY Tutorial was dedicated to the makers, crafters and their local/online communities, who inspired the research team and offered technical knowledge for creating research prototypes. It contributes to the collective knowledge on Instructables. Even being featured on the main homepage, **DIY Tutorial** momentarily drew significant attention. While the reactions were mixed, it remains a valuable resource for makers to learn specific skills, such as programming electronics or cutting a precise square hole in the center of a paper. To date, **DIY Tutorial** on Instructables has been viewed nearly 11,000 times, liked 45 times, and received 7 comments.

[23] https://www.instructables.com/How-to-Make-a-Table-non-table



Figure 7.3. Behind-the-scenes of *DIY Tutorial*.

7.5.3. Documentary Shorts: Leaving Records of Participant Contribution [Inner Ear]



Figure 7.4. ***Documentary Shorts*** **of six households are featured on Studio Tilt's website.**

The *Inner Ear* is a porcelain device that records vibration data to explore people's relationship with data in their homes [113]. After a week, the research team collected the device and "physicalized" selected recordings into two 3D-printed ceramic rings attached to the original device. The physicalized form was grounded in participant data, carefully positioned and contextualized within their living environment. Six households in Seattle, USA, participated. The research team filmed three home-visit interviews and produced two short videos per household, creating 12 ***Documentary Shorts*** *(Olson, Desjardins)*

as AROs[24], which reflect the trend of consuming short videos [285] that can live outside of an academic library/publication.

Documentary Shorts not only collect data but also capture and share participants' lived experiences with the *Inner Ear*. The shorts were primarily made from b-roll footage of participants' space (where the *Inner Ear* was placed) layered with interview audio. Two shorts were created for each household: one documenting the experience of capturing vibration data and another filming the first reactions to seeing their physicalized data and lived experiences with the *Inner Ear*. Video provided an accessible way to present participant experiences using dynamic visuals, intimate dialogue, and genuine interactions.



Figure 7.5. *Documentary Shorts* are produced with videos and recordings captured during the home visits and interviews.

Olson's occupational positionality as a documentary filmmaker and the team's geological positionality in the Seattle area greatly shaped their approach. Participants were already aware of extractive data approaches by big tech companies, such as Amazon, Google, and Meta. Therefore, filming during the interview raised ethical concerns about capturing personal details in domestic environments (e.g., [194, 257]). The team prioritized transparency and ongoing consent throughout the filming process and foregrounded the research process by explaining the nature of the collaboration and translating the research details ahead of time [349]. Ethical considerations resurfaced during editing, as the team was acutely aware that their subjective choices, like editing participant dialogue, could impact how participants were presented. The team remained mindful of how participants' words were framed and stayed in contact throughout editing to ensure a mutually beneficial process that valued their voices.

[24] https://www.studiotilt.design/inner-ear/visit

Initially, the videos were intended as supplementary material in research publications to provide details of the *Inner Ear* project for HCI and design research communities. As the project progressed, the question arose: “Who would be more involved and interested in this project?” Thus, the intended audience shifted from academics to participants and people around them. The team aimed to dive deeply into participants’ personal experiences and reflections, created **Documentary Shorts** and shared them with participants. Delivering not only research insights but also participants’ narratives allowed **Documentary Shorts** to spread beyond academic circles, such as participants’ personal networks. After the study was concluded, participants were invited to a post-project gathering, allowing them to interact with the research team and other participants, asking questions about and beyond the research and sharing their experiences with others. This event further fostered transparency in the project's decision-making process.



Figure 7.6. “Inner Ear Party” hosted by the research team who created *Documentary Shorts*. The party featured a casual Q&A session and showcased participants’ Inner Ear devices.

7.5.4. Digital Media Content: Research Outcomes Dedicated to the ARMY Community [Social Platforms for Playful Communities]

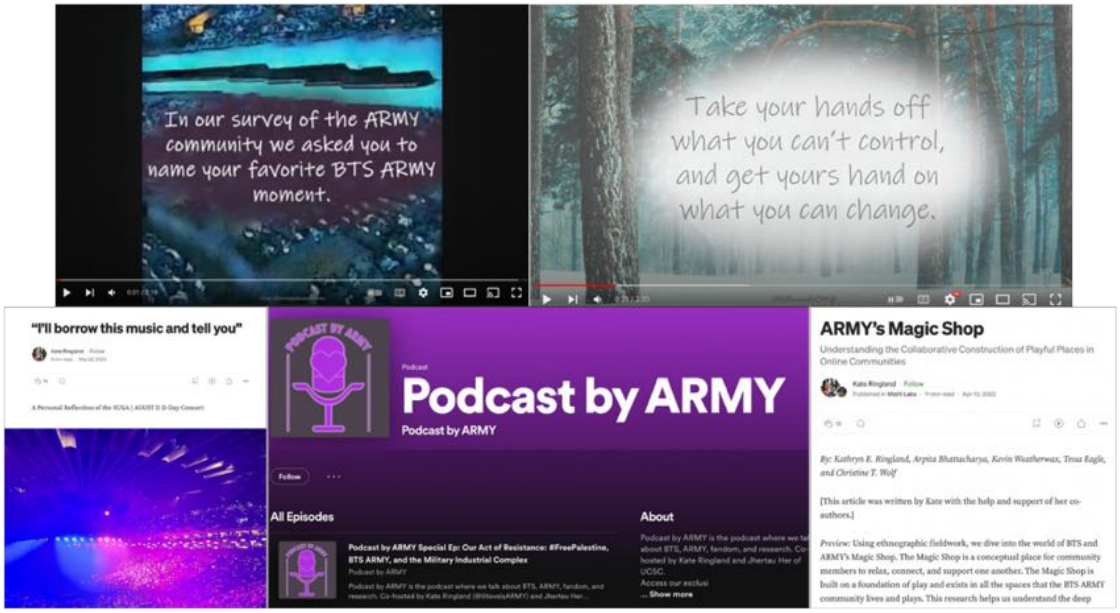

Figure 7.7. A collection of *Digital Media Content*, ranging from YouTube videos to blog posts and Spotify podcasts.

Social Platforms for Playful Communities [264] emerged from ongoing engagement with ARMY, the fandom of BTS (Bangtan Boys, a South Korean boy band), whose members are mostly women and culturally, racially and geographically diverse. Despite its playful nature central to the community's growth [392], the ARMY often faces backlash and discrimination on social media, such as shadow-banning[25] and suspending ARMY accounts on X (formerly Twitter). This research project aimed to support discussion about an alternate online community for ARMY to foster safe, meaningful connections both with BTS and within the community. The research team pushed beyond its academic publication [264] and created ***Digital Media Content*** *(Kritika,*

[25] The practice of a social media platform restricting a user's account without notifying them.

Ringland), including Twitter threads, TikTok and YouTube videos[26][27], blog posts[28][29], and a community-oriented podcast[30], as AROs for the community.

The team adopted a value-sensitive approach [159], using surveys with open-ended questions to elicit the core values of the ARMY community—*Respect*, *Love*, and *Community*—and how these values are embodied and expressed in online interactions. With these insights, the team posed provocative questions on how alternative social platforms could be designed to reflect the core values. The composition of the research team, with half the members identifying as both researchers and ARMY members, enabled them to be more sensitive in the research process, conducting the research with care [125, 127, 274] and adhering to best practices for engaging the online community [126]. The team stayed reflexive throughout the research process, being mindful of their 'dual role' as researchers and community members. The manuscript, written in plain language with minimal academic jargon, was shared with the community before submission to the academic venue. Discussions with community members ensured sensitive information, terminology, and events were handled carefully.

Digital Media Content communicated a variety of research findings, not only making the research more accessible and relevant to the ARMY but also amplifying the community's voice while protecting members from potential harm or unwanted attention. These media outlets explain ongoing research activities and published articles, serving as a research communication hub and fostering engagement with the community members. On top of the research insights, **Digital Media Content** describes research practices, such as giving informed consent and protecting private data. This endeavor has characterized researchers as thoughtful and reliable mediators and translators in the community, explaining not just their own work but also other researchers' work done on the community. Community members have responded positively, leading to increased

[26] https://www.youtube.com/watch?v=nSEfFrJ5LSs

[27] https://www.youtube.com/watch?v=f6_X23U-RI4

[28] https://kateringland.medium.com/ill-borrow-this-music-and-tell-you-7ebfc6ad87d3

[29] https://medium.com/misfitlabs/armys-magic-shop-668cb8a3c0c0

[30] https://podcasters.spotify.com/pod/show/podcastbyarmy

involvement in the research process by suggesting new research ideas and actively participating in interviews and surveys.

A greater understanding of research practices has led to exploring new uses of research outcomes, such as recommendations on community policy. By reporting research findings back to the community in understandable, digestible ways, the community gains insight and opportunities to celebrate their collective achievements. AROs played a critical role in bridging the gap between research findings and the ARMY community, strengthening the researcher-community relationship and fostering continuous engagement and collaboration with the community.

7.5.5. Art Installation: Art as a Medium for Communicating Participant Contributions and Audiences [Meaningful Spaces, Meaningful Places]



Figure 7.8. ***Art Installation*** **was displayed at an academic conference (DIS 2023), inviting attendees and accompanying guests.**

Meaningful Spaces, Meaningful Places is a research project in collaboration with a specialist arts organization, Brightshadow[31], that co-creates Virtual Reality (VR) experiences with people living with dementia [87, 88, 377]. 44 participants with dementia were divided into 4 groups, and they collaborated with artists over 5 weeks of art workshops (20 workshops in total), crafting 4 physical boxes, one box for each group. The box collaboratively represents group members' personally meaningful places, accompanied by soundscapes inspired by the scenes in their memories. These boxes were then transformed into VR environments to offer immersive experiences for participants with dementia, leveraging VR's ability to transport users to new worlds [424] and how this impacted their emotional engagement [421]. Collaborative art-making became a transformative journey, reconnecting participants with memories and allowing them to express their identities. An ***art installation*** *(Ppali)* featuring the four boxes was presented as AROs at an academic conference (DIS'24). The installation featured a video with soundscapes showing the process of creating the boxes and walkthroughs of the VR environments. Visitors received postcards with photographs and QR codes to experience each box's VR setting through 360-degree YouTube videos.

Art Installation presented the most immediate and intimate way to display the beautiful art of the participants, honoring the authenticity of their work and sharing their creative journey. As host of **Art Installation**, Ppali, representing the research team, acted as both *ambassador,* facilitating the discussion between the participants' artworks and their personal stories, and *activist,* challenging societal preconceptions that focus on the inabilities and limitations of those living with dementia rather than their abilities and to celebrate the creativity of people living with dementia. **Art Installation** endeavored to present the art in a way that honored their participants' perspectives and experiences, consciously reminding the team to be aware of how their interpretation and presentation could influence the audience's perception.

[31] https://brightshadow.org.uk



Figure 7.9. Four boxes created by participants are displayed as *Art Installation*, accompanied by QR codes and postcards.

Academics at the conference were the primary audience of **Art Installation**. Instead of engaging with the research through a traditional academic paper, they engaged with the work in an embedded manner, offering them an alternative way to understand the research. **Art Installation** demonstrated the universal resonance of art as a medium for communicating research insights. It created a space where visitors could step into the shoes of the artists—the research participants—experiencing their perspectives not only intellectually but also sensorially and emotionally. This experience provided a deeper understanding of the strength, determination, and creative spirit that fuelled the co-creation process. Presenting collaborative artworks at an open public forum through a tangible format was an impactful way to communicate the creative abilities of the participants and their emotional experiences to the intended audience of the academic community and the wider public. The postcards were used as an artefact that the audience could take home, providing a tangible way to reflect on the experience and share it with others, further extending the reach and impact of **Art Installation**.

7.5.6. Zines: Exploring Midwestern Water, Land and Histories through Self-made Magazines [Midwestern Currents]



Figure 7.10. A front page and inside of "Echoes from the Deep".

Zines are self-published, often handmade magazines that artists, designers, and activists have long used to share their work, connect with others and disseminate hyper-local knowledge, often photocopied without professional editing or wide distribution [99, 254]. *Echoes from the Deep: Legends of the Great Lakes*[32] and *Wetlands* are created as AROs in ***Zines*** *(Wieczorek, Biggs)* that provide a visual and impressionistic reflection on a larger design research agenda exploring the entanglements of American Midwestern water, infrastructure, and environmental sustainability through design and computational thinking. Together, **Zines** aim to share a glimpse of the project with a largely academic audience in a visually impressionistic, non-linear, and non-argumentative way.

Echoes from the Deep emerged from research on conservation challenges in the Great Lakes Region. Inspired by how shipwrecks hint at a unique view of maritime history and culture, *Echoes from the Deep* focuses on lost and forgotten indigenous shipwrecks not shown in the Michigan Department of Natural Resources' shipwreck database [304], featuring AI-generated images of indigenous ships that could have existed in the region. *Wetlands* describes an autoethnographic bike tour down a large

[32] https://www.cathwieczorek.com/shipwrecks

river, exploring human/non-human relationships and sharing impressionistic and visual reflections. It presents photos depicting cultural and environmental intersections of more-than-human entanglements, such as a gas station BBQ, a bathtub filled with brown water from aquifers in cypress preserves and the river scene with the bike.

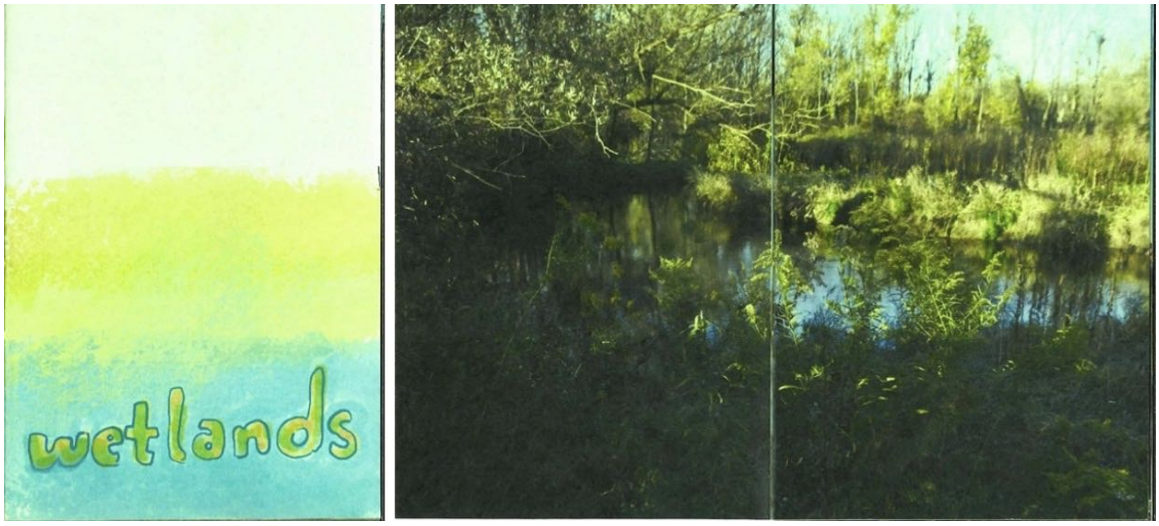

Figure 7.11. A front page and inside of "*Wetlands*".

The research team has a mixed positionality of being in the lands of the American Midwest and being a designer-researcher. Since 2020, Wieczorek, who is a Midwest native, has moved further *away* from the Great Lakes Region. Meanwhile, Biggs moved *to* the Midwest from the West Coast, where mountains and oceans are largely different from the flat and seemingly water-less Midwest. **Zines** were rooted in a desire to reconnect with the region from afar and discover its abundant waterways and historic wetlands. **Zines** inspired their new perspective, allowing the team to process and express their experiences with the Midwestern landscapes both visually and materially.

As a designer-researcher, craft dissemination—including zine-making—is standard practice for graphic designers, often called a "leave-behind." **Zines** allowed the team to reflect and share their research differently by exploring creative, visual, and material aspects, focusing on care-filled details, textures, and bindings from their designerly perspective. When Biggs discovered the zine library organized by a local arts non-profit in collaboration with a feminist bookstore inviting local artists and residents, they saw it as an open-ended space to share the intricacies of research, wanting to be part of a community space dedicated to zine-making of all kinds. *Wetlands* was

submitted and displayed, and visitors and local artists connected with Biggs on Instagram after the pop-up. Seeing the potential of zine libraries for community-building and sharing research creatively sparked the inspiration to host one in the academic context as a conference venue at DIS 2024[33], combining traditional academic practices with more informal and experimental approaches.



Figure 7.12. Social media flier for Bakie Book Fair, where the first zine library took place (left), and Instagram post[34] after the second Zine Library hosted at DIS 2024 (right).

7.6. Case Study Analysis

This section presents four qualities of AROs and identifies their benefits based on our analysis of the six case studies described above. Building on these qualities, we have articulated a definition of ARO. We preface the definition of ARO to make the analysis easier to follow. We define an ARO as **a uniquely situated, dedicated research activity or artifact that emerges as a new endpoint in the research timeline, aiming to translate, communicate, or disseminate research insights in an accessible and engaging form tailored to the intended audience**.

[33] https://dis.acm.org/2024/zine-archive

[34] https://www.instagram.com/p/C95tS59I-wu

7.6.1. Emerging Qualities of ARO

Through our critical reflection and analysis of first-hand narratives from six case studies, we have identified four key qualities—***translational***, ***situational***, ***transparent,*** and ***initiatory*** —that distinguish AROs from other research activities or artifacts. Importantly, these four qualities are not *a priori*. They were developed from our continuous discussions and retrospective analysis of six case studies. The four qualities are not mutually exclusive. Each quality often works organically with one another to describe the complex interplay of AROs. Our goal in identifying them is to aid in understanding the boundaries of conceptualizing, designing and making AROs. The four qualities are not conclusive. Although the case studies placed varying degrees of emphasis on specific qualities, all six cases demonstrated the four qualities. We highlight dominant examples in our analysis to illustrate each quality.

Translational

An ARO's ability to bridge the gap between academic research and the intended audience's understanding characterizes its ***translational quality***. Determining a form of an ARO that best delivers the research insights was an essential step to reach audiences at different points in the research process. In our case studies, the intended audience varied from research participants to broader online and offline communities. Our cases revealed that AROs went beyond simply 'translating' research insights into plain language. Instead, creating AROs involved an iterative multi-step process, often making use of various forms of media, such as audio, video, images, DIY instructions and custom print templates.

For example, the forms of **Audio Documentary** and **Documentary Shorts** were heavily inspired by the research participants. **Audio Documentary**'s form allowed the participants to present the quotes in their own voices and created moments of reflection with questions and pauses for the listeners. To achieve *translational quality*, themes in the findings were simplified and rearranged, then translated into plain language. The participants' voices captured in the interview recordings were featured to introduce key quotes, supporting intimacy and authenticity. This effort helped participants overcome the barriers of academic jargon with screen readers, understand the research outcomes, and connect with each other through their voices and stories. Similarly, Olson and

Desjardins of **Documentary Shorts** concluded that the short videos would best describe the participants and their social circles' desire to know the details of their lived experiences. They focused on participants' personal narratives and reflections to create short videos that could live outside of academic boundaries and are easily sharable. **Documentary Shorts** effectively made the intricacies of the project visible and showed people's lived experiences in a more digestible and relatable form for participants.

On the other hand, **DIY Tutorial** and **Digital Media Content** were influenced by the communities in which the research teams were involved. **DIY Tutorial** focuses on more practical knowledge sharing to contribute to the local and online maker community. Creating meticulous step-by-step instructions with the goal of providing useful insights for the maker community required thoroughly documenting, annotating, and taking pictures of the entire making process. The **Digital Media Content** case also highlights the importance of utilizing formats and platforms familiar to the intended audience. Choosing various forms of digital media that were already popular in the community ensured the research insights were accessible and relevant to the ARMY community, amplifying their voices in ways they were accustomed to.

Tailoring AROs to their respective audiences with appropriate language and form requires substantially more effort than simply translating the research insights. While AROs are encouraged to take on various forms, we observed a risk of *oversimplification*. For example, in the **Audio Documentary** case, the constraints of the audio forced the simplification of themes, leading to the loss of some nuances in the participant quotes. **DIY Tutorial** received mixed reactions in the online DIY community due to the lack of applicability in the knowledge of solving a 'practical' problem beyond a research prototype. Therefore, ARO creators must be aware of the constraints induced by specific forms of AROs and not make assumptions about audience comprehension.

Situational

We found that AROs are carefully crafted, standalone research contributions designed to resonate within a particular setting. ARO's ***situational quality*** emphasizes its unique and original nature, reflecting on its role in relation to the creator's positionality. In our case studies, we observed that acknowledging and critically reflecting on positionality often came before creating AROs.

Focusing on the creators' positionality influenced the theoretical foundation of **Audio Documentary** and **Zines**. Yoo, Odom and Berger of **Audio Documentary**, working on the unceded territories of the native peoples in Western Canada, adopted a decolonial lens that influenced their approach to framing and designing the ARO. Similarly, in the case of **Zines**, Wieczorek and Biggs' connection to the American Midwest and their experiences as designer-researchers shaped the content they chose to highlight in the form of a zine.

In contrast, the fact that the research teams of **DIY Tutorial** and **Digital Media Content** were part of the intended audience formed a unique intertwined positionality. They both underscore the importance of considering the cultural context of a specific community. Being part of the community gives the advantage of knowing the values and practices of the community, such as being familiar with the maker culture and the underlying power dynamics for the **DIY Tutorial** case or knowing how to approach sensitive topics such as online discrimination and respecting the core values of *respect*, *love* and *community* for the **Digital Media Content** case.

