Revisitation: An Interactive VR Archive of Embodied Family Memory

By

Yudi Cao

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Abstract

Revisitation: An Interactive VR Archive of Embodied Family Memory is an ethnographically grounded research-creation project that investigates how virtual reality (VR) can preserve, reconstruct, and share intergenerational memory through spatial and interactive storytelling. The project takes the form of both a VR experience and a physical exhibition. By reimagining four domestic living rooms spanning from the 1920s to the present day, it explores how digitally constructed environments can evoke emotional connections to family histories and make personal archives accessible beyond the family context. The research responds to a gap in conventional digital archives, where photographs, videos, and objects are often preserved as static records while their material, sensory, and emotional contexts become harder to experience. It asks how a VR-based family archive can support subjective, multi-voiced, and embodied forms of memory, while making personal archives more accessible and open to reinterpretation. Grounded in research-creation, autoethnography, ethnographic research, and embodied narrative inquiry, the project draws on family archives, oral histories, interviews, and field research. Within *Revisitation*, memory emerges through first-person navigation, bodily movement, sound, and object-based interaction. Selected archival materials become memory triggers that activate intimate moments through proximity, touch, and interaction. Abstraction and non-realistic sensory interaction are used as design strategies, allowing fragmented and emotionally charged memories to surface through experiential engagement. Through the design and development of an interactive VR archive, Revisitation explores the possibility of more accessible, lightweight, and adaptable approaches

to VR-based memory preservation, positioning family memory as a process that may be shared, reactivated, and reinterpreted across generations.

***Keywords**: VR / Media Archive / Family Memory / Intergeneration / Memory / Embodied Experience / Autoethnography / Narrative Storytelling*

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Dedication

This thesis is dedicated to my maternal family (the Bai family),

especially my grandfather Bai Lizhang (白理彰),

my mother Bai Di (白荻),

and my great-grandfather Bai Xiongyuan (白雄远).

The stories and memories passed down through our family

inspired the creation of this VR archive,

which seeks to preserve and revisit fragments of our shared history.

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Chapter 1: Introduction

1.1 Background and Motivation

This project emerges from a personal and cultural urgency to preserve the fading histories of my mother's Mongolian family lineage. Over generations, political pressures, assimilation, and gendered naming practices in modern Chinese society have gradually obscured my family's Mongolian identity. My great-grandfather, Bai Xiongyuan, was a respected educator during his time. Although he left behind extensive writings and photographs, both his legacy and the family's original clan identity have become increasingly difficult to trace. The Sinicization of surnames and the disappearance of the matrilineal line have accelerated this erasure. This loss is not only genealogical but also cultural, revealing how minority identities can gradually fade within domestic life when stories are not intentionally maintained.

My mother's vivid oral storytelling has long served as the primary conduit for transmitting our family history. Her recollections are emotionally rich yet often fragmented, reflecting the subjective and intergenerational qualities of memory discussed by contemporary media and memory scholars (Garde-Hansen, 2011). At the same time, the family's visual archive contains thousands of photographs, negatives, letters, and videotapes recorded by my grandfather and great-grandfather. These materials now exist in fragile condition. Images are fading, film is deteriorating, and handwritten notes risk permanent loss. While digitizing these artifacts may preserve their informational content, it cannot retain the tactile and atmospheric qualities that give memory its sensory and emotional presence.

These encounters made the limitations of conventional family archiving methods clear. Scholars have shown that personal and collective memories are continually shaped by the media through which they are produced and circulated (van Dijck, 2022).

Meanwhile, much of the existing VR work related to archives has emerged within museums and cultural institutions, where VR is used to display digitized artifacts, reconstruct historical environments, or offer immersive educational experiences(Greuter et al., 2023; Kim, 2020). These examples demonstrate the narrative and experiential potential of VR, but they are rarely designed for domestic or small-scale archiving. Moreover, they often rely on photogrammetry workflows, high production resources, and institutional infrastructures. As a result, there remains a gap in understanding how VR might support personal or intergenerational archives, particularly those that are intimate, emotionally layered, or fragmented. Family memory is often subjective, contradictory, and emotionally layered, which requires an archival form capable of holding multiple narratives instead of compressing them into a single version. Research on VR and embodied interaction emphasizes that immersive environments can support experiential and sensory forms of engagement that traditional digital archives cannot provide(Greuter et al., 2023; Popat, 2016).