Notably, the **Art Installation** case demonstrated how creators can proactively define their own positionality to challenge societal biases and advocate for social change. Motivated to counter negative stereotypes surrounding dementia, they designed an art installation that celebrated the creativity and abilities of the participants. This choice of a particular form situated their ARO in a way that showcased the participants' work in an impactful way and prompted the visitors, who were mostly HCI researchers, to move beyond deficit-based approaches to designing technology for people with dementia, considering their unique skills and personalities.

These nuanced approaches—considering the creator's positionality, the intended audience's context, and the implications of the chosen form while potentially sharing the situational quality with the audience—make AROs more approachable and acceptable. However, an ARO's strong connection to a particular context can also present limitations on *limited transferability* to other contexts. Removing an ARO from its intended setting risks misinterpretation or misunderstanding of its represented values, as the situational nuances that give it strength may become points of confusion. This risk is particularly evident when the creators' positionality is closely tied to the audience, as in **Digital**

Media Content, what resonates with one audience or community might not be as impactful or relevant to another.

Transparent

Transparent quality captures an ARO's openness and honesty, not only revealing the creator's perspectives and any limitations or assumptions in the research process that may have shaped the ARO but also encouraging critical reflection for both the creators and the audience. This reflection leads to a deeper understanding of the research and its implications. However, we acknowledge that transparency is an ambitious goal that is rarely met. In our case studies, we observed varying degrees of achieving transparent quality: *passive, active* and *mixed* approaches to transparency.

AROs with a *passive approach* provide access to information about the research process and the creator's perspectives embedded in the AROs without actively asking for the audience to provide inputs or engage in direct communication in the creation process of AROs. Yoo, Odom and Berger of **Audio Documentary** shared a full paper with the participants, informing the research results in advance. Yet, they drove the decision on which themes and quotes to include in the documentary. Similarly, **DIY Tutorial**'s transparent view of the design and construction of the research artifact was initiated and driven by the creators, allowing others to understand the decisions made and potentially replicate the project, promoting openness and sharing knowledge throughout the research process.

AROs with an *active approach* prioritize dialogue, where the creators actively seek reflection, address concerns, and encourage conversations with the audience. Olson and Desjardins of **Documentary Shorts** foregrounded continuous communication and ongoing consent with participants, ensuring they understood the research process, addressing ethical concerns about privacy, and obtaining consent at each stage during filming and editing. This proactive approach to transparency helped build trust between the research team (including the creators) and the participants, resulting in well-accepted AROs. Similarly, Kritika and Ringland of **Digital Media Content** demonstrated an active approach to transparency by openly disclosing the research process with the ARMY community, such as sharing their manuscripts before submitting them to an academic venue or celebrating academic achievements. This allowed community

members to exchange feedback and ensure that research accurately reflected their values and perspectives.

Lastly, we observed a *mixed approach* to transparency in the **Art Installation** case. Ppali was present at the installation, acting as an ambassador for the participants' artwork, openly explaining the research process, answering questions, and providing nuanced contexts to visitors. At the same time, when Ppali was absent, supplementary materials, such as QR codes to 360 YouTube videos, photographs and take-home postcards, served a passive role in providing more details about the background and context of the research. This mixed approach offers an additional layer of transparency for those who are interested in exploring the research further.

We observed ARO's transparent quality is closely tied to its level of openness and engagement with the audience. Transparency is not simply about revealing every detail but rather about providing meaningful insights into the decisions, challenges, and reflections that shaped the AROs. Approaches to achieving transparency should be carefully planned to avoid *overwhelming the audience* with excessive communication or overly detailed information on research. Finding the right balance and appropriate approaches is essential to deliver the intricacies of the research without sacrificing clarity.

Initiatory

ARO's ***initiatory quality*** refers to its ability to advocate for ongoing interaction and dialogue with and beyond the intended audience. AROs strive to be more than just static research endpoints; they encourage the audience to share their thoughts and impressions directly with the creators or with the people around them. This could include not only research insights but also untold details in the research process and the creation of AROs that are often not shared in academic publications.

In our case studies, we observed that AROs foster multidirectional communication, unlike how traditional research outputs result in one-way dissemination. This is achieved in two ways: by having an easily shareable form or by facilitating a space for open-ended communication between and among the creators and the audience.

Audio Documentary, **Documentary Shorts**, and **Digital Media Content** were designed to encourage conversation through sharing the AROs. The **Audio Documentary** and **Documentary Shorts**, intended for the research participants, later became a catalyst for conversations between them and those around them, including their loved ones. Sharing the AROs within their social circles sparked discussions and reflections, extending the research's impact beyond the intended audience. Similarly, **Digital Media Content** promotes active participation by utilizing widely accepted forms within the community, such as Twitter, TikTok, and YouTube. This approach encouraged community members to provide feedback, share their thoughts, suggest research ideas, and participate in future interviews and surveys, highlighting the reciprocal and initiative nature of AROs.

Meanwhile, **Art Installation** and **Zines** invited more direct in-person conversations between the creators and the audience. **Art Installation** showcased the potential of AROs to create a space for dialogue and reflection. Ppali actively engaged with attendees and visitors, sharing the participants' stories and creative processes. Similarly, the open-ended and non-linear nature of **Zines** allowed audiences to interpret the research from their own perspective. Wieczorek and Biggs' participation at the zine library facilitated face-to-face interaction with visitors, sparking conversations and connections.

From these examples, we observed that AROs foster an open, dedicated space for discussing sensitive topics and issues beyond research insights. They invite the audience to connect with the research, actively participate, and share their perspectives. Yet, open dialogue through AROs can lead to diverse perspectives. Creators should play a role in ensuring respectful communication and preventing misunderstandings of AROs. Another challenge in long-term research engagements is maintaining the momentum that AROs initiate, especially when they rely on ongoing interaction and dialogue with the audience. Other situations, such as limited funding or the conclusion of the study, can pose sustainability issues. Over time, we also explore the question: "What might be a responsible approach to concluding or maintaining the relationship with the audience?"

7.6.2. What Are We Alternating? – The Benefits of AROs

While creating AROs demands extra time and resources, working with them has been rewarding and worth the investment. In this section, we present the benefits of AROs that may be **unaligned** with those pursued by traditional knowledge-creation practices.

Fluidity in Research through Open-Ended Exploration

The open-endedness of ARO promotes ***fluidity*** of research outcomes. Written publications focus on academic objectives, and structured arguments often leave little room for expressing the researcher's personal reflections and emotions in their research journey. In HCI, subtle nuances in design are often captured and acknowledged as tacit knowledge [225]. Yet, sharing or documenting tacit knowledge is challenging due to its unspoken and intuitive nature, which is deeply embedded in personal experiences and specific contexts (e.g., [50, 428]). We see AROs as one way to articulate tacit knowledge. We observed AROs possess an inherent capacity for self-expression for researchers, offering individual and collective experiences by easing anxieties of engaging with perfectly polished research outcomes for broader, non-academic audiences. Biggs of **Zines** transformed personal research experience—an autoethnographic bike trip—into a narrative of their lived experience that was open to interpretation by the audience. Once positioned effectively, AROs require minimal explicit guidance, offering unique experiences for the audience through different materialities. The use of sound in **Audio Documentary** and **Art Installation** or raw materials in **Zines** demonstrates how AROs can convey impressions that traditional academic papers cannot. This flexibility makes research and researchers more approachable, fostering a rich understanding of academic knowledge that speaks to broader audiences.

ARO's creative, expressive approaches and unconventional methods of sharing knowledge push the boundaries of research communication. AROs are not bound to the editorial or structural conventions of traditional academic publications, offering creators great freedom to explore experimental qualities appropriate for their purpose, such as the disorderliness of raw hand-printed zines or the intricate materiality of sound, clay or smell, that advocate for richer, nuanced explorations of research topics that go beyond

the limitations of text, imagery, and annotations [170]. Further, ARO's flexible nature embraces unfinishedness, messiness and imperfection, unlike pursuing the highly-finished and robustness of written publication. We observed that the *unpolishedness* can be positively accepted by the audience in the cases of **Zines** and **Art Installation** when presented appropriately. Wieczorek and Biggs of **Zines** noted, *"We wanted to just make stuff that our regular scholarly work doesn't necessarily make time for. Zines allowed us to play with materials, not worrying about details, such as perfecting images, layout, etc., but being explicit about the core aspects of research. Sharing research in academic contexts usually leads to conversations about how to connect with water and non-human agents through research practice. On the other hand, sharing research through zines led to entirely different conversations: how AI-generated images rendered missing data about indigenous ships, telling stories of their loss and how technology interpreted the lived experiences of indigenous people in the region."* Moving away from the rigid formats also invites the audience to engage with research in open-ended ways, initiating unique dialogues based on the medium and context of the presentation.

Community-Focused Values and Community-Driven Objectives

AROs can enhance the collaborative process by amplifying the voices of participants and involved communities to challenge the hierarchical nature of traditional research dissemination. We recognize a key benefit of AROs is their role at the intersection of researchers, academic knowledge, and audiences. For **Audio Documentary**, the team carefully reviewed research findings and interview recordings to gather insights. For instance, they learned that participants with blindness typically speed up audio to access information quickly. While participants expressed a desire to learn about other blind individual's experiences and responses to interview questions, the creators aimed to evoke emotions rather than simply making it purely informative. Therefore, **Audio Documentary** was designed to offer space for personal reflection and deeper contemplation by incorporating relaxing background music, situating the research team as a storyteller, pacing the narrative and inserting reflective pauses.

A commitment to community-focused values, rooted in the base research, guides the development of AROs that cater to the specific needs and preferences of the intended audience by attending to the unique metaphors, jargon, and behaviours of the community. This approach encourages the audience to share AROs with others in the

community, extending the impact beyond the initial reach. Kritika and Ringland of **Digital Media Content** noted, *"Too often, academic and professional research benefits the institutions or individuals conducting it while offering little in return to the communities that provide the knowledge, experiences, or contexts being studied. We feel that conducting work without giving back to our communities in some way is extractive. By developing AROs, we aim to create and pave the way for research outcomes that are accessible, valuable, and directly beneficial to the communities involved."*

AROs dedicated to a specific community require careful decision-making. Olson of **Documentary Shorts** commented on ethical concerns regarding the extractive nature of research practices, rooted in the creators' positionality and certain forms of AROs. *"What is being presented in the film could easily be influenced by the team who produce it or, more specifically, the team member in charge of editing, which affects how the story is presented and interpreted. Instead, we embraced this as an opportunity to shape our positionality and perspective. Our voices captured in the interview recordings allowed us to tell our own stories in the film while visually depicting participants' lived experiences. Notably, the transparency in the research process—showing the presence of the camera and research team, including the interview questions we asked—was appreciated by participants, contrasting this approach positively with how larger tech companies typically collect data, such as using End-User License Agreement forms to extract data for marketing."* When recording research activities, the recorder or camera usually focuses on participants. However, similar to how **Documentary Shorts** and **Audio Documentary** show interactions with the creators, capturing the whole scene makes research more equitable by presenting research in a way that brings researchers and participants to the same eye level.

Extending Responsibility for People Involved in Research

AROs foster ethical considerations by ensuring reciprocal and meaningful research processes and outcomes for audiences. This contrasts with traditional publications, which often prioritize academic recognition over community engagement. Many HCI research projects involve collaboration with non-academic people who influence the research process. As HCI research inherently involves people ("Human"-Computer Interaction), we, as the creators of AROs, share a strong sense of ***responsibility*** to the individuals and groups who contributed to our research.

Yoo of **Audio Documentary** said: *“Producing the audio documentary required us to sift through hours of interview recordings to find quotes that appear on the published paper. When we edit those quotes for written publication, we work with the transcribed versions in text. Despite we, as researchers, work our best to preserve the meaning of the quotes, we make quite a few changes to their words—cutting and stitching bits and pieces here and there. Listening to the quotes in their voices came to a whole different level. I felt a sincere appreciation for the research participants.”* PPali of **Art Installation** shared a similar reflection on making deep connections with participants. *“Although I previously worked with people with dementia, my interactions were always brief, testing technology or running short workshops. In the Meaningful Places project, we spent six weeks with the same participants, creating art and hearing their stories. Over time, we became friends who shared the joy and challenges of creating something meaningful together. This experience reminded me why I became a researcher: making humane connections with people rather than focusing on intervention effectiveness or novelty. The **Art Installation** gave me the opportunity to focus on amplifying the voices of those I worked with, rather than my own, and to show the impact of their creativity through our collaboration.”*

Witnessing collaborative efforts to make meaningful connections with audiences through AROs has been rewarding. AROs can be a form of appreciation for our contributors. This approach advocates continuous engagement, inviting reflection on individual roles in the research process and dispelling the power dynamics of researchers as "all-knowing" authorities. Prioritizing authenticity and commitment, AROs enable us to explore alternative modes of expression that resonate with both the creators ourselves and the intended audiences.

By exploring these four qualities, we demonstrated how AROs pose questions to reconsider how research is shared, understood, and applied across different contexts, emphasizing fluidity, community-driven values, and a sense of responsibility. Next, we explore how AROs emerged in the research timeline and share unanswered questions that we would like to share with the HCI community.

7.7. Discussion

We have presented six cases of AROs and identified their four qualities and benefits. From our observation, it was evident that AROs often appeared as an organic progression of research, adapting to the needs of both the researchers and the intended audiences. In this section, we discuss how AROs typically emerge during the research process and highlight some considerations for the HCI community regarding the creation and dissemination of AROs.

7.7.1. How AROs Emerge in the Research Process

In HCI design research, valuable insights often surface from the accumulation of varying details in the design process. These subtle nuances, rooted in the materiality and intricacies of design, are often learned through the act of "doing" [172] or acquired as tacit knowledge [225]. While AROs showcase the tangible results of this "doing" process, we find it essential to recognize the distinction between the immediate products of research, or research *outputs*, and the lasting knowledge and influence they generate, which constitute research *outcomes*.

Disentangling Research Outputs & Research Outcomes

In the research timeline, base research precedes the creation of AROs, providing foundational insights and knowledge that shape AROs. Reflecting on the creation of AROs in our case studies, distinguishing between research ***outputs*** and ***outcomes*** is crucial. Research *outputs*, such as photos, interview transcripts, or participants' artwork, are immediate products of research activities. However, these outputs become meaningful through careful curation and interpretation. Research *outcomes* encompass not only tangible outputs but also new research directions, shifts in understanding, and impacts on participants and stakeholders [172]. In our case studies, AROs emphasize *research outcomes* by redefining the value of dissemination, moving beyond singular, polished results towards a fluid, iterative and generative nature of inquiry.

Building on the distinction between *outputs* and *outcomes*, our case studies show that the timing of initiating AROs is rarely predetermined. Instead, it often responds to the evolving needs of the research, researchers, and participants. Thus, AROs become

tangible manifestations of thought processes at various stages of research, unlike traditional research outcomes that signify a project's endpoint. This raises the question: *At what points in the research do we step away from traditional academic outcomes and embrace alternative forms of dissemination instead?*

AROs and the Research Timeline

Our six case studies revealed key moments when AROs emerged organically throughout the research process, conveying nuanced knowledge or reaching diverse audiences more effectively through accessible forms**.** For example, the research team of **Audio Documentary** initially published their research findings in an academic paper. However, when participants expressed a desire to connect deeper with each other through research, this moment marked a branching point, seeking an alternative approach and realizing that the academic paper was not the most appropriate way to share their findings.

This highlights the need for adaptable research outcomes to specific communities or audiences, echoing broader discussions in HCI around *situated knowledge and inclusive design* [437]. Written publications often fail to accommodate diverse ways of knowing. AROs foster deeper engagement through formats tailored to specific cultural, sensory, or community needs. Their flexibility aligns with the *non-linear and iterative nature* of HCI research, which is rich in materiality and tangible engagement, where insights from one project can inspire new directions or applications of others in the field [262, 515]. This is particularly important in HCI, where the interplay between humans, technologies, and contexts constantly evolves [24, 172].

Analyzing the case studies, we describe how adopting AROs can result in discovering new opportunities in the research timeline, allowing research outcomes to remain adaptable. To conceptualize these moments, we introduce three temporal concepts, building on the temporal vocabulary of design events [351]:

- ***Branching*** occurs when a research project takes an unexpected turn, opening new pathways beyond its initial scope, similar to "tangents" or "perpendiculars" in design research [111]. Branching is exemplified by **Audio Documentary**, **Documentary Shorts** and **Art Installation**, when creators met a breaking point where their goals of creating AROs diverged significantly from the base research. Branched projects may have different objectives from the original

research, involving a new medium specifically designed for a distinct purpose, audience, or form.

- ***Refraction*** reflects the influence of one project's insights on another, leading to new directions. In HCI, this mirrors how research artifacts shape and redirect future research trajectories. Our observation of how the local zine library influenced **Zines** and subsequently catalyzed zine-making and sharing in academia exemplifies *Refraction*. For example, creating AROs in the form of RtD videos, documentaries, or zines for one project, capturing the design process and research outcomes, may inspire similar practices in subsequent projects. Refraction demonstrates how creative outputs can ripple through different initiatives, shaping future methodologies.

- ***Multiplying*** occurs when an ARO continues to generate value over time, possibly adapting to entirely new contexts. We observed **Digital Media Content** and **DIY Tutorial** generating audience reactions and further ideas beyond their immediate outcomes. Multiplication of outcomes shows how AROs can outlive the research project and continue to resonate with diverse audiences, expanding their reach and influence. Flourishing beyond how the research project or produced prototypes are initially designed, they can take on a life of their own as different audiences adapt them for their own purposes, such as giving something back or leaving something behind (e.g., [178]).

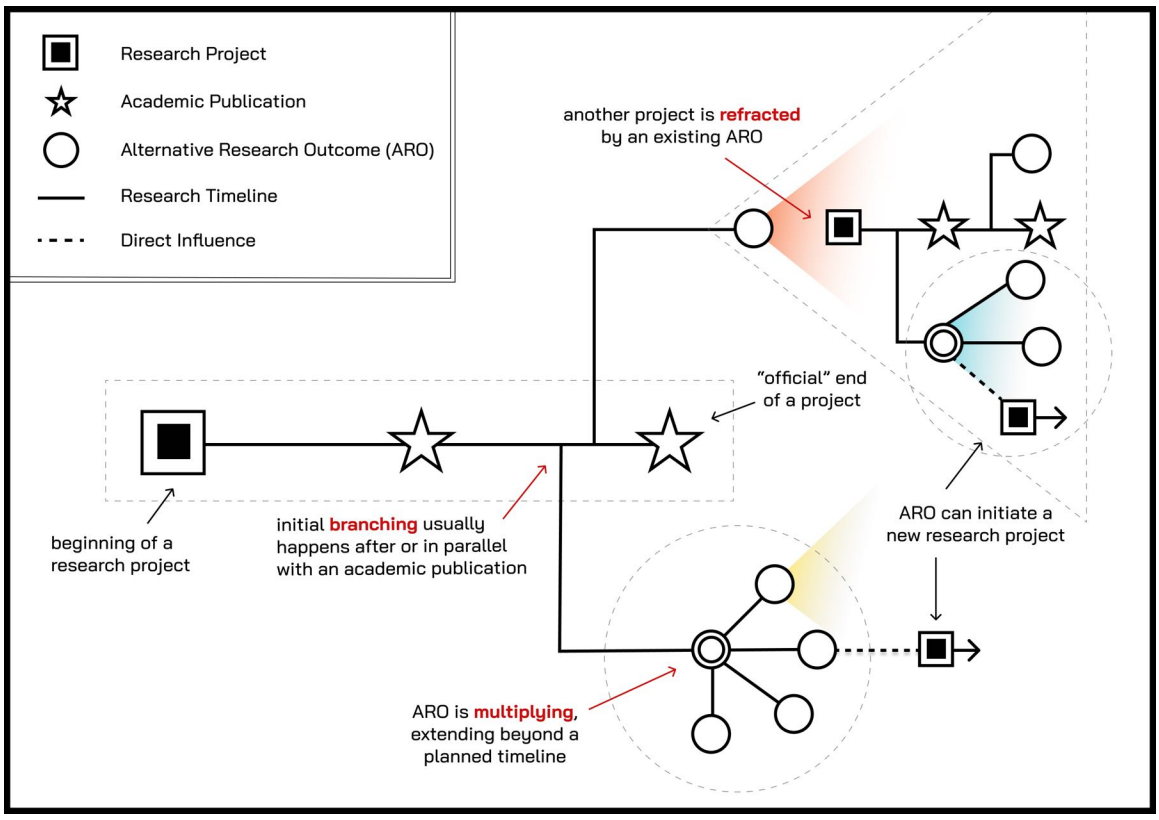

Figure 7.13. A visual description of the three temporal concepts of ARO.

These concepts are not mutually exclusive; even in our cases, AROs can possess multiple concepts depending on the context. These temporal concepts promote the non-linearity of ARO, not only opening new pathways for disseminating research insights but also materializing outcomes that unfold from the “through” part of design research, reflecting the messy nature of design research journeys, not always following a straight path from start to finish [111, 177, 224, 353]. Finally, AROs raise questions about what it means to conclude a research project, acting as ***new beginnings***, inviting continued exploration, adaptation, and reflection, and transforming research into an ongoing dialogue.

7.7.2. Open Questions for the HCI Community

We have explored AROs in HCI, highlighting their potential and challenges. Our case studies demonstrate how flexible forms of AROs push the boundaries of traditional academic dissemination and invite us to rethink how research can be shared, understood, and applied across contexts. However, ARO is still an emerging concept, and the case studies we present are a small subset of what is possible. We believe AROs play a critical role in extending the accessibility and impact of research beyond academia. Moving forward, it is essential to acknowledge the limitations and complexities that AROs may introduce. Next, we invite fellow researchers to reflect on the questions and concerns raised by our discussions.

Are AROs Ethical?

The ethical complexities of AROs are heightened by their sustained interactions with participants and communities, compared to traditional academic research. AROs, such as **Audio Documentary**, **Documentary Shorts**, and **Digital Media Content,** often involve personal narratives or sensitive data, raising concerns about privacy, consent, and long-term participant engagement. The open-access nature of AROs can complicate ethical standards used in academic publishing. *How can researchers ensure ongoing informed consent once ARO artifacts are publicly shared? What happens if participants later wish to withdraw or modify their contributions?* Ensuring informed consent is vital, especially when participants may not fully grasp the long-term implications of sharing their personal information in alternative formats. One way forward is to adopt a participatory ethics model that treats consent as an ongoing process rather than a one-

time agreement. For example, exploring flexible platforms for disseminating AROs that allow participants to modify or remove content post-publication can offer an additional layer of protection for their rights.

Who are the Authors of AROs?

Traditional academic authorship is based on intellectual contributions, while in many AROs, contributors do not always fit this pattern. As demonstrated in the case studies, AROs often involve collaborative efforts from diverse contributors—researchers, designers, community members, and participants—each playing a role in shaping the final outcome. For instance, in **Audio Documentary** and **Art Installation**, participants make significant contributions by sharing personal stories and creative work central to the final outcomes. In our other ARO cases, we found it challenging and limiting to appropriately credit those outside academia who deserve more than being mentioned in the acknowledgments, such as collaborating professionals and artists, into a scholarly portal like PCS. This raises questions of credit and ownership: *Who should be credited, and how should ownership be attributed? How can ownership conflicts be resolved to maintain the integrity of collaboration?* One direction is to develop a more transparent and flexible authorship model, such as an authorship taxonomy that explicitly defines different types of contributions, from intellectual and creative input to technical assistance or community facilitation, similar to open-source software project contribution lists (e.g., Python's contributor list[35], Open AI ChatGPT-4 Technical Report [189]). Foregrounding the formalization of authorship agreements early in the research process can help avoid conflicts by establishing clear expectations, ensuring fairness and promoting trust to maintain the integrity of the collaboration while recognizing the diversity of roles inherent in AROs.

What does Success Mean for AROs?

Analyzing our six case studies, it is clear there is no one-size-fits-all definition of success for AROs. AROs do not rely on traditional academic metrics, such as citation counts and journal impact factors, which often fail to capture the full value, particularly for AROs that prioritize fluidity and social engagement over scholarly prestige. An ARO's success is not about presenting polished, well-cited contributions but rather sharing

[35] https://github.com/python/cpython/graphs/contributors

something, perhaps ambiguous, that evokes a response from the audience. Alternative measures could include impact on the intended audience, ability to foster ongoing engagement and dialogue, and potential for influencing other research projects in the field.

For AROs prioritizing *participant engagement*, such as **Audio Documentary**, **Documentary Shorts,** and **Digital Media Content**, we considered their AROs successful when positively accepted by participants, such as receiving a support message or seeing participants share the AROs with others in their network. AROs like **DIY Tutorial** and **Art Installation** were deemed successful when they opened a space for continuous engagement and discussion, such as getting more than 10,000 views on Instructables for **DIY Tutorial** or having visitors take postcards at **Art Installation**. Wieczorek and Biggs of **Zines** defined their success as connecting with broader communities, such as local artists and residents, and subsequently hosting an academic *Zine Library* to engage with scholars who are passionate about expressing their artistic creativity through zines. Reflecting on success more broadly, Desjardins of **Documentary Shorts** shared their reflections regarding the success of AROs on top of each ARO's individual success: *"From the creator's perspective, one way I assess the success of an ARO is also how satisfied we feel with our design work being presented through the AROs. When confined to academic writing, there is often a lot that is left unsaid, which can lead to frustration as a designer. With an ARO, there is more freedom in presenting an authorial voice that can be highly satisfying as designers."*

It is important to note that ***we are not arguing that every HCI research project should produce an ARO***. Our case study analysis reveals that AROs emerge organically in the research timeline when appropriate. Circling back, this is why we suggest the three temporal concepts of ARO (See *AROs and the Research Timeline* section above.) to visualize the timing and the roles of AROs. In our view, the primary value of AROs lies in reimagining how research is produced, shared, and experienced. Diversifying methods of disseminating research insights can inspire creative approaches to sharing knowledge, connecting researchers with specific audiences who are relevant, interested or deeply engaged in the research process, leading to a more inclusive research ecosystem. Overall, AROs ensure knowledge flows not only within academia but also across communities, disciplines, and contexts, transforming how we understand

and share research. This multifaceted experience in designing, creating, and sharing AROs prompts open-ended inquiries: How do we, as researchers and designers, learn and produce knowledge? What modes of presentation and communication best capture the intricacies of our work?

Where do AROs Belong in the Academic Context and Beyond?

AROs prompt a re-examination of what "impact" means for research contributions to the academic community, which, in turn, prompts a reconsideration of how research is evaluated and recognized. On the surface, AROs are best understood in the community and context they are meant for, reflecting on their *situational qualities*. How can AROs be effectively showcased and archived to ensure their presence and long-term impact within and beyond academic boundaries?

In the context of academia, dedicated tracks at international conferences can invite different types of AROs relevant to a conference's topics, attendees, and themes. This provides an open space for scholars to display their AROs and share the processes of design, theory, and crafting, which are the key components of design research. Conference tracks, such as *Pictorial*, *Artworks*, *Critiques,* and *Art and Performance* (mentioned in Section 7.3.2), offer potential venues for AROs to show their presence within the academic ecosystem. AROs can further initiate new venues, following the successful academic *Zine Library* hosted by the creators of **Zines** at DIS 2024 in Copenhagen. Participating projects and AROs at these tracks can be archived for future access (e.g., *Studio* at TEI 2023[36] and *Zine Library* at DIS 2024[37]).

There is an opportunity to explore the space between academic and public boundaries inspired by the Open Access movement to overcome the traditional barriers of institutional paywalls and subscription fees. One approach is hosting a dedicated ARO repository, similar to the online repository[38] that archives all pictorials. Tagging or grouping AROs by form, context, or other emerging features or characteristics could be helpful in organizing the ARO repository. Additionally, an asynchronous space to show,

[36] https://tei.acm.org/2023/program/studios

[37] https://dis.acm.org/2024/zine-archive

[38] https://materialfordesign.net/pictorials

share, and archive AROs could be valuable. Inspired by "Question Bridge[39]", hosted for two years to facilitate conversations about design research asynchronously [275], a dynamic, emerging, and evolving online space for AROs could facilitate further engagement and conversation around AROs. These open spaces could be curated by scholars but grant full public access for free use, collaboration and communication with ARO creators and audiences.

Lastly, beyond the academic boundary, public events that bring researchers and the public together (e.g., *Work-In-Progress Festival*[40], *Science in the City*[41], and *The Great Exhibition Road Festival*[42]) are excellent venues for disseminating AROs. These events offer accessible platforms for researchers to share their work with wider audiences in engaging and interactive ways, bridging the gap between academia and the public while highlighting the societal relevance of research. Presenting AROs at public events establishes a direct channel to individuals who might not otherwise engage with academic research, raising awareness and illustrating the tangible benefits of research for the general public.

7.8. Conclusion

This paper introduces and articulates the concept of Alternative Research Outcomes (AROs) in HCI research. AROs challenge conventional norms of knowledge-sharing in written publications by embracing unconventional methods to disseminate research insights. As HCI research increasingly engages diverse groups of people and communities, sharing research insights creatively within a given context requires greater attention. Consequently, our aim is to offer an initial understanding of motivations, forms, and dissemination strategies shaping AROs, rather than to develop a comprehensive framework. Based on our first-hand experiences of working with sec ARO case studies, we identified four emerging qualities—*translational*, *situational*, *transparent*, and *initiatory*—as well as possible limitations and benefits of AROs. We acknowledge these qualities emerged in a small set of ARO cases in the field. We look forward to seeing

[39] https://designresearch.works/qubr-archive/index.html

[40] https://2024wip.cyens.org.cy

[41] https://scienceinthecity.org.mt

[42] https://www.imperial.ac.uk/festival

more qualities that may surface from the creation of new AROs in the HCI and design community. AROs offer an opportunity to express and advocate for different commitments driven by care for research participants and relevant communities. From conceptualization to execution, working with AROs has offered value beyond the traditional metrics of academic success. We hope our work encourages recognition and broader discussion and exploration of AROs in and beyond the HCI and design research communities.

Chapter 8.

Conclusion

This dissertation traces my seven-year longitudinal research trajectory that explores how interactive technology can support personal, situated reminiscence experiences for people with blindness, spanning from everyday reminiscing to long-term curation of legacy. What began as an exploratory inquiry aimed at filling the gap at the intersection of blindness and reminiscence in HCI research has ultimately evolved into a deeply reciprocal, collaborative partnership. My work pushes the boundary and critically challenges the sighted perspective and efficiency-driven paradigms in technology through sound-based co-creation, co-speculative design fictions and the concept of Alternative Research Outcomes (AROs). In this concluding chapter, I first revisit each research question mentioned earlier in the Introduction to summarize the contribution of this research to the empirical, practical, and methodological aspects. Then, I reflect on the long-term participatory relationship throughout my research journey, followed by a discussion of limitations and future directions.

8.1. Contributions – Revisiting Research Questions

When I first began my doctoral research in 2018, there was limited research at the intersection of *Blindness* and *Reminiscence*, even though they are two actively researched topics in HCI. While research on *Blindness* in HCI has largely focused on practical challenges and accessibility (e.g., [82, 213]), *Reminiscence* has mostly been studied from the perspective of memory research on older adults with dementia (e.g., [104, 227, 384, 460, 499]). This motivated me to take a more nuanced, collaborative way of understanding blind people's lived experiences, posing the following overarching research question of this dissertation:

How do people with blindness look back, reminisce, and reflect on past memories and meaningful life moments, and how can interactive technology be designed to better support their experiences and practices of reminiscing and remembering?

To answer this question, my dissertation makes three contributions by providing:

1. *empirical insights* into blind people's reminiscence experiences, sensory practices, and personal/social preferences and tensions that give a deeper understanding of non-visual reminiscence and long-term legacy curation for people with blindness,

2. *practical design techniques and strategies* for making more enjoyable, nuanced and dynamic sound memory, and supporting a long-term biographical archive for people with blindness, and

3. a rich methodological demonstration of an approach for navigating and pivoting decisions throughout the design process and maintaining a longitudinal participatory relationship, as well as the conceptual framework of Alternative Research Outcomes (AROs).

Together, these empirical, practical, and methodological contributions establish a holistic understanding of non-visual, long-term memory curation and reciprocal design practices in supporting blind people's reminiscence experiences. Next, I outline how the overarching research question was achieved from the five subsequent research questions, each of which was addressed and answered in chapters 3 to 7.

RQ1: What are the ways people with blindness capture, revisit and share meaningful life experiences and memories, and what is the role of interactive technology in supporting their reminiscence experiences and memory practices?

As stated in Chapter 3, I began with this research question to gain a deeper understanding of blind people's everyday practices and experiences of reminiscence. I recruited nine people with blindness in the Metro Vancouver area, where the research team and I could visit and talk to them in person. This work made two contributions:

- Offering a rich, in-depth understanding of our blind participants' situated practices, cherished artifacts, social interactions and perceived challenges and desires related to their reminiscence experiences, and

- Providing a set of design opportunities to better support blind people's experiences of capturing, sharing and reflecting on meaningful memories.

By exploring the situated sensory and emotional landscapes of our blind participants, the findings show that people with blindness not only engage with multiple sensorial (and multisensory) impressions to capture memories, including sound, smell, and touch, but also treasure the stories and descriptions shared by others. Building on these findings, this study suggests three design opportunities to support reminiscence experiences for people with blindness: (i) Remembering through Sound, such as by

making audio recordings, remembering and noticing people's voices and the unique soundscapes of memorable or mundane places, (ii) Remembering through Social Interactions, such as the descriptions of visual concepts that are given by important others, and shared memories and moments from intimate storytelling, social gathering and family reunions, and lastly, (iii) Remembering through Tactile Impressions, such as touching or feeling the presence of physical objects and mementos that are given by loved ones or collected from trips, as well as recalling and appreciating the unique tangible aesthetics of those meaningful objects. By offering these design opportunities along with the empirical insights, our work opens new possibilities for situated, reflective non-visual interactions for reminiscence experiences for people with blindness.

RQ2: How can research insights derived from the research participants' lived experiences be shared and translated back into reciprocal design practices so that they can engage with the research insights and knowledge in meaningful ways?

Upon completing the first exploratory study, the second research question emerged from participants' genuine curiosity about other blind people's responses and what came out from their contributions amid the pandemic. As described in Chapter 4, we had to find an appropriate way to share our research outcomes in a form other than a paper, which led us to create an hour-long audio documentary. Documenting and analyzing this process made two contributions:

- Providing insights into how a design-led process can be applied to transforming an HCI research publication into a reciprocal alternative form for research participants, and
- Offering a case study to expand conceptual strategies for mobilizing audio-based forms of HCI research outcomes.

Translating a written publication into an audio format was way more challenging than I expected, from finding an appropriate theoretical framing to making ethical decisions about how to use participants' voices in the interview recordings to ensure their contributions are equally represented. Having a decolonial lens particularly helped us critically understand our positionality and reflect on the decisions we made throughout the process of making the audio documentary. In the findings, we unpacked key decisions in each phase of making—*composition*, *production* and *publishing*. This

allowed us to gain a much deeper understanding of how to mobilize the decolonial lens to support reciprocity in research outcomes and to embrace different forms of engaging with participant data in HCI research.

RQ3: How do people with blindness capture, interact with, or reflect on meaningful personal audio recordings for reminiscence, and how can we co-design alternative forms of sound memory that support their preferences, needs, and desires for personal and social reflection in sound?

To address the third research question that emerged from our ongoing engagement with our blind participants as we further explored the design opportunity of reminiscing through sound, we conducted a series of collaborative research activities over a 12-month period, progressing from group interviews to participatory activities and to a final co-design workshop. This study made two contributions:

- Offering three types of sonic mementos as novel design opportunities that extend blind people's cherished audio recordings for more dynamic and nuanced reminiscence experiences, and
- Proposing recommendations on designing sound memory and sonic mementos to support personal reminiscence and collective remembering through sound in HCI research.

The result of this co-design study, presented in Chapter 5, shows that while our participants were highly interested in sound memories, they did not actively create many audio recordings; however, they all had at least one cherished personal audio recording that they kept revisiting and referring to. This study presents three types of sonic mementos from the cherished recordings, co-created with the participants, as concrete exemplars of re-designing audio recordings into more dynamic and enjoyable sonic mementos. The study analyzed different techniques used for each sonic memento: (i) *encapsulation and condensation*, extracting the key moments in the recording to highlight the overall emotions and atmosphere, (ii) *augmentation and expansion*, having additional sound components and details to fill in the missing memories in the recording and (iii) *re-imagination and re-creation*, blending a carefully chosen mix of sound elements to create an abstract summary of the past. The study discussed how different sound layers (e.g., foreground, middle-ground, and background), as well as the pace and framing of memories presented in sound, influence the experience of reminiscing

and remembering. Also, the study suggested that people's voices could hold temporal values that convey the passage of time and point to a specific era at the time of recording, underscoring the value of sound memory and considerations for creating memories in sound.

RQ4: How can co-speculative design fictions, grounded in the situated lived experiences of blind collaborators, reveal their imaginations and desires for future memory technologies, and how do they critically challenge norms in current and emerging technologies regarding longitudinal reminiscence and the curation of memory traces and legacy for people with blindness?

Building on the findings and insights from sound memory, we chose to further engage in a participatory approach, exploring the future of the reminiscence experience and memory technology for people with blindness through co-speculation, speculative design, and design fiction storytelling. Based on what participants shared in the previous sessions, I developed four design concepts of memory objects, which inspired our collaborators to imagine their own speculative memory objects. Together, we wrote 8 design fictions, and as discussed in Chapter 6, this study made the following three contributions:

- Presenting eight participant-authored design fiction stories, grounded in their lived experiences, as speculative accounts of future memory systems for people with blindness,
- Providing a set of design strategies—Designing for Few and three aspects of Narrative Agency—to offer insights into the design of long-term, biographical archives that foster longitudinal legacy for people with blindness, and
- Offering methodological insights into conducting a co-speculative design process with people with blindness, focusing on how speculative narratives can remain deeply grounded in the situated lived experiences of participants.

The analysis of the four design concepts and narratives in the design fiction stories pointed to emerging themes of the reorganization of the narrative self and the desire to leave a posthumous legacy in our collaborators' imaginings of future memory practices. More importantly, we found that the memory objects created by our collaborators and their intended use cases involved *extended waiting* for the right moment that triggers deep reflection, reminiscence, and remembrance, which counters the philosophy of always-available, efficiency-driven, and demand-seeking behaviours in

modern technology. Building on these themes, the study suggested design strategies for *Designing for Few* that identify three types of scarcity as 'selectivity'—Temporal, Situational, and Relational selectivity—in working with a small number of memory data for meaningful reminiscence. Further, the study suggested three types of Narrative Agencies—Interpretive, Curative, and Transcendent—to consider when creating a longitudinal memory technology that supports long-term reflection and the continuous curation of legacy in memory for people with blindness.

RQ5: How can HCI research outcomes be created in alternative forms that go beyond traditional textual dissemination by offering creative, diverse endpoints that communicate research insights to broader audiences, and what are the key qualities that define their value and significance in the research process?

Inspired by the development of audio documentary (Chapter 4), this paper in Chapter 7 introduces the conceptual framing and the definition of Alternative Research Outcomes (AROs) that go beyond written publications and academic boundaries to further disseminate the knowledge generated in research and the research outcomes to broader audiences in alternative, creative forms. This study made three contributions:

- Introducing six case studies of AROs by unpacking motivations, presentations and distributions of each case,
- Articulating four emerging qualities of AROs—translational, situational, transparent and initiatory—by analyzing first-hand experiences of six ARO cases, and
- Discussing how AROs could emerge in the research timeline and posing critical inquiries into the future engagement of AROs in the HCI community.

The study presented six different cases of AROs—Audio Documentary, DIY Tutorial, Documentary Shorts, Digital Media Content, Art Exhibition and Zines—to discuss, reflect on, and iterate on emerging themes and critical inquiries into the key characteristics and values of AROs. Collectively, we proposed the following four emerging qualities of AROs that uniquely distinguish AROs from science or research communications and academic publications.

Translational quality actively reshapes complex academic insights and jargon into plain, accessible language and appropriate forms,

ensuring that the essence of academic knowledge can be easily shared and understood by the intended audience.

Situational quality ensures that the outcome is deeply rooted in and responsive to the specific contexts, such as the unique sensory modalities, values, or cultural preferences of the involved community.

Transparent quality clearly communicates the limitations and context of research, such as researchers' positionality, ethical tensions, pivoting choices, and participants' contributions, revealing the messy and complex reality of knowledge creation.

Initiatory quality frames the research outcome not as a static, definitive endpoint but as a catalyst that sparks ongoing dialogue, raises open questions, and invites reflective engagement with the community and beyond.

Also, the study discussed the alternative values that AROs aim to pursue, which may be unaligned with the traditional knowledge-creation process in academia. Lastly, we posed open questions that had not yet been answered and needed to be explored to initiate ongoing discussions with the broader HCI community about alternative ways of sharing research outcomes.

8.2. Reflections on Reciprocity in Research and Long-term Participatory Relationship

In hindsight, engaging in a long-term participatory research program is a distinct privilege, particularly within the scope of doctoral research. While numerous institutional, situational and personal factors undoubtedly made this work possible, I want to look back and revisit some of the aspects that sustained this unique, ongoing relationship with our collaborators for nearly seven years.

First, I was fortunate to be in a position where I could dedicate significant temporal and physical space to this topic. Above all, long-term commitment requires time. I have been truly fortunate to conduct my doctoral work in a research environment where slowness is deeply appreciated, and often encouraged, unlike projects that require rapid turnarounds that typically involve short-term experimental studies spanning only a few days or weeks. Further, instead of transitioning directly from a master's program, restarting cleanly as a new PhD student at the same lab in the same department granted me to have an extended project timeline. This structural shift

ensured a five or more years to continuously explore, linger with, and deepen my investigation into this domain.

Second, my collaborators and participants frequently noted their appreciation for clear, proactive communication regarding expectations, boundaries, and research goals. Rather than waiting until they ask, I felt personally motivated to consistently share our research progress and updates via email. Providing transparent context that extends far beyond the immediate objectives of upcoming design activities empowered our collaborators and participants to be on the same page, having a shared understanding on the research direction. This open dialogue allowed them to actively bring their own perspectives and opinions, which collectively shaped the next steps in the research process.

Third, counterintuitively, keeping our touchpoints relatively infrequent helped maintain a close and healthy connection. Synthesizing research-related documents and study information inevitably required me to write detailed, extensive emails. By limiting the frequency of these updates, considering the timing before and after major sessions, to only a few times a year, I believe our collaborators and participants were able to spend more time (at least a few weeks to about a month) to thoroughly process and digest the material and information. This pacing maintained an appropriate distance, sustaining genuine interest while actively preventing from any burnout or overwhelming burden. This became especially vital during the pandemic and between periods when I was also heavily occupied with other projects, publications, academic milestones, and exams. My collaborators later shared that during these quiet periods, they found themselves genuinely curious about how the research was evolving and if I was doing well. I am truly grateful to have worked with people who remained as enthusiastic and intrinsically motivated by this topic as much as I am.

Fourth, a crucial part of this journey was learning how to gracefully let go of participants. Over seven years, several individuals who had contributed deeply insightful perspectives had to exit the study due to shifting personal life circumstances, moving out of the province/country, changes in priorities, or simply losing interest. Confronting these various forms of parting required care. Rather than sending a brief good-bye email or text message, I made every effort to ensure they felt comfortable leaving the study. We

openly discussed their preferences regarding the personal information and narratives they had previously shared, and I tried to accommodate their wishes as much I could.