This motivation informs *Revisitation*, which investigates how virtual reality can support the preservation and reactivation of intergenerational memory through reconstructed domestic spaces, sensory immersion, and interaction with personal objects. While the project begins with my own family archive, its aim is not limited to personal remembrance. The broader intention is to propose a participatory framework that may allow other families to preserve, reinterpret, and share their own

histories interactively. In this context, VR becomes not only an artistic medium but also an accessible tool for sustaining cultural memory in a period marked by rapid technological and social change.

1.2 Research Gaps and Questions

Research Gaps		Significance
Most archival practices prioritize factual accuracy and visual reconstruction, overlooking emotional and subjective aspects of family memory.	**Narrative**	This research expands digital archives by acknowledging emotional gaps, contradictions, and subjective memories.
Few digital methods represent fragmented, incomplete, or contradictory family narratives.		It shifts the focus from factual reconstruction to experiential memory, emphasizing how memory is felt rather than how it appeared.
Existing VR archives often rely on photogrammetry, large teams, and expensive hardware.	**Technical**	This research develops a simplified and reusable Unreal Engine framework for personal VR archives.
There is currently no accessible, customizable template for personal or small-scale VR archives.		It lowers technical barriers, allowing individuals and families to create VR memory archives.
There is little support for multiple family members contributing to a shared memory space.	**Collaborative**	The project introduces a participatory model in which memory becomes a collective practice.
Most digital archives remain individually authored rather than collaboratively constructed.		It provides a framework for families to co-create archives while maintaining individual perspectives.

Table. 1 Research gaps and significance

The first gap is narrative. In many museum oriented VR archives and immersive heritage experiences, digital collections prioritize factual accuracy, linear chronology, and visual realism, reflecting long standing conventions in archiving and memory preservation (van Dijck, 2022). While such approaches are valuable for documentation, they provide limited space for the emotional nuance, fragmentation, and sometimes contradictory perspectives that characterize family memory. VR has the potential to stage non linear, multi voiced stories, yet in current institutional uses this potential is only partially explored.

The second gap is technical. Many VR archival projects rely on photogrammetry pipelines, large production teams, and high performance hardware (Kim, 2020), which makes them difficult for ordinary families to adopt in everyday contexts. As explored later in my contextual review of projects such as The Immersive Archive (Greuter et al., 2023) and the Redtory reconstruction (Xing et al., 2024), existing immersive archive systems are frequently optimized for institutional or museum settings rather than domestic or small scale. These conditions limit the accessibility and adaptability of VR as a tool for personal memory preservation, even though the medium itself could be configured in more lightweight ways.

The third gap is collaborative. Family memory is inherently multi-voiced and shaped by different interpretations, yet many archives, including VR-based ones, are designed and authored by a single creator or institution. This can result in unified narratives that downplay disagreements, gaps, or variations in collective remembering. Scholarship on oral history and personal memory highlights the importance of multi-perspectival accounts and shared authorship in shaping cultural memory (Boyd,

2014; Garde-Hansen, 2011), but current digital archiving frameworks seldom foreground collaborative participation among family members as a primary design goal.

Taken together, these gaps suggest the need for an approach that can support emotional complexity, technical accessibility, and collaborative authorship within VR. In response, this thesis is guided by the following research questions:

1. Memories and Differences through Embodied Experiences

How might embodied VR archives activate and accommodate different family members' memories of the same event, thereby creating a richer and more layered understanding of intergenerational memory?

2. Design Principles and Accessibility

How might we identify the key design principles and develop a flexible framework for VR memory preservation that is replicable and accessible to families without technical expertise?

3. Abstraction and Experimentation in Design

How might abstraction and non-realistic sensory interaction function as active design strategies within a VR archive, helping reveal or activate pivotal and intimate moments that are often obscured by linear or single-narrative storytelling?

Together, these questions define the conceptual and methodological direction of this project. The first question addresses the emotional and subjective nature of memory; the second focuses on accessibility and the development of a practical workflow; and the third explores abstraction as a

creative and interpretive tool within VR. Taken collectively, they position *Revisitation* as both a situated family case study and a broader investigation into how embodied VR environments can preserve, reactivate, and reinterpret intergenerational memory.