Fifth, actively looking for new, generative opportunities that built upon previous stages kept our collaborators deeply engaged. As we wrapped up each distinct phase of this project, I consistently asked myself: "What's next?" and "What if...?". These questions served as avenues of inviting my collaborators to co-speculate and ideate together on the next steps of our work. Transitioning from initial, abstract explorations to concrete design opportunities, selecting a specific direction, and designing enjoyable, engaging workshops and research activities were all driven by a shared discussion that did not intend to prematurely close or conclude our collaborative inquiry.

Lastly, for the collaborators who have been sharing the same journey with me from start to now, sharing small moments outside the formal research boundaries really helped us to form a strong connection. Exchanging holiday greetings during Christmas and New Year, passing along interesting articles or videos related (or unrelated) to our topics, randomly bumping into one another and stopping for quick catch-ups on the street all fundamentally shifted our dynamics. Sharing video snippets of local Christmas choirs at local malls and soccer matches wove our lives together, all became parts of our ongoing, deeply human relationship that became far more meaningful than the traditional roles of researcher and participants.

Together, these reflections underscore how my long-term participatory design research is fundamentally relational and spontaneous. Sustaining a seven-year collaborative journey relies less following on rigid steps or guidelines and far more on establishing mutual trust, embracing a deliberate pace of research, and respecting the evolving lives of the people involved. The conversations, activities, artifacts and design fictions we generated together are more than just research outcomes as they feel more like material testaments of a shared understanding and community we build over time.

8.3. What’s Next? – Limitations and Future Work

My doctoral research brings together a Research through Design approach with Participatory Design practices to understand blind people’s practices of reminiscence and remembrance and to suggest insights into guidelines and strategies for designing

interactive technologies to support their experiences. In this section, I critically reflect on my entire research program and discuss the limitations and the future opportunities for HCI and design research that can be extended from my work.

8.3.1. Limitations

In my research, two major limitations need to be acknowledged and addressed. First, there is an inherent limitation of extensibility [172]. Because this work is positioned in RtD, also rooted in deep, longitudinal participatory design from a close-knit group of blind collaborators, and given the nature of the small-scale qualitative approach, the insights generated in this research can be inspiring but have not been proven to be scalable or extensible. This is also related to the highly personal nature of memory and reminiscence [296, 297]. Even among our collaborators, their preferences for particular interactions and expectations varied (Chapters 5 and 6). Therefore, it would be hard to say that the design techniques and strategies suggested in this research regarding sound memory and blind people’s desire for future memory practices are a rule of thumb, meaning they may not be universally applicable as a standardized approach for the blind population as a whole. Instead, they should be viewed as a generative provocation for future design possibilities.

Second, this research is limited by the absence of a long-term, in-the-wild investigation of our co-created outcomes. My research deliberately prioritized a deep, participatory approach, focusing on co-designing sound memories and co-speculating design fictions rooted in our collaborators' lived experiences. Yet, while this long-term, ongoing relationship has yielded rich qualitative insights, these sonic mementos and speculative future concepts remained short-term interventions that we could not investigate their impact and influence in real-life contexts I did not build functional, working prototypes of these interactive sonic artifacts to deploy as design probes, that is one of the common approaches in RtD, which leaves a gap in our understanding of how they would be adapted into or challenge our collaborators' situated everyday routines over time. Although this participatory, collaborative positioning was a much-needed choice to avoid bringing "sighted-in-mind" biases and assumptions to the research, the lack of field deployment has limited what we can know about the in-situ engagement of

our co-created research outcomes, material frictions, and domestic adaptations and negotiations these memory objects and systems would have surfaced.

8.3.2. Future Work

Finally, I discuss a set of future research directions that can be extended from my work.

Expanding Non-Visual Reminiscence Experiences

While this dissertation focuses on the sound and auditory dimensions of blind people's reminiscence experiences, my initial exploratory study (Chapter 3) pointed to two other design opportunities. Building on these insights, future research could continue to investigate the horizons of remembering through social interactions, tactile impressions, and multi-modal interactions. Exploring social interactions implies investigating how interactive platforms, services, or artifacts can mediate collective storytelling, shared remembrance, and the collaborative construction of verbal descriptions among people with blindness and their support networks without relying on visual media. Concurrently, tactile impressions offer a rich domain for investigating how the physical form, material feel, unique patterns, and tangible aesthetics of an interactive artifact can act as direct sensory triggers for deeper reflection. Taking a step further, there is great potential in exploring the intersections of multi-modality, converging different combinations and situated usages of multi-modal design approaches that seamlessly weave sound, physicality, and social connection into meaningful interactions. For example, investigating how a tactile artifact can simultaneously layer with a localized soundscape while facilitating a shared social reflection could offer a rich contextual foundation for making meaningful memories for people with blindness. Moreover, existing works in HCI and design research already utilize a mix of sensory impressions (e.g., [88, 256, 324, 343, 347]), and these approaches can be creatively translated or adapted for people with blindness. Taken together, exploring these diverse sensory dimensions of reminiscence will allow the HCI community to move toward a holistic, pluralistic understanding of non-visual reminiscence. This research trajectory will not only provide more diverse, engaging memory experiences for people with blindness but also challenge visual-dominant memory systems—contributing to a deeper understanding of how interaction design can extend beyond visual data toward more

accessible, cross-modal landscapes of memory, reminiscence, and remembrance that can ultimately scale to sighted populations.

Advancing Sonic Mementos and Sound Memory

The development of co-created sonic mementos in Chapter 5 and memory concepts in Chapter 6 established interesting opportunities to work with cherished audio recordings. The design techniques of encapsulation, augmentation, and re-creation create an extensive design space for exploring more nuanced, diverse acoustic techniques that manipulate the temporal and emotional layers of sound. Future work should investigate how modifications to the sonic structure of audio—such as changes in pacing, modulating different vocal and atmospheric timbres, or experimenting with silences and communicative pauses—can elicit different domains of impressions, emotional comfort or reflections in sonic reminiscence. Further, future work can examine how these sonic strategies can be applied, expanded, or translated across highly diverse personal contexts and life stages within the blind community. This research trajectory can also potentially scale outward to sighted populations. In an era where mainstream digital archives and data consumption are becoming oversaturated with ephemeral media, such as shorts and reels, and heavily visual documentations, creating space for these non-visual, reflective audio pieces within memory and reflective technology could offer unique opportunities to sighted users for calmness and mental rest. Future studies can explore how these customized, low-demand sonic mementos and sonic interactions can reshape different values and experiences that are not easily achieved by visual media, advocating that designing for alternative sensory modalities fundamentally enriches meaningful reminiscence experiences for everyone.

Materializing Co-design Outcomes

From the perspective of Research through Design (RtD), there is a compelling opportunity to materialize these personalized sonic mementos (Chapter 5) and speculative memory concepts (Chapter 6) into interactive research prototypes or tangible design probes. In particular, the four design concepts described in Chapter 6.5.1 (The Egg, The Eraser, The Box, and The Long Pause) serve as idiosyncratic interactions that push the boundaries of sonic interventions in memory. Deploying these artifacts into people's everyday environments through field study methods (e.g., [84, 341, 343, 345, 462]) will allow researchers to observe lived experiences with physical,

interactive sonic objects--investigating how they influence people's everyday experiences of reminiscence over weeks or months. This line of research inquiry, combined with multi-modal interactions between sound and physicality, will yield deep empirical insights into the curation of sound memory within domestic contexts.

On top of gaining empirical insights from deployments, materializing these sonic mementos and speculative memory concepts poses a critical methodological opportunity to investigate how the co-design process, especially the actual making process of physical research artifacts, can be radically grounded in participants' lived experiences. In this vein, future research should use the creation of these prototypes as a critical inquiry into how design decisions for physical interactions, highly technical hardware, material choices, and the fabrication process can be negotiated and navigated together in deeply participatory, reciprocal ways. This stands in contrast to traditional approaches, where research participants are invited only to take part in short activities to gather insights, after which the final research prototype is built solely by researchers and designers. Therefore, I suggest there is an important opportunity to weave participants' nuanced and situated experiences directly into both the decision-making and the actual making of research prototypes. This hands-on making process can be reimagined as a shared and ongoing dialogue, establishing new possibilities for how marginalized communities, or communities engaged in long-term partnerships, can retain creative agency over the material and physical forms of co-created research prototypes.

Formalizing Accessible, Non-Visual Co-Creative Activities and Toolkits

Another methodological research opportunity lies on the need to develop and document specific co-creative tools and activities tailored for designing with blind community. Because mainstream research on reminiscence, reflection and interaction design has largely focused on visual paradigm, knowledge and references on accessible design toolkits, generative activities or adapting existing resources to work with blind people in the research process remain scarce in HCI literature [1]. Over the course of this seven-year research trajectory, a significant amount of time was dedicated to organically uncovering, pivoting, negotiating and creating bespoke activities to remain deeply attuned to our collaborators' situated and lived experiences. Future work should synthesize these first-hand experiences and insights into practical and actionable design guidelines that extend far beyond specific context of reminiscence. For example,

creating tactile brainstorming toolkits, techniques to map non-visual components, and suggestions to be mindful or to be pay close attention to when working with the blind community would allow researchers and designers to be aware of clear ethical and reciprocal boundaries so that blind participants and collaborators can contribute their creative potential and expression to the research. Formalizing these resources as open-source toolkits or assets for the broader HCI and design community will drastically lower the barrier for emerging researchers and also become great inspiration for adjacent contexts in disability and/or accessibility, ensuring that participatory design can be more collaboratively conducted with, rather than merely for, the blind community.

Maturing the ARO Framework

The conceptualization of Alternative Research Outcomes (AROs) represents a vital contribution of my doctoral program, yet the exploration of this paradigm is only just beginning. In the context of my research, the design and execution of AROs as an audio documentary (Chapter 4) successfully achieved an ethical and methodological commitment to the value of reciprocity, which practically helped maintain the close relationship with our collaborators and encouraged them to stay motivated in this research, but I must acknowledge that working on AROs requires significant time and resources. While having a dedicated framing and its four emerging qualities is highly encouraging and useful to maintain the initiative and enthusiasm, currently, and unfortunately, the broader HCI and design disciplines lack the institutional infrastructure, academic acknowledgement, dedicated funding mechanisms, and metrics to evaluate for graduate degree or tenure-track to properly reward and acknowledge this highly intensive, alternative form of knowledge production. I must acknowledge that the concept is in a relatively niche position, mostly accepted within the design and participatory design communities. To mature and expand this framework, it needs to integrate more case studies from different contexts and focuses, experimental and established formats, and more firsthand experiences of deployments and engagements to refine and push the boundaries of what an ARO can be. Therefore, accumulating a rich and diverse set of case studies is essential for critically analyzing the underlying motivations, hidden labour, institutional barriers and limitations, and, more importantly, their contribution to the broader HCI research community and to the knowledge generation process in HCI research. This continued effort will eventually, and hopefully, allow us to articulate clear rationales for producing AROs in the research process and for

putting effort into AROs, showing that they are not optional or a personal interest but rather a legitimate, widely recognized, and equitable approach to knowledge production in academia.

References

[1] A. Hayton, P., Wilson, A., Morris, B., Dent, J. and Crivellaro, C. 2025. The Blind Leading the Blind: Designing a Co-Creation Workshop for Visually Impaired and Sighted Participants by a Visually Impaired Researcher. *Proceedings of the 27th International ACM SIGACCESS Conference on Computers and Accessibility* (Oct. 2025), 1–8.

[2] Acheson, K. 2008. Silence as Gesture: Rethinking the Nature of Communicative Silences. *Communication Theory*. 18, 4 (Nov. 2008), 535–555. https://doi.org/10.1111/j.1468-2885.2008.00333.x.

[3] Agrba, L. 2021. Extending scholarship to oral traditions through podcasting. *Macleans.ca*.

[4] Ahmad, A. 2019. Living a feminist life. *Contemporary Political Theory*. 18, 2 (June 2019), 125–128. https://doi.org/10.1057/s41296-018-0199-2.

[5] Alahmadi, T. and Drew, S. 2017. Subjective Evaluation of Website Accessibility and Usability: A Survey for People with Sensory Disabilities. (Apr. 2017), 11.

[6] Allen, A.L. 2008. Dredging up the past: Lifelogging, Memory, and Surveillance. *The University of Chicago Law Review*. 75, 1 (2008), 47–74.

[7] Altarriba Bertran, F., Buruk, O. 'Oz, Spors, V. and Hamari, J. 2023. Playful Inspiration for a New Wave of Joyful Forest Technology. *Proceedings of the 2023 ACM Designing Interactive Systems Conference* (New York, NY, USA, July 2023), 1886–1903.

[8] Altarriba Bertran, F., Duval, J., Bisbe Armengol, L., Chen, I., Dong, V., Dastoor, B., Altarriba Bertran, A. and Isbister, K. 2021. A Catalog of Speculative Playful Urban Technology Ideas: Exploring the Playful Potential of Smart Cities. *Proceedings of the 24th International Academic Mindtrek Conference* (New York, NY, USA, Sept. 2021), 60–71.

[9] Altarriba Bertran, F., Pometko, A., Gupta, M., Wilcox, L., Banerjee, R. and Isbister, K. 2021. The Playful Potential of Shared Mealtime: A Speculative Catalog of Playful Technologies for Day-to-day Social Eating Experiences. *Proceedings of the ACM on Human-Computer Interaction*. 5, CHI PLAY (Oct. 2021), 267:1-267:26. https://doi.org/10.1145/3474694.

[10] Amer, P. 2020. Working Scientist podcast: Science communication made simple. *Nature*. (May 2020), d41586-020-01526-y. https://doi.org/10.1038/d41586-020-01526-y.

[11] van Amstel, F.M.C. and Gonzatto, R.F. 2022. Existential time and historicity in interaction design. *Human–Computer Interaction*. 37, 1 (Jan. 2022), 29–68. https://doi.org/10.1080/07370024.2021.1912607.

[12] Andersen, K. and Wakkary, R. 2019. The Magic Machine Workshops: Making Personal Design Knowledge. *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, May 2019), 1–13.

[13] Archibald, J. 2008. *Indigenous storywork: Educating the heart, mind, body, and spirit*. UBC press.

[14] Arima, S. and Uriu, D. 2025. Designing Diegetic Prototypes in Interfuit: A Design Fiction Film on Near-Future Virtual Funerals in Japan. *Proceedings of the Extended Abstracts of the CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, 25 2025), 1–2.

[15] Audiopedia 2022. Fair Access to Vital Knowledge for All.

[16] Auger, J. 2013. Speculative design: crafting the speculation. *Digital Creativity*. 24, 1 (Mar. 2013), 11–35. https://doi.org/10.1080/14626268.2013.767276.

[17] Austin, T. 2020. *Narrative environments and experience design: Space as a medium of communication*. Routledge.

[18] 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.

[19] 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.

[20] Babu, R., Singh, R. and Ganesh, J. 2010. Understanding Blind Users' Web Accessibility and Usability Problems. *AIS Transactions on Human-Computer Interaction*. 2, 3 (Sept. 2010), 73–94.

[21] Barcham, M. 2021. Towards a radically inclusive design – indigenous story-telling as codesign methodology. *CoDesign*. 0, 0 (24 2021), 1–13. https://doi.org/10.1080/15710882.2021.1982989.

[22] Bardzell, J., Bardzell, S., Dalsgaard, P., Gross, S. and Halskov, K. 2016. Documenting the Research Through Design Process. *Proceedings of the 2016 ACM Conference on Designing Interactive Systems* (New York, NY, USA, June 2016), 96–107.

[23] Bardzell, J., Bardzell, S. and Koefoed Hansen, L. 2015. Immodest Proposals: Research Through Design and Knowledge. *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems* (New York, NY, USA, 2015), 2093–2102.

[24] Bardzell, S. 2010. Feminist HCI: taking stock and outlining an agenda for design. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (Atlanta, Georgia, USA, Apr. 2010), 1301–1310.

[25] Bardzell, S., Bardzell, J., Forlizzi, J., Zimmerman, J. and Antanitis, J. 2012. Critical design and critical theory: the challenge of designing for provocation. *Proceedings of the Designing Interactive Systems Conference* (New York, NY, USA, June 2012), 288–297.

[26] Barthes, R. 2012. „The Grain of the Voice “, u: The Sound Studies Reader, Johnathan Sterne (ur.). (2012).

[27] Baum, F., MacDougall, C. and Smith, D. 2006. Participatory action research. *Journal of epidemiology and community health*. 60, 10 (2006), 854.

[28] Baumann, A., Shaw, P., Trotter, L., Clinch, S. and Davies, N. 2024. Mnemosyne - Supporting Reminiscence for Individuals with Dementia in Residential Care Settings. *Proceedings of the 2024 CHI Conference on Human Factors in Computing Systems* (May 2024), 1–17.

[29] Baumann, K., Caldwell, B., Bar, F. and Stokes, B. 2018. Participatory Design Fiction: Community Storytelling for Speculative Urban Technologies. *Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, 20 2018), 1.

[30] Bawden, D. and Robinson, L. 2009. The dark side of information: overload, anxiety and other paradoxes and pathologies. *Journal of information science*. 35, 2 (2009), 180–191.

[31] Beck, J. and Ekbia, H.R. 2018. The Theory-Practice Gap as Generative Metaphor. *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*. Association for Computing Machinery. 1–11.

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

[33] Belk, R.W. 2013. Extended Self in a Digital World. *Journal of Consumer Research*. 40, 3 (Oct. 2013), 477–500. https://doi.org/10.1086/671052.

[34] Belk, R.W. 1988. Possessions and the Extended Self. *Journal of Consumer Research*. 15, 2 (Sept. 1988), 139–168. https://doi.org/10.1086/209154.

[35] 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.

[36] 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, June 2019), 35–47.

[37] 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.

[38] Berger, A., Odom, W., Storz, M., Bischof, A., Kurze, A. and Hornecker, E. 2019. The Inflatable Cat: Idiosyncratic Ideation of Smart Objects for the Home. *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, May 2019), 1–12.

[39] Biesta, G. 2020. Risking Ourselves in Education: Qualification, Socialization, and Subjectification Revisited. *Educational Theory*. 70, 1 (2020), 89–104. https://doi.org/10.1111/edth.12411.

[40] Bilić, S. and Sorenson, J. 2026. Crafting Legacies with Care: Speculative Frameworks for the Digital Afterlife. *DRS Biennial Conference Series* (June 2026).

[41] BioMedicalCentral - Blog Network: 2024. *https://blogs.biomedcentral.com/*. Accessed: 2024-02-08.

[42] Bischof, A., Lefeuvre, K., Kurze, A., Storz, M., Totzauer, S. and Berger, A. 2016. Exploring the Playfulness of Tools for Co-Designing Smart Connected Devices: A Case Study with Blind and Visually Impaired Students. *Proceedings of the 2016 Annual Symposium on Computer-Human Interaction in Play Companion Extended Abstracts* (New York, NY, USA, 15 2016), 93–99.

[43] Blauert, J. 1997. *Spatial hearing: the psychophysics of human sound localization*. MIT press.

[44] Blevis, E., Hauser, S. and Odom, W. 2015. Sharing the hidden treasure in pictorials. *Interactions*. 22, 3 (Apr. 2015), 32–43. https://doi.org/10.1145/2755534.

[45] Bluck, S. and Alea, N. 2009. Thinking and talking about the past: Why remember? *Applied Cognitive Psychology*. 23, 8 (2009), 1089–1104. https://doi.org/10.1002/acp.1612.

[46] Bluck, S. and Levine, L.J. 1998. Reminiscence as autobiographical memory: a catalyst for reminiscence theory development. *Ageing & Society*. 18, 2 (Mar. 1998), 185–208. https://doi.org/10.1017/S0144686X98006862.

[47] Blythe, M. 2014. Research through design fiction: narrative in real and imaginary abstracts. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (New York, NY, USA, 26 2014), 703–712.

[48] Blythe, M., Steane, J., Roe, J. and Oliver, C. 2015. Solutionism, the Game: Design Fictions for Positive Aging. *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems - CHI '15* (Seoul, Republic of Korea, 2015), 3849–3858.

[49] Boer, L. and Donovan, J. 2012. Provotypes for participatory innovation. *Proceedings of the Designing Interactive Systems Conference* (June 2012), 388–397.

[50] Bofylatos, S. and Spyrou, T. 2017. Meaning, knowledge and artifacts, giving a voice to tacit knowledge. *The Design Journal*. 20, sup1 (July 2017), S4422–S4433. https://doi.org/10.1080/14606925.2017.1352938.

[51] Bonetti, R., Cohen, N. and Yavuz, S.U. 2019. Enabling relationships in a co-creative process with children. *Proceedings of the 4th Biennial Research Through Design Conference* (2019).

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

[53] 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.

[54] Boucher, A., Brown, D., Ovalle, L., Sheen, A., Vanis, M., Odom, W., Oogjes, D. and Gaver, W. 2018. TaskCam: Designing and Testing an Open Tool for Cultural Probes Studies. *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, 2018), 71:1-71:12.

[55] Boucher, A. and Gaver, W. 2017. Designing and Making the Datacatchers: Batch Producing Location-Aware Mobile Devices. *Proceedings of the Eleventh International Conference on Tangible, Embedded, and Embodied Interaction* (New York, NY, USA, Mar. 2017), 243–251.

[56] Boucher, A. and Gaver, W. 2006. Developing the drift table. *Interactions*. 13, 1 (2006), 24–27.

[57] 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. https://doi.org/10.1016/j.ijhcs.2010.12.005.

[58] Braun, V. and Clarke, V. 2019. Reflecting on reflexive thematic analysis. *Qualitative Research in Sport, Exercise and Health*. 11, 4 (Aug. 2019), 589–597. https://doi.org/10.1080/2159676X.2019.1628806.

[59] Bravo-Adasme, N., Cataldo, A. and Grandón, E. 2026. Understanding digital hoarding: conceptual framework and future research based on a scoping review. *Humanities and Social Sciences Communications*. (Apr. 2026). https://doi.org/10.1057/s41599-026-07263-3.

[60] Brewer, R.N. 2018. Facilitating discussion and shared meaning: Rethinking co-design sessions with people with vision impairments. *Proceedings of the 12th EAI International Conference on Pervasive Computing Technologies for Healthcare* (New York, NY, USA, May 2018), 258–262.

[61] 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.

[62] Brock, A.M., Truillet, P., Oriola, B., Picard, D. and Jouffrais, C. 2015. Interactivity Improves Usability of Geographic Maps for Visually Impaired People. *Human–Computer Interaction*. 30, 2 (Mar. 2015), 156–194. https://doi.org/10.1080/07370024.2014.924412.

[63] Brown, V.R. and Paulus, P.B. 2002. Making Group Brainstorming More Effective: Recommendations From an Associative Memory Perspective. *Current Directions in Psychological Science*. 11, 6 (Dec. 2002), 208–212. https://doi.org/10.1111/1467-8721.00202.

[64] Bryant, F.B., Smart, C.M. and King, S.P. 2005. Using the Past to Enhance the Present: Boosting Happiness Through Positive Reminiscence. *Journal of Happiness Studies*. 6, 3 (Sept. 2005), 227–260. https://doi.org/10.1007/s10902-005-3889-4.

[65] 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.

[66] Buranyi, S. 2017. Is the staggeringly profitable business of scientific publishing bad for science? *The Guardian*.

[67] van der Burg, V., de Boer, G., Josua Benjamin, J., Halperin, B.A., Akdag, A.A., Chandrasegaran, S. and Lloyd, P. 2026. Reflective AI: A Slow Technology Approach for Design Education. *Proceedings of the 2026 CHI Conference on Human Factors in Computing Systems* (Apr. 2026), 1–19.

[68] Burns, T.W., O'Connor, D.J. and Stocklmayer, S.M. 2003. Science Communication: A Contemporary Definition. *Public Understanding of Science*. 12, 2 (Apr. 2003), 183–202. https://doi.org/10.1177/09636625030122004.

[69] Butler, R.N. 1963. The Life Review: An Interpretation of Reminiscence in the Aged. *Psychiatry*. 26, 1 (Feb. 1963), 65–76. https://doi.org/10.1080/00332747.1963.11023339.

[70] 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.

[71] Caramiaux, B., Altavilla, A., Pobiner, S.G. and Tanaka, A. 2015. Form Follows Sound: Designing Interactions from Sonic Memories. *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2015), 3943–3952.

[72] Carpiano, R.M. 2009. Come take a walk with me: The "Go-Along" interview as a novel method for studying the implications of place for health and well-being. *Health & Place*. 15, 1 (Mar. 2009), 263–272. https://doi.org/10.1016/j.healthplace.2008.05.003.

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

[74] Casnati, F., Ianniello, A. and Romani, A. 2024. Provocation Through Narratives: New Speculative Design Tools for Human-Non-Human Collaborations. *Multidisciplinary Aspects of Design* (Cham, 2024), 747–755.

[75] Cerviño, C., Correia, F. and Alcaraz, M. 2015. Scientific Illustration. An indispensable tool for knowledge transmission. (2015), 261–277.

[76] Chametzky, B. 2022. Coding in Classic Grounded Theory: I've Done an Interview; Now What? *Grounded Theory Review*. 21, 02 (Dec. 2022), 22–32.

[77] Chandrasekera, T., Yoon, S.-Y. and D'Souza, N. 2015. Virtual environments with soundscapes: a study on immersion and effects of spatial abilities. *Environment and Planning B: Planning and Design*. 42, 6 (2015), 1003–1019.

[78] Charlotte Smith, R., Winschiers-Theophilus, H., Paula Kambunga, A. and Krishnamurthy, S. 2020. Decolonizing Participatory Design: Memory Making in Namibia. *Proceedings of the 16th Participatory Design Conference 2020 - Participation(s) Otherwise - Volume 1* (Manizales, Colombia, June 2020), 96–106.

[79] Chattopadhyay, B. 2017. Reconstructing atmospheres: Ambient sound in film and media production. *Communication and the Public*. 2, 4 (Dec. 2017), 352–364. https://doi.org/10.1177/2057047317742171.

[80] Chattopadhyay, B. 2022. *Sound Practices in the Global South: Co-listening to Resounding Plurilogues*. Springer Nature.

[81] Chaudhari, C., Prakash, A., Tsaasan, A.M., Brubaker, J.R. and Tanenbaum, T.J. 2016. Penseive Box: Themes for Digital Memorialization Practices. *Proceedings of the TEI '16: Tenth International Conference on Tangible, Embedded, and Embodied Interaction* (Feb. 2016), 398–403.

[82] 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.

[83] Chen, A.Y.S. and Odom, W. 2021. Crafting temporality in design: Introducing a designer-researcher approach through the creation of Chronoscope. *The Routledge International Handbook of Practice-Based Research*. Routledge. 368–380.

[84] Chen, A.Y.S., Odom, W., Neustaedter, C., Zhong, C. and Lin, H. 2023. Exploring Memory-Oriented Interactions with Digital Photos In and Across Time: A Field Study of Chronoscope. *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2023), 1–20.

[85] 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.

[86] Chen, P.G., Diaz, N., Lucas, G. and Rosenthal, M.S. 2010. Dissemination of Results in Community-Based Participatory Research. *American Journal of Preventive Medicine*. 39, 4 (Oct. 2010), 372–378. https://doi.org/10.1016/j.amepre.2010.05.021.

[87] Cheung, E., Ppali, S., Otkhmezuri, B., Thomas, C.L. and Covaci, A. 2023. Co-creating Meaningful Spaces: Stepping into Virtual Worlds Crafted by People Living with Dementia. *Companion Publication of the 2023 ACM Designing Interactive Systems Conference* (New York, NY, USA, July 2023), 81–85.

[88] Cheung, E., Ppali, S., Xygkou, A., Covaci, A., Jawharieh, H.H., Thomas, C.L. and Ang, C.S. 2023. Meaningful Spaces, Meaningful Places: Co-creating VR Experiences with People Living with Dementia. *Companion Publication of the 2023 ACM Designing Interactive Systems Conference* (New York, NY, USA, July 2023), 217–221.

[89] Choi, K.Y., Shinsato, D., Zhang, S., Nakagaki, K. and Ishii, H. 2018. reMi: Translating Ambient Sounds of Moment into Tangible and Shareable Memories through Animated Paper. *Adjunct Proceedings of the 31st Annual ACM Symposium on User Interface Software and Technology* (New York, NY, USA, 11 2018), 84–86.

[90] 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.

[91] Colusso, L., Bennett, C.L., Hsieh, G. and Munson, S.A. 2017. Translational Resources: Reducing the Gap Between Academic Research and HCI Practice. *Proceedings of the 2017 Conference on Designing Interactive Systems* (New York, NY, USA, June 2017), 957–968.

[92] Conference, R.T.D. and Sadokierski, Z. 2019. Critical Journal / Contextual Portfolio: A framework for documenting and disseminating RtD as scholarly research. (Apr. 2019). https://doi.org/10.6084/m9.figshare.7855829.v2.

[93] Conway, M.A. 2005. Memory and the self. *Journal of Memory and Language*. 53, 4 (Oct. 2005), 594–628. https://doi.org/10.1016/j.jml.2005.08.005.

[94] Conway, M.A. and Pleydell-Pearce, C.W. 2000. The construction of autobiographical memories in the self-memory system. *Psychological Review*. 107, 2 (Apr. 2000), 261–288. https://doi.org/10.1037/0033-295X.107.2.261.

[95] 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. https://doi.org/10.1080/07370024.2012.656047.

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

[97] Cox, R., Irving, A. and Wright, C. 2016. *Beyond text?: Critical practices and sensory anthropology*. Manchester University Press.

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

[99] Croley, C. 2023. A short history of zines.

[100] Cross, N. 1982. Designerly ways of knowing. *Design studies*. 3, 4 (1982), 221–227.

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

[102] Culén, A.L., Børsting, J. and Gaver, W. 2020. Strategies for Annotating Portfolios: Mapping Designs for New Domains. *Proceedings of the 2020 ACM Designing Interactive Systems Conference* (New York, NY, USA, July 2020), 1633–1645.

[103] Cullen, C. and Metatla, O. 2018. Multisensory storytelling: a co-design study with children with mixed visual abilities. *Proceedings of the 17th ACM Conference on Interaction Design and Children* (New York, NY, USA, June 2018), 557–562.

[104] Cully, J.A., LaVoie, D. and Gfeller, J.D. 2001. Reminiscence, Personality, and Psychological Functioning in Older Adults. *The Gerontologist*. 41, 1 (Feb. 2001), 89–95. https://doi.org/10.1093/geront/41.1.89.

[105] Dalsgaard, P. 2016. Experimental Systems in Research Through Design. *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, 2016), 4991–4996.

[106] Dalton, M.A., Desjardins, A. and Wakkary, R. 2014. From DIY tutorials to DIY recipes. *CHI '14 Extended Abstracts on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2014), 1405–1410.

[107] Davidoff, S., Lee, M.K., Dey, A.K. and Zimmerman, J. 2007. Rapidly Exploring Application Design Through Speed Dating. *UbiComp 2007: Ubiquitous Computing* (2007), 429–446.

[108] Deeken, A.H., Mukhopadhyay, S. and Jiang, X. 'Sara' 2020. Social media in academics and research: 21st-century tools to turbocharge education, collaboration, and dissemination of research findings. *Histopathology*. 77, 5 (2020), 688–699. https://doi.org/10.1111/his.14196.

[109] Deng, Z., Yang, P., Zhao, Y., Zhao, X. and Dong, F. 2015. Life-Logging Data Aggregation Solution for Interdisciplinary Healthcare Research and Collaboration. *2015 IEEE International Conference on Computer and Information Technology; Ubiquitous Computing and Communications; Dependable, Autonomic and Secure Computing; Pervasive Intelligence and Computing* (Oct. 2015), 2315–2320.

[110] Derrida, J. 2012. The voice that keeps silence. *The sound studies reader*. (2012), 495–503.

[111] Desjardins, A. and Key, C. 2020. Parallels, Tangents, and Loops: Reflections on the “Through” Part of RtD. *Proceedings of the 2020 ACM Designing Interactive Systems Conference* (New York, NY, USA, July 2020), 2133–2147.

[112] 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, June 2019), 147–160.

[113] Desjardins, A., Tihanyi, T., El Shabazz-Thompson, F., Craft, B. and Saimo, J. 2023. The Inner Ear: Capturing and Physicalizing Home Vibrations. *Proceedings of the 2023 ACM Designing Interactive Systems Conference* (New York, NY, USA, July 2023), 594–607.

[114] Desjardins, A. and Wakkary, R. 2016. Living In A Prototype: A Reconfigured Space. *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, May 2016), 5274–5285.

[115] Desjardins, A., Wakkary, R., Odom, W., Lin, H. and Schilling, M.L. 2017. Exploring DIY tutorials as a way to disseminate research through design. *Interactions*. 24, 4 (June 2017), 78–82. https://doi.org/10.1145/3098319.

[116] Di Lodovico, C. 2023. Exploring the Tensions of Self-tracking Wearable Technologies Through Design. *Human-Computer Interaction* (Cham, 2023), 30–46.

[117] 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.

[118] Dirks, L.G. 2021. Collaborative Research Results Dissemination: Applying Postcolonial Theory to Indigenous Community Contexts. *Diversity, Divergence, Dialogue* (Cham, 2021), 394–403.

[119] DiSalvo, C. and Lukens, J. 2009. Towards a Critical Technological Fluency: The Confluence of Speculative Design and Community Technology Programs. (Dec. 2009).

[120] Dissemination Planning Tool: Exhibit A from Volume 4. Programs, Tools, and Products: *https://www.ahrq.gov/patient-safety/reports/advances/planning.html*. Accessed: 2024-12-06.

[121] 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, June 2014), 63–72.

[122] 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.

[123] Dunford, R. 2017. Toward a decolonial global ethics. *Journal of Global Ethics*. 13, 3 (Sept. 2017), 380–397. https://doi.org/10.1080/17449626.2017.1373140.

[124] Dykes, T., Blythe, M., Wallace, J., Thomas, J. and Regan, T. 2016. RtD Comics: A Medium for Representing Research Through Design. *Proceedings of the 2016 ACM Conference on Designing Interactive Systems* (New York, NY, USA, 2016), 971–982.

[125] Dym, B., Aragon, C., Bullard, J., Davis, R. and Fiesler, C. 2018. Online Fandom: Boldly Going Where Few CSCW Researchers Have Gone Before. *Companion of the 2018 ACM Conference on Computer Supported Cooperative Work and Social Computing* (New York, NY, USA, Oct. 2018), 121–124.

[126] Dym, B. and Fiesler, C. 2020. Ethical and privacy considerations for research using online fandom data. *Transformative Works and Cultures*. 33, (June 2020). https://doi.org/10.3983/twc.2020.1733.

[127] Dym, B. and Fiesler, C. 2020. Social Norm Vulnerability and its Consequences for Privacy and Safety in an Online Community. *Proceedings of the ACM on Human-Computer Interaction*. 4, CSCW2 (Oct. 2020), 155:1-155:24. https://doi.org/10.1145/3415226.

[128] Echo-Hawk, R.C. 2000. Ancient History in the New World: Integrating Oral Traditions and the Archaeological Record in Deep Time. *American Antiquity*. 65, 2 (Apr. 2000), 267–290. https://doi.org/10.2307/2694059.

[129] Ehn, P. 2008. Participation in Design Things. *Proceedings of the Tenth Anniversary Conference on Participatory Design 2008* (Indianapolis, IN, USA, 2008), 92–101.

[130] Ehn, P. 1993. Scandinavian design: On participation and skill. *Participatory Design: Principles and Practices*. CRC Press. 77.

[131] Elements of Episodic Memory: 1983. *https://philpapers.org/rec/TULEOE*. Accessed: 2023-09-02.

[132] Elizabeth, B.S. and Dandavate, U. 1999. Design for experiencing: new tools. (1999).

[133] 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.

[134] 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. https://doi.org/10.1080/07370024.2015.1093422.

[135] 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 (2016), 45–45.

[136] Eraut, M. 2000. Non-formal learning and tacit knowledge in professional work. *British Journal of Educational Psychology*. 70, 1 (Mar. 2000), 113–136. https://doi.org/10.1348/000709900158001.

[137] 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.

[138] Fallman, D. 2003. Design-oriented human-computer interaction. *Proceedings of the SIGCHI conference on Human factors in computing systems* (2003), 225–232.

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

[140] Farias, P.G., Bendor, R. and van Eekelen, B.F. 2022. Social dreaming together: A critical exploration of participatory speculative design. *Proceedings of the Participatory Design Conference 2022 - Volume 2* (New York, NY, USA, 19 2022), 147–154.

[141] Farman, J. 2013. *The mobile story: Narrative practices with locative technologies*. Routledge.

[142] Fazackerley, A. 2023. 'Too greedy': mass walkout at global science journal over 'unethical' fees. *The Observer*.

[143] Feinberg, M. 2017. A Design Perspective on Data. *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, May 2017), 2952–2963.

[144] Feng, C. 2016. Designing Wearable Mobile Device Controllers for Blind People: A Co-Design Approach. *Proceedings of the 18th International ACM SIGACCESS Conference on Computers and Accessibility* (New York, NY, USA, Oct. 2016), 341–342.

[145] Feng, S., Mäntymäki, M., Dhir, A. and Salmela, H. 2021. How Self-tracking and the Quantified Self Promote Health and Well-being: Systematic Review. *Journal of Medical Internet Research*. 23, 9 (Sept. 2021), e25171. https://doi.org/10.2196/25171.

[146] 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. https://doi.org/10.1016/j.procs.2012.10.011.

[147] Fogg-Rogers, L., Sardo, A.M. and Grand, A. 2015. Beyond dissemination—science communication as impact. *Journal of Science Communication*. 14, 03 (2015), C01.

[148] Foote, J. 1999. An overview of audio information retrieval. *Multimedia systems*. 7, 1 (1999), 2–10.

[149] Fox, S., Menking, A., Steinhardt, S., Hoffmann, A.L. and Bardzell, S. 2017. Imagining Intersectional Futures: Feminist approaches in CSCW. *Companion of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing* (New York, NY, USA, Feb. 2017), 387–393.

[150] Fox, S. and Rosner, D. 2016. Extensions from the “field” | ACM Interactions.

[151] Fox, S. and Rosner, D.K. 2016. Continuing the Dialogue: Bringing Research Accounts Back into the Field. *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, May 2016), 1426–1430.

[152] Fox, S., Ulgado, R.R. and Rosner, D. 2015. Hacking Culture, Not Devices: Access and Recognition in Feminist Hackerspaces. *Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing* (New York, NY, USA, Feb. 2015), 56–68.

[153] Fox, S.E., Silva, R.M.L. and Rosner, D.K. 2018. Beyond the Prototype: Maintenance, Collective Responsibility, and Public IoT. *Proceedings of the 2018 Designing Interactive Systems Conference* (New York, NY, USA, 2018), 21–32.

[154] Frade, R., Vairinhos, M. and Gouveia, M. 2026. Feminist HCI in Practice: Developing a Storytelling Platform for Women in Tech Communities. *HCI International 2025 – Late Breaking Papers* (Cham, 2026), 13–27.

[155] Francomano, D., Rodríguez González, M.I., Valenzuela, A.E.J., Ma, Z., Raya Rey, A.N., Anderson, C.B. and Pijanowski, B.C. 2022. Human-nature connection and soundscape perception: Insights from Tierra del Fuego, Argentina. *Journal for Nature Conservation*. 65, (Feb. 2022), 126110. https://doi.org/10.1016/j.jnc.2021.126110.

[156] Frauenberger, C. 2019. Entanglement HCI The Next Wave? *ACM Transactions on Computer-Human Interaction*. 27, 1 (Nov. 2019), 2:1-2:27. https://doi.org/10.1145/3364998.

[157] 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. https://doi.org/10.1080/15710882.2011.587013.

[158] Frauenberger, C., Makhaeva, J. and Spiel, K. 2016. Designing Smart Objects with Autistic Children: Four Design Exposès. *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, May 2016), 130–139.

[159] Friedman, B., Kahn, P. and Borning, A. 2002. Value Sensitive Design: Theory and Methods. (2002).

[160] Friedman, B. and Nathan, L.P. 2010. Multi-lifespan information system design: a research initiative for the hci community. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (2010), 2243–2246.

[161] Friedman, B. and Yoo, D. 2017. Pause: A Multi-lifespan Design Mechanism. *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, May 2017), 460–464.

[162] 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, July 2020), 297–310.

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

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

[165] 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.

[166] Fry, T. 2009. Design futuring. *University of New South Wales Press, Sydney*. (2009), 71–77.

[167] Fyfe, A., Coate, K., Curry, S., Lawson, S., Moxham, N. and Røstvik, C.M. 2017. *Untangling Academic Publishing: A history of the relationship between commercial interests, academic prestige and the circulation of research*. Zenodo.

[168] Galloway, A. and Caudwell, C. 2018. Speculative design as research method: From answers to questions and “staying with the trouble.” *Undesign*. Routledge.

[169] Garde, J.A. and van der Voort, M.C. 2014. Participants' view on personal gains and PD process. *Proceedings of the 13th Participatory Design Conference: Short Papers, Industry Cases, Workshop Descriptions, Doctoral Consortium papers, and Keynote abstracts - Volume 2* (New York, NY, USA, Oct. 2014), 79–82.

[170] Gaver, B. and Bowers, J. 2012. Annotated portfolios. *Interactions*. 19, 4 (July 2012), 40–49. https://doi.org/10.1145/2212877.2212889.

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

[172] Gaver, W. 2012. What should we expect from research through design? *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (New York, NY, USA, May 2012), 937–946.

[173] 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, 2011), 1757–1766.

[174] Gaver, W., Boucher, A., Brown, D., Chatting, D., Matsuda, N., Ovalle, L., Sheen, A. and Vanis, M. 2022. Yo–Yo Machines: Self-Build Devices that Support Social Connections During the Pandemic. *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2022), 1–17.

[175] Gaver, W., Boucher, A., Jarvis, N., Cameron, D., Hauenstein, M., Pennington, S., Bowers, J., Pike, J., Beitra, R. and Ovalle, L. 2016. The Datacatcher: Batch Deployment and Documentation of 130 Location-Aware, Mobile Devices That Put Sociopolitically-Relevant Big Data in People's Hands: Polyphonic Interpretation at Scale. *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems* (2016), 1597–1607.

[176] Gaver, W., Boucher, A., Vanis, M., Sheen, A., Brown, D., Ovalle, L., Matsuda, N., Abbas-Nazari, A. and Phillips, R. 2019. My Naturewatch Camera: Disseminating Practice Research with a Cheap and Easy DIY Design. *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, May 2019), 1–13.

[177] Gaver, W., Bowers, J., Kerridge, T., Boucher, A. and Jarvis, N. 2009. Anatomy of a failure: how we knew when our design went wrong, and what we learned from it. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2009), 2213–2222.

[178] Gaver, W. and Gaver, F. 2023. Living with Light Touch: An Autoethnography of a Simple Communication Device in Long-Term Use. *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2023), 1–14.