1.3 Significance and Contribution

This thesis contributes to the field by proposing a new way of understanding and designing personal digital archives through virtual reality. Rather than treating VR as a tool for visual reconstruction, the project frames it as a medium for experiential remembering, one that foregrounds the sensory, affective, and interpretive dimensions of family history. This perspective broadens the role of VR within archival and interactive media research, positioning domestic memory as a valid and meaningful site of immersive design.

The thesis also offers a contribution to research-creation by demonstrating how creative practice can operate as a method for investigating intergenerational memory. Through iterative prototyping, material experimentation, and reflexive documentation, the project provides a model for how artistic processes can generate knowledge about memory, space, and narrative beyond traditional textual analysis. This approach highlights the methodological value of practice-based inquiry in studying forms of remembrance that are embodied, fragmented, or emotionally layered.

Finally, the project contributes a practical framework for families and non-technical users who wish to preserve their histories interactively. By developing a modular and adaptable workflow in Unreal Engine, the thesis proposes an accessible model that does not rely on high-end photogrammetry or

institutional resources. This expands the potential for VR to be used not only in professional or museum contexts but also in everyday cultural preservation, where personal archives often face the risk of loss, fragmentation, or limited participation.

Together, these contributions position Revisitation as both a situated family case study and a broader proposal for how VR can support the creation of intimate, adaptable, and participatory memory environments.

Chapter 2: Literature and Contextual Review

2.1 Literature Review

The turn toward virtual reality (VR) in media art and interactive design has reshaped how memory can be encountered and interpreted. VR functions not only as a technical platform but as an experiential medium in which meaning arises through spatial, sensory, and embodied engagement. This orientation aligns with research-creation methodologies, where insight is produced through the act of making and through the experiential conditions that creative practice enables (Chapman & Sawchuk, 2015). Within this methodological frame, VR becomes a site for examining how domestic space, atmosphere, and gesture shape the interpretation of personal memory.

Across digital heritage, museum studies, and memory studies, researchers have explored how digital media transform the nature of archives and the circulation of personal and collective histories. Scholarship in media and memory emphasizes that remembering is always mediated by the technologies and formats through which it is expressed (Garde-Hansen, 2011; van Dijck, 2022). In parallel, work on VR and immersive interaction demonstrates how presence, embodiment, and multisensory cues support affective meaning-making in ways that differ from traditional screen-based media(Jerald, 2016; Murray, 1997; Slater, 2009). Together, these discussions indicate that VR has distinctive potential for examining subjective, emotional, and relational dimensions of memory.

Most VR-based archival projects, however, concentrate on institutional or large-scale cultural heritage, emphasizing historical accuracy, photogrammetry, and museum-oriented reconstruction (Kalay

et al., 2007; Parry, 2007). While these approaches establish important frameworks, they leave limited space for the fragmented, contradictory, and emotionally situated qualities of family memory. Personal archives often exist in the textures of domestic space and in sensory cues embedded in everyday objects, yet these intimate registers remain underexamined within existing VR scholarship.

This literature review focuses on four areas that provide the conceptual foundation for this project. The first concerns VR and immersive experience. The second examines media and memory theory. The third addresses archival practices and the challenges of representing personal and familial histories. The fourth considers embodied interaction and sensory meaning-making within immersive environments. Together, these areas outline the theoretical landscape that informs this research-creation project and support the development of an embodied VR archive capable of holding multiple perspectives and emotional textures within family memory.

2.1.1 VR and Immersive Experience

Virtual reality is widely understood as a medium defined by spatial immersion, multisensory engagement, and embodied interaction. Rather than extending screen-based representation, VR restructures how users perceive, move, and interpret information within simulated environments. This shift positions VR as a powerful tool for memory work, since memory is closely tied to spatial awareness, sensory cues, and the affective experience of being present within an environment.

A central concept in VR research is presence, which Slater defines as the psychological sense of "being there" within a virtual environment. Presence is not generated by visual fidelity alone but

emerges through consistent sensory cues and meaningful action possibilities (Slater, 2009). Jerald argues that the strength of VR lies in its ability to align visual, auditory, and proprioceptive feedback with user movement, creating a continuous loop between perception and action (Jerald, 2016). This alignment makes VR uniquely suited for experiences that depend on emotional resonance and embodied response, including memory reconstruction.