[179] Gaver, W.W., Boucher, A., Pennington, S. and Walker, B. 2004. Cultural probes and the value of uncertainty. *interactions*. 11, 5 (Sept. 2004), 53. https://doi.org/10.1145/1015530.1015555.

[180] Gaver, W.W., Bowers, J., Boehner, K., Boucher, A., Cameron, D.W.T., Hauenstein, M., Jarvis, N. and Pennington, S. 2013. Indoor weather stations: investigating a ludic approach to environmental HCI through batch prototyping. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2013), 3451–3460.

[181] van Gennip, D., van den Hoven, E. and Markopoulos, P. 2015. Things That Make Us Reminisce: Everyday Memory Cues as Opportunities for Interaction Design. *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2015), 3443–3452.

[182] Gerlach, A. 2018. Thinking and Researching Relationally: Enacting Decolonizing Methodologies With an Indigenous Early Childhood Program in Canada. *International Journal of Qualitative Methods*. 17, 1 (Dec. 2018), 1609406918776075. https://doi.org/10.1177/1609406918776075.

[183] Giaccardi, E. and Redström, J. 2020. Technology and More-Than-Human Design. *Design Issues*. 36, 4 (Sept. 2020), 33–44. https://doi.org/10.1162/desi_a_00612.

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

[185] Gleaton, E.C. and Catrambone, R. 2026. A Taxonomy for Understanding the Disuse of Technology by Older Adults: A Qualitative Analysis of Disuse of Smart Speakers. *Human Factors: The Journal of the Human Factors and Ergonomics Society*. 68, 3 (Mar. 2026), 354–367. https://doi.org/10.1177/00187208251386675.

[186] Goodsell, D.S. 2021. Painting a Portrait of SARS-CoV-2: Art can be a tool for understanding the inner workings of cells. *American Scientist*. 109, 2 (Mar. 2021), 88–94.

[187] Goodwin, C., Woolley, S., de Quincey, E. and Collins, T. 2023. Quantifying Device Usefulness - How Useful is an Obsolete Device? *Human-Computer Interaction – INTERACT 2023* (Cham, 2023), 90–99.

[188] Goveia da Rocha, B., Andersen, K. and Tomico, O. 2022. Portfolio of Loose Ends. *Proceedings of the 2022 ACM Designing Interactive Systems Conference* (New York, NY, USA, June 2022), 527–540.

[189] GPT-4 Technical Report: 2023. *https://arxiv.org/abs/2303.08774v6*. Accessed: 2024-09-12.

[190] Gregg, N. 1987. Reflections on the Feminist Critique of Objectivity. *Journal of Communication Inquiry*. 11, 1 (Jan. 1987), 8–18. https://doi.org/10.1177/019685998701100102.

[191] Gregory, J. 2003. Scandinavian approaches to participatory design. *International Journal of Engineering Education*. 19, 1 (2003), 62–74.

[192] Groten, A. 2022. Unsettling individualized design practice through collaboration. *Critical by Design?: Genealogies, Practices, Positions*. transcript Verlag. 110–123.

[193] 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.

[194] H. Tan, N., Y. Wong, R., Desjardins, A., A. Munson, S. and Pierce, J. 2022. Monitoring Pets, Deterring Intruders, and Casually Spying on Neighbors: Everyday Uses of Smart Home Cameras. *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2022), 1–25.

[195] Hacihabiboglu, H., De Sena, E., Cvetkovic, Z., Johnston, J. and Smith III, J.O. 2017. Perceptual Spatial Audio Recording, Simulation, and Rendering: An overview of spatial-audio techniques based on psychoacoustics. *IEEE Signal Processing Magazine*. 34, 3 (May 2017), 36–54. https://doi.org/10.1109/MSP.2017.2666081.

[196] Hagood, M. 2019. *Hush: Media and sonic self-control*. Duke University Press.

[197] Hallett, J., Held, S., McCormick, A.K.H.G., Simonds, V., Real Bird, S., Martin, C., Simpson, C., Schure, M., Turnsplenty, N. and Trottier, C. 2017. What Touched Your Heart? Collaborative Story Analysis Emerging From an Apsáalooke Cultural Context. *Qualitative Health Research*. 27, 9 (July 2017), 1267–1277. https://doi.org/10.1177/1049732316669340.

[198] Hallnäs, L. and Redström, J. 2001. Slow Technology – Designing for Reflection. *Personal and Ubiquitous Computing*. 5, 3 (Aug. 2001), 201–212. https://doi.org/10.1007/PL00000019.

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

[200] 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.

[201] Hanks, W.F. 1989. Text and Textuality. *Annual Review of Anthropology*. 18, (1989), 95–127.

[202] Hannah, M.A. and Lam, C. 2016. Patterns of Dissemination: Examining and Documenting Practitioner Knowledge Sharing Practices on Blogs. *Technical Communication*. 63, 4 (Nov. 2016), 328–345.

[203] Haraway, D. 1988. Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective. *Feminist Studies*. 14, 3 (1988), 575. https://doi.org/10.2307/3178066.

[204] Harrison, S., Sengers, P. and Tatar, D. 2011. Making epistemological trouble: Third-paradigm HCI as successor science. *Interacting with Computers*. 23, 5 (Sept. 2011), 385–392. https://doi.org/10.1016/j.intcom.2011.03.005.

[205] Harter, L.M. 2019. Storytelling in Acoustic Spaces: Podcasting as Embodied and Engaged Scholarship. *Health Communication*. 34, 1 (Summer 2019), 125–129. https://doi.org/10.1080/10410236.2018.1517549.

[206] Harvey, M., Langheinrich, M. and Ward, G. 2016. Remembering through lifelogging: A survey of human memory augmentation. *Pervasive and Mobile Computing*. 27, (Apr. 2016), 14–26. https://doi.org/10.1016/j.pmcj.2015.12.002.

[207] 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, June 2014), 295–304.

[208] Hauser, S., Wakkary, R., Odom, W., Verbeek, P.-P., Desjardins, A., Lin, H., Dalton, M., Schilling, M. and de Boer, G. 2018. Deployments of the table-non-table: A Reflection on the Relation Between Theory and Things in the Practice of Design Research. *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2018), 1–13.

[209] Hay, K. 2022. Zineography: Exploring the Participatory Design Process of Collaborative Zine Making. *Proceedings of the Participatory Design Conference 2022 - Volume 2* (New York, NY, USA, Aug. 2022), 313–316.

[210] Hayes, G.R., Patel, S.N., Truong, K.N., Iachello, G., Kientz, J.A., Farmer, R. and Abowd, G.D. 2004. The Personal Audio Loop: Designing a Ubiquitous Audio-Based Memory Aid. *Mobile Human-Computer Interaction - MobileHCI 2004* (Berlin, Heidelberg, 2004), 168–179.

[211] Hendriks, N., Slegers, K. and Duysburgh, P. 2015. Codesign with people living with cognitive or sensory impairments: a case for method stories and uniqueness. *CoDesign*. 11, 1 (Jan. 2015), 70–82. https://doi.org/10.1080/15710882.2015.1020316.

[212] 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.

[213] Hersh, M. and Johnson, M.A. 2010. *Assistive Technology for Visually Impaired and Blind People*. Springer Science & Business Media.

[214] 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.

[215] 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.

[216] Hirsch, L., Hild, F. and Obaid, M. 2022. Design Recommendations for Historical Cemeteries Using Speculative Design. *Proceedings of the 25th International Academic Mindtrek Conference* (Nov. 2022), 147–157.

[217] Hofer, B.K. and Pintrich, P.R. 1997. The Development of Epistemological Theories: Beliefs About Knowledge and Knowing and Their Relation to Learning. *Review of Educational Research*. 67, 1 (Mar. 1997), 88–140. https://doi.org/10.3102/00346543067001088.

[218] Hofer, J., Busch, H., Poláčková Šolcová, I. and Tavel, P. 2017. When Reminiscence is Harmful: The Relationship Between Self-Negative Reminiscence Functions, Need Satisfaction, and Depressive Symptoms Among Elderly People from Cameroon, the Czech Republic, and Germany. *Journal of Happiness Studies*. 18, 2 (Apr. 2017), 389–407. https://doi.org/10.1007/s10902-016-9731-3.

[219] 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.

[220] Hofmann, M., Kasnitz, D., Mankoff, J. and Bennett, C.L. 2020. Living Disability Theory: Reflections on Access, Research, and Design. (2020), 13.

[221] Holbrook, J.B. 2019. Open Science, Open Access, and the Democratization of Knowledge. *Issues in Science and Technology*. 35, 3 (2019), 26–28.

[222] van den Hoven, E. 2014. A future-proof past: Designing for remembering experiences. *Memory Studies*. 7, 3 (July 2014), 370–384. https://doi.org/10.1177/1750698014530625.

[223] Hoven, E. van den, Sas, C. and Whittaker, S. 2012. Introduction to this Special Issue on Designing for Personal Memories: Past, Present, and Future. *Human–Computer Interaction*. 27, 1–2 (Apr. 2012), 1–12. https://doi.org/10.1080/07370024.2012.673451.

[224] Howell, N., Desjardins, A. and Fox, S. 2021. Cracks in the Success Narrative: Rethinking Failure in Design Research through a Retrospective Trioethnography. *ACM Transactions on Computer-Human Interaction*. 28, 6 (15 2021), 42:1-42:31. https://doi.org/10.1145/3462447.

[225] Howells, J. 1996. Tacit knowledge. *Technology Analysis & Strategic Management*. 8, 2 (Jan. 1996), 91–106. https://doi.org/10.1080/09537329608524237.

[226] 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.

[227] Hsu, L.-J., Swaminathan, M., Khoo, W., Amon, K.J., Sato, H., Dobbala, S., Tsui, K., Crandall, D. and Sabanovic, S. 2025. Bittersweet Snapshots of Life: Designing to Address Complex Emotions in a Reminiscence Interaction between Older Adults and a Robot. *Proceedings of the 2025 CHI Conference on Human Factors in Computing Systems* (Apr. 2025), 1–18.

[228] Huang, Y., Skatova, A., Bedwell, B., Rodden, T., Shipp, V. and Bertenshaw, E. 2015. Designing for Human Sustainability: The Role of Self-Reflection. *Proceedings of the 17th International Conference on Human-Computer Interaction with Mobile Devices and Services Adjunct* (New York, NY, USA, Aug. 2015), 1042–1045.

[229] Hutchinson, H., Mackay, W., Westerlund, B., Bederson, B.B., Druin, A., Plaisant, C., Beaudouin-Lafon, M., Conversy, S., Evans, H., Hansen, H., Roussel, N. and Eiderbäck, B. 2003. Technology probes: inspiring design for and with families. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2003), 17–24.

[230] Ihde, D. 1976. Listening and voice: A phenomenology of sound. *Human Studies*. 1, 3 (1976).

[231] 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.

[232] Iversen, O.S. and Dindler, C. 2014. Sustaining participatory design initiatives. *CoDesign*. 10, 3–4 (July 2014), 153–170. https://doi.org/10.1080/15710882.2014.963124.

[233] Iwasa, J.H. 2016. The Scientist as Illustrator. *Trends in Immunology*. 37, 4 (Apr. 2016), 247–250. https://doi.org/10.1016/j.it.2016.02.002.

[234] Jacobsen, B.N. and Beer, D. 2021. Quantified nostalgia: Social media, metrics, and memory. *Social Media+ Society*. 7, 2 (2021), 20563051211008822.

[235] Jacquemard, T., Novitzky, P., O'Brolcháin, F., Smeaton, A.F. and Gordijn, B. 2014. Challenges and Opportunities of Lifelog Technologies: A Literature Review and Critical Analysis. *Science and Engineering Ethics*. 20, 2 (June 2014), 379–409. https://doi.org/10.1007/s11948-013-9456-1.

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

[237] Jang, E., Johnson, M., Burnell, E. and Heimerl, K. 2017. Unplanned Obsolescence. *Proceedings of the 2017 Workshop on Computing Within Limits* (June 2017), 93–101.

[238] 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.

[239] Jarvis, N., Cameron, D. and Boucher, A. 2012. Attention to detail: annotations of a design process. *Proceedings of the 7th Nordic Conference on Human-Computer Interaction: Making Sense Through Design* (New York, NY, USA, Oct. 2012), 11–20.

[240] Jayaratne, K. 2016. The Memory Tree: Using Sound to Support Reminiscence. *Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems* (New York, NY, USA, May 2016), 116–121.

[241] Jenkins, T., Andersen, K., Gaver, W., Odom, W., Pierce, J. and Vallgårda, A. 2016. Attending to Objects as Outcomes of Design Research. *Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems* (New York, NY, USA, May 2016), 3423–3430.

[242] Jiang, Q., Naseem, M., Lai, J., Toyama, K. and Papalambros, P. 2022. Understanding Power Differentials and Cultural Differences in Co-design with Marginalized Populations. *Proceedings of the 5th ACM SIGCAS/SIGCHI Conference on Computing and Sustainable Societies* (New York, NY, USA, June 2022), 165–179.

[243] Jiang, S., Li, Z., Zhou, P. and Li, M. 2019. Memento: An Emotion-driven Lifelogging System with Wearables. *ACM Transactions on Sensor Networks*. 15, 1 (Jan. 2019), 1–23. https://doi.org/10.1145/3281630.

[244] Jiang, Z., Yeo, S., Seow, W.X., Donovan and Perrault, S.T. 2025. Remini: Leveraging Chatbot-Mediated Mutual Reminiscence for Promoting Positive Affect and Feeling of Connectedness among Loved Ones. *Proceedings of the ACM on Human-Computer Interaction*. 9, 7 (Oct. 2025), 1–43. https://doi.org/10.1145/3757650.

[245] Jin, Y., Cai, W., Chen, L., Zhang, Y., Doherty, G. and Jiang, T. 2024. Exploring the Design of Generative AI in Supporting Music-based Reminiscence for Older Adults. *Proceedings of the 2024 CHI Conference on Human Factors in Computing Systems* (May 2024), 1–17.

[246] 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.

[247] Jones, S.L. and Kelly, R. 2018. Dealing With Information Overload in Multifaceted Personal Informatics Systems. *Human–Computer Interaction*. 33, 1 (Jan. 2018), 1–48. https://doi.org/10.1080/07370024.2017.1302334.

[248] 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. https://doi.org/10.4156/jdcta.vol5.issue5.40.

[249] Joshi, T., Biggs, H., Bardzell, J. and Bardzell, S. 2024. Who is “I”?: Subjectivity and Ethnography in HCI. *Proceedings of the 2024 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, May 2024), 1–15.

[250] Jung, J.Y., Steinberger, T., Kim, J. and Ackerman, M.S. 2022. “So What? What’s That to Do With Me?” Expectations of People With Visual Impairments for Image Descriptions in Their Personal Photo Activities. *Proceedings of the 2022 ACM Designing Interactive Systems Conference* (June 2022), 1893–1906.

[251] Kanngieser, A. 2015. Geopolitics and the Anthropocene: Five Propositions for Sound. *GeoHumanities*. 1, 1 (Jan. 2015), 80–85. https://doi.org/10.1080/2373566X.2015.1075360.

[252] Kawachi, M. 2020. Enabling citizens’ speculation: The method of co-speculation for collectively imagining possible futures of ‘ikigai’ in an aging society. (2020).

[253] Keane, W. 2003. Self-Interpretation, Agency, and the Objects of Anthropology: Reflections on a Genealogy. *Comparative Studies in Society and History*. 45, 2 (Apr. 2003), 222–248. https://doi.org/10.1017/S0010417503000124.

[254] Kero, R.H. 2021. A History of Zines. *BOOK RIOT*.

[255] Kim, K.J., Jang, S., Kim, B., Kwon, H. and Park, Y.-W. 2019. muRedder: Shredding Speaker for Ephemeral Musical Experience. *Proceedings of the 2019 on Designing Interactive Systems Conference* (New York, NY, USA, June 2019), 127–134.

[256] Kim, S., Jang, S., Moon, J., Han, M. and Park, Y.-W. 2022. Slide2Remember: an Interactive Wall Frame Enriching Reminiscence Experiences by Providing Re-encounters of Taken Photos and Heard Music in a Similar Period. *Designing Interactive Systems Conference* (New York, NY, USA, June 2022), 288–300.

[257] Kinnee, B., Rosner, D.K. and Desjardins, A. 2022. Sonic Technologies of a Queer Breakup. *Proceedings of the 2022 ACM Designing Interactive Systems Conference* (New York, NY, USA, June 2022), 1377–1393.

[258] Kirby, D. 2010. The Future is Now: Diegetic Prototypes and the Role of Popular Films in Generating Real-world Technological Development. *Social Studies of Science*. 40, 1 (Feb. 2010), 41–70. https://doi.org/10.1177/0306312709338325.

[259] 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.

[260] Kneifel, J. 2023. *Memento Flori: Speculative design approaches to memorials of the future*. Simon Fraser University.

[261] Kosch, T., Welsch, R., Chuang, L. and Schmidt, A. 2023. The Placebo Effect of Artificial Intelligence in Human–Computer Interaction. *ACM Transactions on Computer-Human Interaction*. 29, 6 (Jan. 2023), 1–32. https://doi.org/10.1145/3529225.

[262] Koskinen, I., Zimmerman, J., Binder, T., Redström, J. and Wensveen, S. 2011. Design Research through Practice. (2011).

[263] 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. https://doi.org/10.3233/RNN-160647.

[264] Kritika, K. and Ringland, K.E. 2023. “You are finally Home”: Centering Playful Marginalized Community Values in Designing Online Social Platforms. *Companion Publication of the 2023 Conference on Computer Supported Cooperative Work and Social Computing* (New York, NY, USA, Oct. 2023), 81–85.

[265] Kurzgesagt: *https://kurzgesagt.org/*. Accessed: 2024-02-08.

[266] LaBelle, B. 2015. *Background noise: perspectives on sound art*. Bloomsbury Publishing USA.

[267] Laura Ramí-rez Galleguillos, M. and Coşkun, A. 2020. How Do I matter? A Review of the Participatory Design Practice with Less Privileged Participants. *Proceedings of the 16th Participatory Design Conference 2020 - Participation(s) Otherwise - Volume 1* (New York, NY, USA, June 2020), 137–147.

[268] Lee, H.-C., Cheng, Y.F., Cho, S.Y., Tang, H.-H., Hsu, J. and Chen, C.-H. 2014. Picgo: designing reminiscence and storytelling for the elderly with photo annotation. *Proceedings of the 2014 companion publication on Designing interactive systems* (New York, NY, USA, 21 2014), 9–12.

[269] Lee, K. 2025. Designing Personal Informatics in Context: Toward Collective Well-being through Nuanced Personal Data. *Companion Publication of the 2025 ACM Designing Interactive Systems Conference* (July 2025), 100–103.

[270] Lee, Y. and Lee, C.H. 2026. When Plants Play: Rethinking Plant Materiality in Digital Games. *Proceedings of the 2026 CHI Conference on Human Factors in Computing Systems* (Apr. 2026), 1–17.

[271] 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.

[272] Lewis, D.W. 2017. The Inevitability of Open Access | Lewis | College & Research Libraries. (Apr. 2017). https://doi.org/https://doi.org/10.5860/crl-299.

[273] Li, J., Yan, Z., Jarjue, E.H., Shetty, A. and Peng, H. 2022. TangibleGrid: Tangible Web Layout Design for Blind Users. *Proceedings of the 35th Annual ACM Symposium on User Interface Software and Technology* (New York, NY, USA, 28 2022), 1–12.

[274] Liang, C.A., Munson, S.A. and Kientz, J.A. 2021. Embracing Four Tensions in Human-Computer Interaction Research with Marginalized People. *ACM Transactions on Computer-Human Interaction*. 28, 2 (17 2021), 14:1-14:47. https://doi.org/10.1145/3443686.

[275] Lindley, J., Green, D., Dore, M., Mason, Z., Coulton, C., Berger, A. and Sturdee, M. 2022. Communicating the value of design research. *DRS Biennial Conference Series*. (June 2022).

[276] Lindley, S.E. 2012. Before I Forget: From Personal Memory to Family History. *Human–Computer Interaction*. 27, 1–2 (Apr. 2012), 13–36. https://doi.org/10.1080/07370024.2012.656065.

[277] lisahunter and emerald, elke 2016. Sensory narratives: capturing embodiment in narratives of movement, sport, leisure and health. *Sport, Education and Society*. 21, 1 (Jan. 2016), 28–46. https://doi.org/10.1080/13573322.2015.1065244.

[278] Liu, X., Carrington, P., Chen, X. “Anthony” and Pavel, A. 2021. What Makes Videos Accessible to Blind and Visually Impaired People? *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems* (Yokohama Japan, May 2021), 1–14.

[279] Lohmann, J.C. 2018. *The Department of Seaweed: Co-Speculative Design in a Museum Residency*. Royal College of Art (United Kingdom).

[280] Lomborg, S. and Frandsen, K. 2016. Self-tracking as communication. *Information, Communication & Society*. 19, 7 (July 2016), 1015–1027. https://doi.org/10.1080/1369118X.2015.1067710.

[281] Long, T. et al. 2025. Facilitating Longitudinal Interaction Studies of AI Systems. *Adjunct Proceedings of the 38th Annual ACM Symposium on User Interface Software and Technology* (Sept. 2025), 1–5.

[282] 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.

[283] Loveless, N. 2019. *How to make art at the end of the world: A manifesto for research-creation*. Duke University Press.

[284] Loveless, N.S. 2015. Towards a Manifesto on Research-Creation. *RACAR: revue d’art canadienne / Canadian Art Review*. 40, 1 (2015), 52–54.

[285] Lowenstein-Barkai, H. and Lev-on, A. 2022. News videos consumption in an age of new media: a comparison between adolescents and adults. *Journal of Children and Media*. 16, 1 (Jan. 2022), 78–94. https://doi.org/10.1080/17482798.2021.1915831.

[286] Löwgren, J. 2013. Annotated portfolios and other forms of intermediate-level knowledge. *Interactions*. 20, 1 (Jan. 2013), 30–34. https://doi.org/10.1145/2405716.2405725.

[287] Lyckvi, S., Roto, V., Buie, E. and Wu, Y. 2018. The role of design fiction in participatory design processes. *Proceedings of the 10th Nordic Conference on Human-Computer Interaction* (New York, NY, USA, 29 2018), 976–979.

[288] Maas, F. et al. 2023. “hubbel”: A Hybrid Letterbox That Stimulates Civic Participation Through Local Information Sharing in Neighbourhoods. *Proceedings of the 2023 ACM Designing Interactive Systems Conference* (New York, NY, USA, 10 2023), 1826–1841.

[289] 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. https://doi.org/10.1038/sj.eye.6701879.

[290] MacKenzie, L.E. 2019. Science podcasts: analysis of global production and output from 2004 to 2018. *Royal Society Open Science*. 6, 1 (Jan. 2019), 180932. https://doi.org/10.1098/rsos.180932.

[291] Magnusson, C., Hedvall, P.-O. and Caltenco, H. 2018. Co-designing together with Persons with Visual Impairments. *Mobility of Visually Impaired People: Fundamentals and ICT Assistive Technologies*. E. Pissaloux and R. Velazquez, eds. Springer International Publishing. 411–434.

[292] 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.

[293] Mapes, M. and Terigele, T. 2023. Criticizing Paywall Publishing, or Integrating Open Access into the Feminist Movement. *Journal of Feminist Scholarship*. 22, 22 (Jan. 2023), 1–17. https://doi.org/10.23860/jfs.2023.22.01.

[294] 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.

[295] 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.

[296] 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.

[297] McAdams, D.P. 2011. Narrative Identity. *Handbook of Identity Theory and Research*. S.J. Schwartz, K. Luyckx, and V.L. Vignoles, eds. Springer. 99–115.

[298] McAdams, D.P. and Cox, K.S. 2010. Self and Identity across the Life Span. *The Handbook of Life-Span Development*. John Wiley & Sons, Ltd.

[299] McAdams, S.E. and Bigand, E.E. 1993. Thinking in sound: The cognitive psychology of human audition. (1993).

[300] McCarthy, S., Sayers, H.M., McKevitt, P. and McTear, M.F. 2009. MemoryLane: reminiscence for older adults. *CEUR Workshop Proceedings* (Technical University of Aachen (RWTH), Germany, Sept. 2009), 22–27.

[301] 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.

[302] Mellis, D.A. and Buechley, L. 2014. Do-it-yourself cellphones: an investigation into the possibilities and limits of high-tech diy. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2014), 1723–1732.

[303] 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. https://doi.org/10.1080/15710882.2015.1007877.

[304] Michigan Shipwrecks Web App [Map]: *https://midnr.maps.arcgis.com/apps/webappviewer/index.html?id=2d6d46fccdc349c197202403a476988d*. Accessed: 2024-09-12.

[305] Miles, M.B. and Huberman, A.M. 1985. *Qualitative data analysis*. Sage Newbury Park,, CA.

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

[307] Misra, S., Dhar, D. and Nandi, S. 2023. Design Fiction: A Way to Foresee the Future of Human–Computer Interaction Design Challenges. *Design in the Era of Industry 4.0, Volume 1* (Singapore, 2023), 809–822.

[308] Mizen, M.B. 2004. Scrapbook photo albums are therapeutic for Alzheimer's patients. *Creative Memories*. (2004), 2–3.

[309] Mohajan, D. and Mohajan, H. 2022. Exploration of Coding in Qualitative Data Analysis: Grounded Theory Perspective. 1, (Sept. 2022), 50–60.

[310] Moncur, W., Julius, M., Van Den Hoven, E. and Kirk, D. 2015. Story Shell: the participatory design of a bespoke digital memorial. *Proceedings of 4th Participatory Innovation Conference* (2015), 470–477.

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

[312] Moura, M., Portugal, C. and Guimarães, M. 2026. Digital Platform to Foster Social Engagement for the Visually Impaired. *DRS Biennial Conference Series* (June 2026).

[313] Mucina, D.D. 2011. Story as Research Methodology. *AlterNative: An International Journal of Indigenous Peoples*. 7, 1 (May 2011), 1–14. https://doi.org/10.1177/117718011100700101.

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

[315] 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.

[316] Naff, D.B. 2020. Podcasting as a Dissemination Method for a Researcher-Practitioner Partnership. *International Journal of Education Policy and Leadership*. 16, 13 (2020).

[317] Neilson, D. 2020. Beyond the subject–object binary: Towards cosmopolitan knowledge. *Theory & Psychology*. 30, 3 (June 2020), 448–454. https://doi.org/10.1177/0959354320920943.

[318] Nelson, H.G. and Stolterman, E. 2003. *The design way: Intentional change in an unpredictable world: Foundations and fundamentals of design competence*. Educational Technology.

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

[320] Nicenboim, I., Elisa, G. and Redström, J. 2023. Designing more-than-human AI : experiments on situated conversations and silences. *diid disegno industriale industrial design*. 80 (2023), 32–43.

[321] Nicenboim, I., Oogjes, D., Biggs, H. and Nam, S. 2025. Decentering Through Design: Bridging Posthuman Theory with More-than-Human Design Practices. *Human–Computer Interaction*. 40, 1–4 (Jan. 2025), 195–220. https://doi.org/10.1080/07370024.2023.2283535.

[322] Nicenboim, I., View Profile, Giaccardi, E., View Profile, Søndergaard, M.L.J., View Profile, Reddy, A.V., View Profile, Strengers, Y., View Profile, Pierce, J., View Profile, Redström, J., and View Profile 2020. More-Than-Human Design and AI: In Conversation with Agents. *Companion Publication of the 2020 ACM Designing Interactive Systems Conference* (July 2020), 397–400.

[323] Niedderer, K. 2013. Explorative Materiality and Knowledge. The Role of Creative Exploration and Artefacts in Design Research. *FormAkademisk*. 6, 2 (Aug. 2013). https://doi.org/10.7577/formakademisk.651.

[324] 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.

[325] 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.

[326] 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.

[327] Nordin, H., Almeida, T. and Wiberg, M. 2023. Designing to restory the past : storytelling for empowerment through a digital archive. *International Journal of Design*. 17, 1 (2023), 91–104.

[328] 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.

[329] Odom, W., Banks, R., Durrant, A., Kirk, D. and Pierce, J. 2012. Slow Technology: Critical Reflection and Future Directions. *Proceedings of the Designing Interactive Systems Conference* (New York, NY, USA, 2012), 816–817.

[330] 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.

[331] Odom, W., Barnett, S., Brand, N., Yoo, M., Lin, H. and White, J. 2024. Negotiating Conceptual and Practical Frictions in Making the Capra Short Film: Extending a Research through Design Artifact with Video. *Proceedings of the 2024 ACM Designing Interactive Systems Conference* (New York, NY, USA, July 2024), 2866–2881.

[332] Odom, W., Berger, A. and De Roeck, D. 2021. Co-Designing and Co-Speculating on Different Forms of Domestic Smart Things. *Designing Smart Objects in Everyday Life: Intelligences, Agencies, Ecologies*. Bloomsbury Publishing. 224–246.

[333] Odom, W., Bertran, I., Hertz, G., Lin, H., Chen, A.Y.S., Harkness, M. and Wakkary, R. 2019. Unpacking the Thinking and Making Behind a Slow Technology Research Product with Slow Game. *Proceedings of the 2019 Conference on Creativity and Cognition* (New York, NY, USA, June 2019), 15–28.

[334] 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* (New York, NY, USA, Apr. 2018), 1–9.

[335] Odom, W., Jenkins, T., Andersen, K., Gaver, B., Pierce, J., Vallgårda, A., Boucher, A., Chatting, D., van Kollenburg, J. and Lefeuvre, K. 2017. Crafting a place for attending to the things of design at CHI. *Interactions*. 25, 1 (Dec. 2017), 52–57. https://doi.org/10.1145/3161605.

[336] Odom, W., Lindley, S., Pschetz, L., Tsaknaki, V., Vallgårda, A., Wiberg, M. and Yoo, D. 2018. Time, Temporality, and Slowness: Future Directions for Design Research. *Proceedings of the 2018 ACM Conference Companion Publication on Designing Interactive Systems* (New York, NY, USA, May 2018), 383–386.

[337] 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.

[338] Odom, W., Stolterman, E. and Chen, A.Y.S. 2022. Extending a Theory of Slow Technology for Design through Artifact Analysis. *Human–Computer Interaction*. 37, 2 (Mar. 2022), 150–179. https://doi.org/10.1080/07370024.2021.1913416.

[339] Odom, W. and Wakkary, R. 2015. Intersecting with Unaware Objects. *Proceedings of the 2015 ACM SIGCHI Conference on Creativity and Cognition* (New York, NY, USA, June 2015), 33–42.

[340] Odom, W., Wakkary, R., Bertran, I., Harkness, M., Hertz, G., Hol, J., Lin, H., Naus, B., Tan, P. and Verburg, P. 2018. Attending to Slowness and Temporality with Olly and Slow Game: A Design Inquiry Into Supporting Longer-Term Relations with Everyday Computational Objects. *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2018), 1–13.

[341] 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.

[342] Odom, W., Wakkary, R., Lim, Y., Desjardins, A., Hengeveld, B. and Banks, R. 2016. From Research Prototype to Research Product. *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems - CHI '16* (Santa Clara, California, USA, May 2016), 2549–2561.

[343] 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, July 2020), 283–295.

[344] 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.

[345] 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.

[346] Ogbonnaya-Ogburu, I.F., Smith, A.D.R., To, A. and Toyama, K. 2020. Critical Race Theory for HCI. *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2020), 1–16.

[347] 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, Sept. 2008), 163–172.

[348] 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.

[349] Olson, W., El Shabazz-Thompson, F., Wells, M., Yee, J., Saimo, J.R., Xiong, B., Craft, B. and Desjardins, A. 2023. Exposing Tensions in Documentary Filmmaking for Design Research: The Inner Ear Shorts. *Companion Publication of the 2023 ACM Designing Interactive Systems Conference* (New York, NY, USA, July 2023), 198–202.

[350] Oogjes, D., Biggs, H., Desjardins, A., Campo Woytuk, N., Janicki, S., Helms, K., Andersen, K., Devendorf, L., Søndergaard, M.L.J. and Jönsson, L. 2025. How do design stories work? Exploring narrative forms of knowledge in HCI. *Proceedings of the Extended Abstracts of the CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, 25 2025), 1–6.

[351] Oogjes, D. and Desjardins, A. 2024. A temporal vocabulary of Design Events for Research through Design. *Proceedings of the CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, May 2024), 1–12.

[352] Oogjes, D. and Wakkary, R. 2022. Weaving Stories: Toward Repertoires for Designing Things. *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2022), 1–21.

[353] Oogjes, D., Wakkary, R., Lin, H. and Alemi, O. 2020. Fragile! Handle with Care: The Morse Things. *Proceedings of the 2020 ACM Designing Interactive Systems Conference* (New York, NY, USA, July 2020), 2149–2162.

[354] Open Access: 2023. *https://science.gc.ca/site/science/en/interagency-research-funding/policies-and-guidelines/open-access*. Accessed: 2024-01-31.

[355] Open access - European Commission: *https://research-and-innovation.ec.europa.eu/strategy/strategy-2020-2024/our-digital-future/open-science/open-access_en*. Accessed: 2024-01-31.

[356] Open-Access-Initiativen - BMBF Digitale Zukunft: *https://www.bildung-forschung.digital/digitalezukunft/de/wissen/open-access/open-access-initiativen/open-access-initiativen_node.html*. Accessed: 2024-01-31.

[357] Orlikowski, W.J. 2006. Material knowing: the scaffolding of human knowledgeability. *European Journal of Information Systems*. 15, 5 (Oct. 2006), 460–466. https://doi.org/10.1057/palgrave.ejis.3000639.

[358] Orton, L., Lloyd-Williams, F., Taylor-Robinson, D., O'Flaherty, M. and Capewell, S. 2011. The Use of Research Evidence in Public Health Decision Making Processes: Systematic Review. *PLOS ONE*. 6, 7 (July 2011), e21704. https://doi.org/10.1371/journal.pone.0021704.

[359] Özdemir, V. 2023. Feminism Is for Everyone: Scientists, Too. *OMICS: A Journal of Integrative Biology*. 27, 11 (Nov. 2023), 497–498. https://doi.org/10.1089/omi.2023.0216.

[360] 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.

[361] 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.

[362] Perin, D., Keselman, A. and Monopoli, M. 2003. The academic writing of community college remedial students: Text and learner variables. *Higher Education*. 45, 1 (Jan. 2003), 19–42. https://doi.org/10.1023/A:1021237532056.

[363] Petrelli, D., van den Hoven, E. and Whittaker, S. 2009. Making history: intentional capture of future memories. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2009), 1723–1732.

[364] 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. https://doi.org/10.1007/s00779-016-0993-x.

[365] Petrelli, D., Not, E., Sarini, M., Stock, O., Strapparava, C. and Zancanaro, M. 1999. HyperAudio: location-awareness + adaptivity. *CHI '99 extended abstracts on Human factors in computing systems - CHI '99* (Pittsburgh, Pennsylvania, 1999), 21.

[366] 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.

[367] 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.

[368] Pierce, J. 2021. In Tension with Progression: Grasping the Frictional Tendencies of Speculative, Critical, and other Alternative Designs. *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, May 2021), 1–19.

[369] Pierce, J. 2014. On the presentation and production of design research artifacts in HCI. *Proceedings of the 2014 conference on Designing interactive systems* (New York, NY, USA, June 2014), 735–744.

[370] Pierce, J. and Paulos, E. 2014. Counterfunctional things: exploring possibilities in designing digital limitations. *Proceedings of the 2014 conference on Designing interactive systems* (New York, NY, USA, June 2014), 375–384.

[371] 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.

[372] Pierce, J. and Paulos, E. 2015. Making Multiple Uses of the Obscura 1C Digital Camera: Reflecting on the Design, Production, Packaging and Distribution of a Counterfunctional Device. *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2015), 2103–2112.

[373] Pijanowski, B.C., Farina, A., Gage, S.H., Dumyahn, S.L. and Krause, B.L. 2011. What is soundscape ecology? An introduction and overview of an emerging new science. *Landscape ecology*. 26, (2011), 1213–1232.

[374] Pijanowski, B.C., Villanueva-Rivera, L.J., Dumyahn, S.L., Farina, A., Krause, B.L., Napoletano, B.M., Gage, S.H. and Pieretti, N. 2011. Soundscape Ecology: The Science of Sound in the Landscape. *BioScience*. 61, 3 (Mar. 2011), 203–216. https://doi.org/10.1525/bio.2011.61.3.6.

[375] Pinch, T. and Bijsterveld, K. 2004. Sound Studies: New Technologies and Music. *Social Studies of Science*. 34, 5 (Oct. 2004), 635–648. https://doi.org/10.1177/0306312704047615.

[376] Powell, K.M. and Takayoshi, P. 2003. Accepting Roles Created for Us: The Ethics of Reciprocity. *College Composition and Communication*. 54, 3 (2003), 394–422. https://doi.org/10.2307/3594171.

[377] Ppali, S., Cheung, E., Covaci, A., She, W.J. and Ang, C.S. 2025. Creating with Care: Co-designing Immersive Experiences through Art-making with People Living with Dementia. *Proceedings of the 2025 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2025).

[378] Ppali, S., Jang, Y.J., Pasia, M., Papallas, A., Zaphiris, P. and Covaci, A. 2024. Tingbao: A musical Immersive Experience Inspired by Environmental Themes. *Companion Proceedings of the 2024 Annual Symposium on Computer-Human Interaction in Play* (New York, NY, USA, Oct. 2024), 318–323.

[379] 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.

[380] 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.

[381] Pschetz, L. and Bastian, M. 2018. Temporal Design: Rethinking time in design. *Design Studies*. 56, (May 2018), 169–184. https://doi.org/10.1016/j.destud.2017.10.007.

[382] Raby, F. and Dunne, A. 2013. *Speculative Everything*.

[383] Race, L., Fleet, C., Miele, J.A., Igoe, T. and Hurst, A. 2019. Designing Tactile Schematics: Improving Electronic Circuit Accessibility. *The 21st International ACM SIGACCESS Conference on Computers and Accessibility* (New York, NY, USA, Oct. 2019), 581–583.

[384] Raja, A., Ruitenburg, Y., van Velzen, N., Lee, M. and Brankaert, R. 2026. Talking to Heirlooms: Exploring Embodiments of Conversational Agents Designed to Support Reminiscence for People with Dementia. *Proceedings of the Extended Abstracts of the 2026 CHI Conference on Human Factors in Computing Systems* (Apr. 2026), 1–7.

[385] Ranjan, A., View Profile, Balakrishnan, R., View Profile, Chignell, M., and View Profile 2006. Searching in Audio: the Utility of Transcripts, Dichotic Presentation, and Time-Compression. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (Apr. 2006), 721–730.

[386] Rapp, A. and Cena, F. 2016. Personal informatics for everyday life: How users without prior self-tracking experience engage with personal data. *International Journal of Human-Computer Studies*. 94, (Oct. 2016), 1–17. https://doi.org/10.1016/j.ijhcs.2016.05.006.

[387] Rapp, A., Odom, W., Pschetz, L. and Petrelli, D. 2022. Introduction to the special issue on time and HCI. *Human–Computer Interaction*. 37, 1 (Jan. 2022), 1–14. https://doi.org/10.1080/07370024.2021.1955681.

[388] Rayne, A., Byrnes, G., Collier-Robinson Ngāi Tahu, L., Ngāti Apa ki te rā tō, Te Whānau-ā-Apanui, Ngāti Porou, Hollows, J., McIntosh, A., Ramsden Kāti Huikai, M., Kāi Tahu, Rupene Ngāi Tūāhuriri, M., Ngāi Tahu, Tamati-Elliffe Kāi Te Pahi, P., Kāi Te Ruahikihiki (Ōtākou), Te Atiawa, Ngāti Mutunga, Thoms Ngāti Kurī, C., Ngāi Tahu and Steeves, T.E. 2020. Centring Indigenous knowledge systems to re-imagine conservation translocations. *People and Nature*. 2, 3 (2020), 512–526. https://doi.org/10.1002/pan3.10126.

[389] Rayner, S.J. 2019. Academic Publishing. *The Oxford Handbook of Publishing*. A. Phillips and M. Bhaskar, eds. Oxford University Press. 0.

[390] Ribeiro, R., Trifan, A. and Neves, A.J.R. 2022. Lifelog Retrieval From Daily Digital Data: Narrative Review. *JMIR mHealth and uHealth*. 10, 5 (May 2022), e30517. https://doi.org/10.2196/30517.

[391] Richardson, J. 2004. Jonathan Sterne, The Audible Past: Cultural Origins of Sound Reproduction. Duke University Press, Durham & London, 2003. 450 pp. Paperback. ISBN 0-8223-3013.X. *Organised Sound*. 9, 1 (Apr. 2004), 117–119. https://doi.org/10.1017/S1355771804230151.

[392] Ringland, K.E., Bhattacharya, A., Weatherwax, K., Eagle, T. and Wolf, C.T. 2022. ARMY's Magic Shop: Understanding the Collaborative Construction of Playful Places in Online Communities. *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2022), 1–19.

[393] Robinson, D. 2020. *Hungry Listening: Resonant Theory for Indigenous Sound Studies*. U of Minnesota Press.

[394] Roedl, D.J. and Stolterman, E. 2013. Design research at CHI and its applicability to design practice. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2013), 1951–1954.

[395] Saganowski, S., Perz, B., Polak, A.G. and Kazienko, P. 2023. Emotion Recognition for Everyday Life Using Physiological Signals From Wearables: A Systematic Literature Review. *IEEE Transactions on Affective Computing*. 14, 3 (July 2023), 1876–1897. https://doi.org/10.1109/TAFFC.2022.3176135.

[396] 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.

[397] Sakaguchi-Tang, D.K., Cunningham, J.L., Roldan, W., Yip, J. and Kientz, J.A. 2021. Co-Design with Older Adults: Examining and Reflecting on Collaboration with Aging Communities. *Proceedings of the ACM on Human-Computer Interaction*. 5, CSCW2 (18 2021), 362:1-362:28. https://doi.org/10.1145/3479506.

[398] Salselas, I. and Penha, R. 2019. The role of sound in inducing storytelling in immersive environments. *Proceedings of the 14th International Audio Mostly Conference: A Journey in Sound* (New York, NY, USA, Sept. 2019), 191–198.

[399] Samuel, C.A. and Ortiz, D.L. 2021. "Method and meaning": Storytelling as decolonial praxis in the psychology of racialized peoples. *New Ideas in Psychology*. 62, (Aug. 2021), 100868. https://doi.org/10.1016/j.newideapsych.2021.100868.

[400] 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.

[401] Sanders, E.B.-N. 2000. Generative Tools for Co-designing. *Collaborative Design*. S.A.R. Scrivener, L.J. Ball, and A. Woodcock, eds. Springer London. 3–12.

[402] Sanders, E.B.-N. and Stappers, P.J. 2008. Co-creation and the new landscapes of design. *CoDesign*. 4, 1 (Mar. 2008), 5–18. https://doi.org/10.1080/15710880701875068.

[403] Sanders, E.B.-N. and Stappers, P.J. 2014. Probes, toolkits and prototypes: three approaches to making in codesigning. *CoDesign*. 10, 1 (Jan. 2014), 5–14. https://doi.org/10.1080/15710882.2014.888183.