Researchers in immersive narrative further emphasize how VR transforms the relationship between user and story. Murray describes VR narrative as an interactive field in which meaning emerges through navigation, action, and interpretive choice rather than through linear sequences (Murray, 1997). This relational structure enables VR to support fragmented, non-linear, or multi-perspective memory work because users navigate memory spatially instead of following a predetermined storyline. For family archives that contain contradictory accounts or partial recollections, this non-linearity provides an expressive advantage.

Another key dimension is the role of domestic or everyday environments in shaping affective memory. VR environments are able to reproduce spatial layouts, lighting conditions, and atmospheric qualities that influence how memories are interpreted. Research on immersive exhibitions and cultural heritage reconstructions suggests that spatial fidelity and atmospheric detail can support cognitive engagement as well as emotional attachment, even when photorealistic accuracy is not the primary goal (Champion, 2015). This insight is essential for personal archives, where memory often resides in ordinary furniture arrangements, familiar sounds, or objects that carry subjective meaning.

In addition, VR's capacity for multisensory design contributes to its potential as a memory-based medium. Immersive projects increasingly integrate tactile cues, spatialized audio, and embodied gestures to deepen user engagement and support nonverbal forms of meaning making. These design strategies connect to broader theories of embodied cognition, which argue that understanding and remembering emerge from bodily action and sensory experience rather than abstract information processing. In this sense, VR offers an environment where memory is not only viewed but enacted.

Taken together, research on presence, spatial narrative, sensory immersion, and affective engagement reveals why VR is more than a technical platform for displaying archival material. It operates as a medium that can activate memory through embodied experience, allowing users to inhabit reconstructed domestic spaces and interpret personal or family histories through movement, atmosphere, and sensory resonance. This capacity positions VR as an important site for developing new approaches to family archives, particularly those that foreground emotional texture, partial recollection, and multiple perspectives.

2.1.2 Media and Memory Theory

Memory is not a purely psychological phenomenon. It is shaped through the practices, technologies, and material forms that support recollection. Memory is always mediated, and each act of recording restructures what is remembered and how it becomes meaningful (van Dijck, 2022). This view shifts attention from memory as internal storage to the sociotechnical systems that influence interpretation and emotional resonance.

Materiality plays a central role in how memories are formed and transmitted. Physical media such as photo albums, handwritten letters, and cassette tapes hold emotional significance through their textures, sounds, and marks of use (Garde-Hansen, 2011). These sensory qualities embed experiences of time and presence. When materials become digital, their affective power does not disappear but is reorganized through interfaces, metadata structures, and software environments. Digital archives therefore do not simply preserve content; they reshape the frameworks through which remembering takes place (van Dijck, 2022).

Media and memory scholarship also emphasizes the relational nature of memory. Remembering is guided by social frameworks that determine which events become meaningful (Halbwachs, 1992). Personal memory and cultural memory interrelate to form shared reference points that persist beyond individual lifetimes (Assmann, 2011). Memory emerges through networks of circulation across media, generations, and communities rather than isolated acts of recall (Erll, 2011). This perspective is especially relevant for family archives, where memories frequently overlap, contradict, or coexist in fragmented forms. These variations are not errors but fundamental characteristics of intergenerational memory.

Digital media intensifies these dynamics. Contemporary memory exists within a fluid digital ecosystem where files circulate across platforms and acquire new meaning through repeated recontextualization (Hoskins, 2011). For family archives that already contain inconsistencies, digital environments make the fragmentary nature of memory more visible. Instead of stabilizing recollection,

digital systems foreground uncertainty, absence, and the shifting conditions under which memory is accessed.

VR extends these theoretical concerns by adding spatial and embodied dimensions to the mediation of memory. Popat describes VR as a form of embodied materiality in which presence emerges through movement, perceptual awareness, and sensory engagement (Popat, 2016). VR constructs environments that feel emotionally and spatially tangible despite lacking physical substance. This immersive quality positions VR as a medium in which memory can be encountered not only visually but somatically.

The instability of digital archives further aligns with the contradictions explored in VR environments. Kim argues that digital archives simultaneously preserve and disrupt, offering accessibility while generating fragmentation and disorientation (Kim, 2020). This paradox becomes a productive framework for thinking about VR-based family archives that contain gaps, silences, and conflicting narratives.

Building on these perspectives, this research understands family memory as an evolving constellation of mediated fragments. The VR environments created in this project treat memory as a process rather than a record. Family photographs, oral stories, objects, and handwritten notes are reconstructed within interactive domestic spaces where participants move, listen, and explore. Users activate sounds, trigger spatial transitions, or uncover hidden elements through embodied interaction. Spaces of absence, such as uncompleted rooms or silent audio channels, function as reminders of forgetting and temporal distance. Through this approach, VR becomes a framework for experiencing

memory as relational, unstable, and emotionally layered. The medium supports a form of remembering that acknowledges inconsistency as inherent to family history and treats sensory engagement as central to the process of meaning making.

2.1.3 Archival Practices and Approaches

Archival studies and digital heritage research provide essential frameworks for understanding how personal and intergenerational histories are preserved, interpreted, and transformed across media. Traditional archival practice is grounded in principles of stability, authenticity, and long-term preservation. Yet scholars have shown that archives are not neutral containers of the past. They are cultural constructs shaped by institutional structures, selective preservation, and the biases embedded in classification systems (Schwartz & Cook, 2002). These structures determine which narratives become part of the historical record and which are excluded. For family archives, which often consist of everyday materials, oral histories, and informal collections, these conventions can overlook emotional, subjective, or fragmentary forms of memory.

Digital heritage scholarship expands these discussions by examining how computational media reshape archival logic. Digital archives introduce new forms of accessibility and reconstruction, but they also intensify instability and incompleteness. Digital files depend on changing software systems, formats, and infrastructures that evolve or disappear over time (Kalay et al., 2007). Scholars argue that digital preservation is not simply a technical challenge but an interpretive process in which meaning shifts each time a file is migrated, reencoded, or recontextualized within new interfaces (Parry, 2007).

This instability is particularly significant for family archives, where materials may already contain gaps created by loss, damaged media, selective remembering, or intergenerational silence.

Oral history provides additional insights into the subjective and relational qualities of family memory. Oral history methodologies emphasize voice, emotion, and perspective, highlighting that memory is shaped through storytelling rather than objective recollection (Portelli, 1991). Differences between narrators are not inconsistencies to be corrected but evidence of lived experience and cultural context. Oral history scholarship also foregrounds the co-creation of memory between interviewer and participant, recognizing that every retelling is shaped by the conditions of the encounter. This relational approach aligns with digital and immersive media environments that allow multiple perspectives to coexist rather than be collapsed into a single narrative.

Recent work in personal and domestic archiving further highlights how everyday materials function as sites of emotional meaning. Family photographs, handwritten notes, household objects, and audio recordings carry the embodied traces of lived experience, but they are rarely preserved within institutional (Gilliland & McKemmish, 2014). These materials often circulate informally across households, devices, and generations, acquiring new significance as they are reinterpreted in changing contexts. Digital environments can amplify this circulation, enabling families to reorganize and remix their archives through scanning, sharing, and multimedia reconstruction.

VR-based archival projects extend these archival debates into spatial and experiential domains. Existing immersive archive initiatives have primarily focused on cultural heritage, monument

reconstruction, or museum exhibition design, often emphasizing visual accuracy and historical fidelity (Kalay et al., 2007). These approaches provide valuable techniques but rarely address the intimate, emotional, and contradictory qualities of personal memory. VR introduces opportunities to integrate oral histories, material traces, and spatial memory into interactive environments that reflect the lived textures of domestic life. Through embodied navigation, gesture based interaction, and atmospheric design, VR can accommodate layered and conflicting accounts rather than presenting a unified narrative.

For this research, archival practice is treated as an active process rather than a method of preservation. The VR environments created in this project reconstruct domestic spaces as interpretive frameworks where family photographs, recorded stories, and personal objects function as memory cues. Participants explore these archives through movement, interaction, and sensory engagement. The presence of missing objects, silent spaces, or incomplete scenes acknowledges the gaps inherent in family history. Instead of stabilizing memory, the VR archive foregrounds its instability and relational nature, allowing multiple perspectives to coexist within the same virtual environment. This approach aligns archival studies, oral history, and digital heritage research with immersive design, supporting a mode of family archiving that values subjectivity, emotional resonance, and co-authorship.