[404] Schafer, R.M. 1993. *The soundscape: Our sonic environment and the tuning of the world*. Simon and Schuster.

[405] Scheepmaker, L., Kender, K., Frauenberger, C. and Fitzpatrick, G. 2021. Leaving the Field: Designing a Socio-Material Toolkit for Teachers to Continue to Design Technology with Children. *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, May 2021), 1–14.

[406] Schön, D. and Bennett, J. 1996. Reflective conversation with materials. *Bringing design to software* (1996), 171–189.

[407] 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.

[408] SDU, Denmark and Lenskjold, T. 2022. Shitty stories: Experimenting with probiotic participation through design. (June 2022).

[409] Seita, M., Lee, S., Andrew, S., Shinohara, K. and Huenerfauth, M. 2022. Remotely Co-Designing Features for Communication Applications using Automatic Captioning with Deaf and Hearing Pairs. *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2022), 1–13.

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

[411] Sellen, A.J. and Whittaker, S. 2010. Beyond total capture: a constructive critique of lifelogging. *Communications of the ACM*. 53, 5 (May 2010), 70–77. https://doi.org/10.1145/1735223.1735243.

[412] Sengers, P., Boehner, K., David, S. and Kaye, J. “Jofish” 2005. Reflective design. *Proceedings of the 4th decennial conference on Critical computing: between sense and sensibility* (New York, NY, USA, Aug. 2005), 49–58.

[413] Seonghee, K. and Boryung, J. 2008. An analysis of faculty perceptions: Attitudes toward knowledge sharing and collaboration in an academic institution. *Library & Information Science Research*. 30, 4 (Dec. 2008), 282–290. https://doi.org/10.1016/j.lisr.2008.04.003.

[414] Shirsawade, A. 2024. *What If, We Live Forever Digitally? : Investigating the Future of AI-based Digital Afterlife. A Speculative Design Approach.*

[415] 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. https://doi.org/10.1109/5326.704589.

[416] Sillence, E., Dawson, J.A., Brown, R.D., McKellar, K. and Neave, N. 2026. Digital hoarding and personal use digital data. *Human–Computer Interaction*. 41, 1 (Jan. 2026), 6–25. https://doi.org/10.1080/07370024.2023.2293001.

[417] 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).

[418] Simandan, D. 2019. Revisiting positionality and the thesis of situated knowledge. *Dialogues in Human Geography*. 9, 2 (July 2019), 129–149. https://doi.org/10.1177/2043820619850013.

[419] Simonsen, J. and Robertson, T. 2012. *Routledge International Handbook of Participatory Design*. Routledge.

[420] Singer, J.B. 2019. Podcasting as Social Scholarship: A Tool to Increase the Public Impact of Scholarship and Research. *Journal of the Society for Social Work and Research*. 10, 4 (Dec. 2019), 571–590. https://doi.org/10.1086/706600.

[421] Siriaraya, P. and Ang, C.S. 2014. Recreating living experiences from past memories through virtual worlds for people with dementia. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2014), 3977–3986.

[422] 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.

[423] Skågeby, J. 2019. Critical incidents in everyday technology use: exploring digital breakdowns. *Personal and Ubiquitous Computing*. 23, 1 (Feb. 2019), 133–144. https://doi.org/10.1007/s00779-018-1184-8.

[424] Slater, M. and Sanchez-Vives, M.V. 2016. Enhancing Our Lives with Immersive Virtual Reality. *Frontiers in Robotics and AI*. 3, (2016).

[425] Smith, L., Pihama, L., Cameron, N., Mataki, T., Morgan, H. and Te Nana, R. 2019. Thought Space Wānanga—A Kaupapa Māori Decolonizing Approach to Research Translation. *Genealogy*. 3, 4 (Dec. 2019), 74. https://doi.org/10.3390/genealogy3040074.

[426] Smith, L.T. 2021. *Decolonizing Methodologies: Research and Indigenous Peoples*. Bloomsbury Publishing.

[427] Smith, L.T. 2019. *Decolonizing research: Indigenous storywork as methodology*. Bloomsbury Publishing.

[428] Son, K., Choi, D., Kim, T.S. and Kim, J. 2024. Demystifying Tacit Knowledge in Graphic Design: Characteristics, Instances, Approaches, and Guidelines. *Proceedings of the 2024 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, May 2024), 1–18.

[429] 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* (New York, NY, USA, May 2017), 2853–2864.

[430] 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.

[431] Stadler, G. 2015. On Whiteness and Sound Studies. *Sounding Out!*

[432] Stenhaug, M., Johansen, H.D. and Johansen, D. 2016. Transforming Healthcare through Life-Long Personal Digital Footprints. *2016 IEEE First International Conference on Connected Health: Applications, Systems and Engineering Technologies (CHASE)* (June 2016), 36–41.

[433] Stolterman, E. and Wiberg, M. 2010. Concept-driven interaction design research. *Human–Computer Interaction*. 25, 2 (2010), 95–118.

[434] Sturdee, M., Genç, H.U. and Wanick, V. 2024. Diversifying Knowledge Production in HCI: Exploring Materiality and Novel Formats for Scholarly Expression. *Proceedings of the Eighteenth International Conference on Tangible, Embedded, and Embodied Interaction* (New York, NY, USA, 11 2024), 1–3.

[435] Sturdee, M., Robinson, S. and Linehan, C. 2020. Research Journeys: Making the Invisible, Visual. *Proceedings of the 2020 ACM Designing Interactive Systems Conference* (New York, NY, USA, July 2020), 2163–2175.

[436] Suber, P. 2012. *Open Access*. The MIT Press.

[437] Suchman, L. 2002. Located accountabilities in technology production. *Scandinavian journal of information systems*. 14, 2 (2002), 7.

[438] Sundblad, Y. 2011. UTOPIA: Participatory Design from Scandinavia to the World. *History of Nordic Computing 3* (Berlin, Heidelberg, 2011), 176–186.

[439] Sutherland, I. and Acord, S.K. 2007. Thinking with art: from situated knowledge to experiential knowing. *Journal of Visual Art Practice*. 6, 2 (Jan. 2007), 125–140. https://doi.org/10.1386/jvap.6.2.125_1.

[440] Sweeten, G., Sillence, E. and Neave, N. 2018. Digital hoarding behaviours: Underlying motivations and potential negative consequences. *Computers in Human Behavior*. 85, (Aug. 2018), 54–60. https://doi.org/10.1016/j.chb.2018.03.031.

[441] Tanenbaum, T.J. 2014. Design fictional interactions: why HCI should care about stories. *interactions*. 21, 5 (Spring 2014), 22–23. https://doi.org/10.1145/2648414.

[442] Taylor, J.L., Soro, A., Hong, A.L., Roe, P. and Brereton, M. 2016. Designing For Cross-Cultural Perspectives of Time. *Proceedings of the First African Conference on Human Computer Interaction* (Nov. 2016), 219–224.

[443] Taylor, N., Cheverst, K., Wright, P. and Olivier, P. 2013. Leaving the wild: lessons from community technology handovers. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2013), 1549–1558.

[444] Tennant, J.P., Waldner, F., Jacques, D.C., Masuzzo, P., Collister, L.B. and Hartgerink, Chris.H.J. 2016. The academic, economic and societal impacts of Open Access: an evidence-based review. *F1000Research*. 5, (Sept. 2016), 632. https://doi.org/10.12688/f1000research.8460.3.

[445] Teo, T. 2017. From Psychological Science to the Psychological Humanities: Building a General Theory of Subjectivity. *Review of General Psychology*. 21, 4 (Dec. 2017), 281–291. https://doi.org/10.1037/gpr0000132.

[446] 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). https://doi.org/10.14448/jsesd.12.0006.

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

[448] 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. https://doi.org/10.1007/s00779-018-1110-0.

[449] Thompson, E. 2004. *The soundscape of modernity: architectural acoustics and the culture of listening in America, 1900-1933*. MIT press.

[450] Tran O'Leary, J., Zewde, S., Mankoff, J. and Rosner, D.K. 2019. Who Gets to Future? Race, Representation, and Design Methods in Africatown. *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, May 2019), 1–13.

[451] Truax, B. 2019. Acoustic Ecology and the World Soundscape Project. *Sound, Media, Ecology*. M. Droumeva and R. Jordan, eds. Springer International Publishing. 21–44.

[452] Truax, B. 2016. Environmental Sound and its Relation to Human Emotion. *Canadian Acoustics*. 44, 3 (Aug. 2016).

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

[454] 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, June 2014), 995–1004.

[455] Tulving, E. 1972. Episodic and semantic memory. *Organization of memory*. 1, 381–403 (1972), 1.

[456] Tulving, E. 2005. Episodic Memory and Autonoesis: Uniquely Human? *The Missing Link in Cognition: Origins of self-reflective consciousness*. H.S. Terrace and J. Metcalfe, eds. Oxford University Press. 0.

[457] Turchet, L., Baker, D. and Stockman, T. 2021. Musical Haptic Wearables for Synchronisation of Visually-impaired Performers: a Co-design Approach. *Proceedings of the 2021 ACM International Conference on Interactive Media Experiences* (New York, NY, USA, June 2021), 20–27.

[458] Two Minute Papers: *https://www.youtube.com/channel/UCbfYPyITQ-7l4upoX8nvctg*. Accessed: 2024-02-08.

[459] 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. https://doi.org/10.1109/3468.911370.

[460] Unbehaun, D., Taugerbeck, S., Aal, K., Vaziri, D.D., Lehmann, J., Tolmie, P., Wieching, R. and Wulf, V. 2021. Notes of memories: Fostering social interaction, activity and reminiscence through an interactive music exergame developed for people with dementia and their caregivers. *Human–Computer Interaction*. 36, 5–6 (Oct. 2021), 439–472. https://doi.org/10.1080/07370024.2020.1746910.

[461] Uriu, D. and Arima, S. 2025. Designing Virtual Funerals as a Design Fiction: A Film-Based Exploration of Near-Future Memorial Rituals. *Proceedings of the 2025 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, 25 2025), 1–19.

[462] Uriu, D. and Odom, W. 2016. Designing for Domestic Memorialization and Remembrance: A Field Study of Fenestra in Japan. *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, 2016), 5945–5957.

[463] 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.

[464] 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.

[465] Vemuri, S., DeCamp, P., Bender, W. and Schmandt, C. 2004. Improving speech playback using time-compression and speech recognition. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (Apr. 2004), 295–302.

[466] Ventura, A. and Köbis, N. 2024. Understanding Opportunities and Risks of Synthetic Relationships: Leveraging the Power of Longitudinal Research with Customised AI Tools. arXiv.

[467] 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.

[468] 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.

[469] Vines, J., Clarke, R., Light, A. and Wright, P. 2015. The beginnings, middles and endings of participatory research in HCI: An introduction to the special issue on 'perspectives on participation.' *International Journal of Human-Computer Studies*. 74, (Feb. 2015), 77–80. https://doi.org/10.1016/j.ijhcs.2014.11.002.

[470] Vines, J., Clarke, R., Wright, P., McCarthy, J. and Olivier, P. 2013. Configuring participation: on how we involve people in design. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2013), 429–438.

[471] 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, June 2019), 1463–1477.

[472] Wakkary, R., Desjardins, A. and Hauser, S. 2016. Unselfconscious Interaction: A Conceptual Construct. *Interacting with Computers*. 28, 4 (June 2016), 501–520. https://doi.org/10.1093/iwc/iwv018.

[473] Wakkary, R., Lin, H., Mortimer, S., Low, L., Desjardins, A., Doyle, K. and Robbins, P. 2016. Productive Frictions: Moving from Digital to Material Prototyping and Low-Volume Production for Design Research. *Proceedings of the 2016 ACM Conference on Designing Interactive Systems* (2016), 1258–1269.

[474] Wakkary, R. and Maestri, L. 2007. The resourcefulness of everyday design. *Proceedings of the 6th ACM SIGCHI conference on Creativity & cognition* (New York, NY, USA, June 2007), 163–172.

[475] Wakkary, R., Oogjes, D. and Behzad, A. 2022. Two Years or More of Co-speculation: Polylogues of Philosophers, Designers, and a Tilting Bowl. *ACM Transactions on Computer-Human Interaction*. 29, 5 (20 2022), 47:1-47:44. https://doi.org/10.1145/3514235.

[476] Wallace, J., Rogers, J., Shorter, M., Thomas, P., Skelly, M. and Cook, R. 2018. The SelfReflector: Design, IoT and the High Street. *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*. Association for Computing Machinery. 1–12.

[477] Watters, J.K. and Biernacki, P. 1989. Targeted Sampling: Options for the Study of Hidden Populations. *Social Problems*. 36, 4 (Oct. 1989), 416–430. https://doi.org/10.2307/800824.

[478] 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 (July 2010), 527–564. https://doi.org/10.1177/0164027510364122.

[479] 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. https://doi.org/10.1023/A:1021628525902.

[480] Weiley, V. and Edmonds, E. 2011. The HCI researcher as artist and designer: approaches to creativity and distance. *Proceedings of the 8th ACM conference on Creativity and cognition* (New York, NY, USA, Nov. 2011), 233–238.

[481] Wenzel, E.M., Begault, D.R. and Godfroy-Cooper, M. 2017. Perception of Spatial Sound. *Immersive Sound*. Routledge.

[482] Westerhof, G.J. and Bohlmeijer, E.T. 2014. Celebrating fifty years of research and applications in reminiscence and life review: State of the art and new directions. *Journal of Aging Studies*. 29, (Apr. 2014), 107–114. https://doi.org/10.1016/j.jaging.2014.02.003.

[483] Westerkamp, H. 2006. Soundwalking as ecological practice. (2006).

[484] 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, July 2020), 221–226.

[485] White, J., Odom, W., Brand, N. and Zhong, C. 2023. Memory Tracer & Memory Compass: Investigating Personal Location Histories as a Design Material for Everyday Reminiscence. *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2023), 1–19.

[486] Whittaker, S., Kalnikaitė, V., Petrelli, D., Sellen, A., Bergman, O., Clough, P. and Brockmeier, J. Socio-Technical Lifelogging: Deriving Design Principles for a Future Proof Digital Past. 27.

[487] Wiebe, S.M. 2019. “Just” Stories or “Just Stories”?: Mixed Media Storytelling as a Prism for Environmental Justice and Decolonial Futures. *Engaged Scholar Journal: Community-Engaged Research, Teaching, and Learning*. 5, 2 (June 2019), 19–35. https://doi.org/10.15402/esj.v5i2.68333.

[488] WildTech(@wildtechresearch): *https://www.instagram.com/wildtechresearch/*. Accessed: 2024-02-04.

[489] 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.

[490] Wilson, C., Sitbon, L., Ploderer, B., Opie, J. and Brereton, M. 2020. Self-Expression by Design: Co-Designing the ExpressiBall with Minimally-Verbal Children on the Autism Spectrum. *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2020), 1–13.

[491] Wilson, S. 2008. Presentation: How We Transfer Knowledge. *Research is ceremony: Indigenous Research Methods*. Fernwood Publishing. 122–125.

[492] Wingrove, P. 2022. Academic lexical coverage in TED talks and academic lectures. *English for Specific Purposes*. 65, (Jan. 2022), 79–94. https://doi.org/10.1016/j.esp.2021.09.004.

[493] Winschiers-Theophilus, H., Zaman, T., Maasz, D., Muashekele, C., Mbinge, U., Jengan, G., Stanley, C. and Ab Hamid, K. 2022. Indigenous Knowledge Fairs: a new approach to pluralistic knowledge dissemination in HCI. *Adjunct Proceedings of the 2022 Nordic Human-Computer Interaction Conference* (New York, NY, USA, Oct. 2022), 1–5.

[494] Winters, R.M., Harden, E.L. and Moore, E.B. 2020. Co-Designing Accessible Science Education Simulations with Blind and Visually-Impaired Teens. *Proceedings of the 22nd International ACM SIGACCESS Conference on Computers and Accessibility* (New York, NY, USA, Oct. 2020), 1–4.

[495] Wirfs-Brock, J., Perera, J. and Geere, D. 2024. Open Sonifications: A Manifesto for Many Ecologies of Data and Sound. *Proceedings of the 2024 ACM Designing Interactive Systems Conference* (New York, NY, USA, July 2024), 2660–2674.

[496] Wissenschaftskommunikation 2022. Forms of Science Communication.

[497] Wong, R.Y. and Khovanskaya, V. 2018. Speculative Design in HCI: From Corporate Imaginations to Critical Orientations. *New Directions in Third Wave Human-Computer Interaction: Volume 2 - Methodologies*. M. Filimowicz and V. Tzankova, eds. Springer International Publishing. 175–202.

[498] Woodiwiss, J., Smith, K. and Lockwood, K. 2017. Introduction: Doing Feminist Narrative Research. *Feminist Narrative Research: Opportunities and Challenges*. J. Woodiwiss, K. Smith, and K. Lockwood, eds. Palgrave Macmillan UK. 1–10.

[499] Woods, B., O'Philbin, L., Farrell, E.M., Spector, A.E. and Orrell, M. 2018. Reminiscence therapy for dementia. *Cochrane database of systematic reviews*. 3 (2018). https://doi.org/10.1002/14651858.CD001120.pub3.

[500] Wright, P. and McCarthy, J. 2008. Empathy and Experience in HCI. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (New York, NY, USA, 2008), 637–646.

[501] Xie, B., Druin, A., Fails, J., Massey, S., Golub, E., Franckel, S. and Schneider, K. 2012. Connecting generations: developing co-design methods for older adults and children. *Behaviour & Information Technology*. 31, 4 (Apr. 2012), 413–423. https://doi.org/10.1080/01449291003793793.

[502] Xu, S., Chen, C., Liu, Z., Jin, X., Yuan, L.-P., Yan, Y. and Qu, H. 2024. Memory Reviver: Supporting Photo-Collection Reminiscence for People with Visual Impairment via a Proactive Chatbot. *Proceedings of the 37th Annual ACM Symposium on User Interface Software and Technology* (Oct. 2024), 1–17.

[503] Ye, Y. and Zhang, D. 2024. Co-creating pluralistic futures: A systematic literature review on participatory speculative design. *DRS Biennial Conference Series* (June 2024).

[504] Yip, J.C., Ello, F.M.T., Tsukiyama, F., Wairagade, A. and Ahn, J. 2023. "Money shouldn't be money!" : An Examination of Financial Literacy and Technology for Children Through Co-Design. *Proceedings of the 22nd Annual ACM Interaction Design and Children Conference* (New York, NY, USA, June 2023), 82–93.

[505] 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.

[506] Yoo, M., Berger, A., Lindley, J., Green, D.P., Boeva, Y., Nicenboim, I. and Odom, W. 2023. Beyond Academic Publication: Alternative Outcomes of HCI Research. *Companion Publication of the 2023 ACM Designing Interactive Systems Conference* (New York, NY, USA, July 2023), 114–116.

[507] Yoo, M., Knight, L., Odom, W. and Berger, A. 2022. Storywork & Reciprocity: On the Design of an Audio Documentary that Extends HCI Research back to Participants. *Designing Interactive Systems Conference* (New York, NY, USA, June 2022), 1345–1357.

[508] Yoo, M., Odom, W. and Berger, A. 2021. Understanding Everyday Experiences of Reminiscence for People with Blindness: Practices, Tensions and Probing New Design Possibilities. *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems* (Yokohama Japan, May 2021), 1–15.

[509] Yoo, M., Odom, W., Berger, A., Barnett, S., Kenny, S., Lo, P., Shamsher, S., Russell, G. and Knight, L. 2024. Remembering through Sound: Co-creating Sound-based Mementos together with People with Blindness. *Proceedings of the CHI Conference on Human Factors in Computing Systems* (New York, NY, USA, May 2024), 1–19.

[510] Zhang, Z., Xu, L., Wang, X., Zhang, X. and Fan, M. 2025. Understanding and Co-designing Photo-based Reminiscence with Older Adults. *Proceedings of the ACM on Human-Computer Interaction*. 9, 2 (May 2025), 1–30. https://doi.org/10.1145/3711094.

[511] Zhang, Z., Xu, M., Wang, M., Xu, L., Zhang, X. and Fan, M. 2026. From Memory to Meaning: A Systematic Review of Reminiscence Technologies in HCI. *Proceedings of the 2026 CHI Conference on Human Factors in Computing Systems* (Apr. 2026), 1–18.

[512] Zimmerman, J. and Forlizzi, J. 2014. Research Through Design in HCI. *Ways of Knowing in HCI*. J.S. Olson and W.A. Kellogg, eds. Springer New York. 167–189.

[513] Zimmerman, J. and Forlizzi, J. 2017. Speed Dating: Providing a Menu of Possible Futures. *She Ji: The Journal of Design, Economics, and Innovation*. 3, 1 (Mar. 2017), 30–50. https://doi.org/10.1016/j.sheji.2017.08.003.

[514] Zimmerman, J. and Forlizzi, J. 2008. The role of design artifacts in design theory construction. *Artifact*. 2, 1 (2008), 41–45.

[515] Zimmerman, J., Forlizzi, J. and Evenson, S. 2007. Research through design as a method for interaction design research in HCI. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (New York, NY, USA, Apr. 2007), 493–502.

[516] Zimmerman, J., Stolterman, E. and Forlizzi, J. 2010. An Analysis and Critique of Research Through Design: Towards a Formalization of a Research Approach. *Proceedings of the 8th ACM Conference on Designing Interactive Systems* (New York, NY, USA, 2010), 310–319.

[517] 2020. *Depression: From Bloodletting to Wearable Devices*.

[518] Microsoft Research Podcast. *Microsoft Research*.

[519] 2003. Publish and be praised. *The Guardian*.

[520] Quick-Start Guide to Dissemination for Practice-Based Research Networks. Agency for Healthcare Research and Quality.