2.1.4 Embodied Interaction and Physical–Virtual Alignment in VR

Embodiment has been widely recognized as one of the defining affordances of virtual reality. Unlike screen-based media, VR situates the user's body as the primary site of experience, allowing movement, posture, and tactile expectations to shape how meaning is constructed within the environment. Studies

of VR presence show that bodily engagement supports stronger emotional resonance and spatial understanding, especially when participants interact with environments that mirror familiar physical routines or domestic gestures (Slater, 2009).

Within this broader field, physical–virtual alignment plays a critical role in enhancing embodied immersion. Research demonstrates that users experience virtual scenes as more credible and emotionally grounded when physical objects in the real world correspond to virtual objects in the headset. Physical props such as tables, shelves, walls, or stairs provide tactile anchors that reduce cognitive effort during navigation and intensify the sense of being "in" the space. Empirical studies show that even minimal alignment, such as touching a real wall that matches a virtual wall, can dramatically heighten presence (Insko, 2001).

Tangible proxies extend this logic by using simple real-world shapes to represent more complex virtual objects. Hinckley and colleagues show that cubes, boards, or textured forms enable users to form stronger spatial memory of VR environments, because the body integrates these physical cues into its perception of the virtual world (Hinckley et al., 1994). These insights are directly relevant for VR archives situated in domestic settings. Everyday objects, such as a wooden box, a table edge, or the surface of a photo frame, carry habitual gestures that evoke intimate recollections. When these items are mapped to corresponding virtual elements, they activate embodied memory alongside visual memory.

More recent work demonstrates that physical objects can be dynamically repurposed through perceptual redirection. A single real-world object can function as multiple virtual objects, enabling

designers to construct complex narrative spaces using minimal physical material. Azmandian and colleagues show that this form of haptic retargeting significantly increases immersion while reducing spatial and logistical constraints (Azmandian et al., 2016). For a VR family archive, this technique allows one physical object to embody different temporal layers, aligning with the shifting contexts of intergenerational memory.

Bodily cues from the floor further contribute to the realism of movement. Lécuyer's research demonstrates that stepping onto real ramps, boxes, or uneven surfaces produces a stronger sensation of climbing, leaning, or descending than visual simulation alone (Lécuyer, 2009). These subtle physical additions enhance not only immersion but also the emotional resonance of memory-based environments by grounding abstract or fragmented memories in lived bodily experience.

Finally, aligning an entire physical room with its virtual counterpart supports natural movement and reduces navigational anxiety. Benko and colleagues show that users move with greater confidence and emotional investment when the room's dimensions, pathways, and furniture placements match the real physical space (Jones et al., 2015). This is particularly impactful for domestic memory archives, where the familiarity of spatial arrangement contributes to feelings of comfort, recognition, and personal connection.

For this project, these findings inform the use of simple physical elements in the installation of the VR memory archive. Small props, real furniture edges, textured surfaces, or shallow platforms can be integrated into the gallery environment to reinforce bodily engagement. When combined with virtual

reconstructions of family living rooms, these tangible anchors support an embodied form of remembering that integrates gesture, space, and sensory memory.

2.2 Contextual Review

2.2.1 Immersive Storytelling and Personal Memory

In creative practices that use virtual reality, *The Book of Distance* serves as an important reference case. This work centers on the author's grandfather, a Japanese Canadian who faced exclusion and internment during World War II. Through VR, the project allows audiences to enter this family history. It combines traditional archival materials, such as documents, letters, and photographs, with carefully staged visual design. Viewers move and interact in the virtual environment to trigger fragments of the story. In this way, Okita retraces his grandfather's life and also strengthens the emotional connection between the audience and history (Okita, 2020).

The significance of this case lies in its demonstration of how VR can move beyond the limits of text and photographic archives and transform memory into an experiential event. He, Wu, Li, and Tong note that many cultural heritage VR projects lack emotional resonance (He et al., 2024). *The Book of Distance* addresses this gap by engaging multiple senses and embodied participation, allowing audiences to feel rather than simply learn about history. At the same time, the project has limitations. Its narrative framework remains relatively linear. Audiences follow a pre-set story path and have limited agency in the reconstruction of the archive.

My research is also grounded in family archives but emphasizes memories at the personal and domestic level rather than collective narratives of migration or ethnicity. Through interactive design in VR, I aim to give audiences the ability to choose among objects, images, and story fragments, creating a nonlinear and multi-voiced memory experience. This approach highlights historical events and also considers how memory is transmitted and reshaped across generations. While The Book of Distance demonstrates the potential of VR to restage family history, my project further investigates how VR can turn the family archive into a dynamic process of shared participation, emotional connection, and reinterpretation.

2.2.2 Interactive Archives and Emotional Devices

Another set of cases that closely relates to this research focuses on interaction and emotional resonance in archival practices. *The Immersive Archive* developed by Greuter, Burrell, and Smith is a key example (Greuter et al., 2023). Using 360 degree video, photogrammetry, and virtual reconstruction, the project transforms a past theatre performance into a digital archive that can be revisited multiple times. Unlike traditional archives, this approach preserves the visual and spatial qualities of the performance and allows viewers to navigate the virtual environment freely, forming individual pathways of perception. The project highlights the potential of digital archives as interactive systems that function not only as repositories but also as experimental spaces for generating embodied knowledge. However, its primary focus remains on representing performance art. Although viewers can move through the reconstructed space, they have limited ability to alter the narrative or actively shape the construction of memory.

By contrast, the *TeleAbsence* project by the Tangible Media Group at the Massachusetts Institute of Technology places greater emphasis on emotional interaction (Ishii et al., 2025). It employs objects marked by human use, such as a piano, typewriter, and telephone, to create a sense of connection with an absent other. Unlike conventional two-way telecommunication, the interaction here is essentially one-way, and the lack of response becomes meaningful in itself. This design challenges traditional models of human computer interaction by turning grief, loss, and remembrance into reflective interactive experiences. *TeleAbsence* expands the definition of the archive and demonstrates the role of materiality in shaping emotional memory.

For my research, these cases highlight two key insights. First, *The Immersive Archive* shows the importance of spatial and layered storytelling, which informs my thinking about how VR can be used to construct complex family memory environments. Second, *TeleAbsence* suggests that an archive is not only about storing or retrieving information but also about holding emotions, absences, and silences. In my VR archive, family photographs, heirlooms, and oral history recordings are not simply evidence. They act as triggers for emotional resonance and invite audiences to connect with unfamiliar family memories. Compared with these cases, my project emphasizes domestic archives and focuses on exploration and participation, enabling viewers not only to look at the past but also to feel intimate memories through interaction and embodied engagement.

2.2.3 Cultural Heritage and Virtual Reconstruction

In the field of cultural heritage preservation and display, the VR reconstruction of the Redtory industrial site in Guangzhou by Xing, Xiao, and Luo provides an important reference point. Redtory was

originally an industrial complex later repurposed into a creative park, but it was demolished in 2019. Because the physical site no longer exists, the research team used virtual reality technologies to reconstruct its history and cultural memory. They drew on online sources and archival images to digitally restore the site, employed Unreal Engine 5 and Quixel Mixer to reproduce environmental details, and presented the final version through Oculus Quest 2 (Xing et al., 2024).

The project included four main narrative scenes, which were an introduction, the factory building, a historical square, and a creative corridor. It integrated Bartle's player taxonomy to diversify user engagement. Visitors could navigate the virtual environment and trigger different story elements through interactive features, creating individualized narrative pathways. A user study with 40 young participants compared the VR platform with traditional pamphlets. Results showed that the VR group achieved higher levels of knowledge retention, learning effectiveness, and emotional engagement as measured with the Learning Experience Questionnaire (LEQ) and User Experience Questionnaire (UEQ). However, the study also noted that complex interactions and the learning curve of the devices sometimes produced feelings of distance rather than emotional connection.

For my research, the value of this case lies in its demonstration of how virtual reconstruction can preserve and communicate cultural memory after the disappearance of a physical site. At the same time, the Redtory project remains focused on a broad scale and emphasizes industrial heritage and urban culture with clear goals of education and historical transmission. My work instead shifts toward family memory and uses VR to reconstruct intimate domestic settings and personal objects, placing private and familial archives at the center of the experience. This turn addresses limitations of existing

projects that focus mainly on public heritage and highlights the significance of memory in personal life and everyday experience.

2.2.4 Summary of Findings

In the literature review, I examined theories of mediated memory (van Dijck, 2022) alongside discussions of instability and fragmentation in digital archives (Kim, 2020). Together, these works suggest that memory is both private and public and is always mediated by technological forms that shape how it is produced and sustained. Research on archival practices (Boyd, 2014) expands this perspective by showing that archives are not only technical systems for storage but also sites where emotional, ethical, and social dimensions are negotiated. Theories of embodied interaction (Dourish, 2001; Ishii et al., 2025) further demonstrate how presence, multisensory design, and materiality affect the way people engage with memory. At the methodological level, autoethnography (Chang, 2016; Ellis et al., 2010) and research through creation (Chapman & Sawchuk, 2015) emphasize the researcher's dual role as narrator, participant, and designer, which makes these approaches particularly relevant for projects centered on family archives.

In the contextual review, I analyzed cases where VR and interactive media are applied to reconstruct personal and collective histories. *The Book of Distance* (Okita, 2020) illustrates how VR can transform a family story into a spatial and emotionally charged experience. *The Immersive Archive* (Greuter et al., 2023)and *TeleAbsence* (Ishii et al., 2025) highlight how interactive design and tangible media can expand the concept of the archive and address not only what is present but also how absence can be felt. The VR reconstruction of the Redtory site in Guangzhou (Xing et al., 2024) demonstrates the educational and

preservational potential of virtual heritage, although its focus remains on industrial and collective memory rather than the intimacy of family narratives.

Taken together, these studies and projects suggest two possible directions. First, immersive and interactive archives may benefit from going beyond preservation as their primary goal and instead creating conditions for active participation, embodied engagement, and emotional resonance. Second, there appears to be a gap in archival research and practice. While cultural heritage and national memory have been studied extensively, intimate family archives seem comparatively less visible in the literature I have reviewed. My project aims to respond to this potential gap by using a research through creation approach to design a VR based family archive that foregrounds personal stories, multisensory triggers, and embodied participation. In doing so, it proposes one way to extend existing archival theory and practice toward the affective and everyday dimensions of memory.

2.3 Ethnographic Research Context and Family Archives

This project is grounded in an ethnographic research context shaped by family interviews, oral histories, personal archives, field visits, and inherited materials. While Revisitation is developed from my own family history, the project treats family memory as a shared and multi-voiced archive. It gathers stories, objects, photographs, videos, documents, and oral accounts from multiple family members, examining how these materials can be translated into spatial, sensory, and interactive forms.

The primary sources for this project come from the archives and memories of several family members: Bai Di, my mother; Bai Lizhang, my maternal grandfather; Bai Xiongyuan, my

great-grandfather; and Fang Biao, my mother's cousin and my uncle. Bai Di's materials include analog video recordings, photographs, press materials, and personal notes from her work as a television presenter and actor in 1990s Shenzhen. Bai Lizhang's archive is connected to domestic creativity, photography, music, and my own childhood memories of him. Bai Xiongyuan's archive connects private family memory with public history, particularly through materials related to Peking University, Cai Yuanpei, and a calligraphic work preserved by the family. Fang Biao contributed oral accounts, historical interpretation, and contextual guidance, especially in relation to Bai Xiongyuan and my field visit to Miyun Tanying.

Bai Di's archive is especially important for the project's 1990s Shenzhen environment. Her materials include analog video recordings, photographs, press materials, and personal notes related to her work as a television presenter and actor. These materials capture both family life and broader media transitions, including the shift from analog video formats to television broadcast culture, and from square 4:3 screens to later widescreen displays. In the VR environment, these materials shape the 1990s domestic space through both content and media form. The television becomes an interactive object through which users encounter Bai Di's archive within the visual and technological conditions in which many of these memories were first recorded.

Bai Lizhang's archive is connected to domestic creativity, photography, music, and family life. His materials include family photographs, artworks, documents, music-related traces, and my own childhood memories of him. My memory of Bai Lizhang differs from Bai Di's memory of him. I remember him mostly after retirement: an elderly man who often narrowed his

eyes and smiled gently, with a softness that made me think of a cat. Bai Di remembers him from a different time in his life. In her account, he strongly supported her career and had a wide range of creative and intellectual abilities. He painted, composed music, spoke Russian, practiced photography, and created an atmosphere of artistic curiosity at home.

One of the most important examples concerns photography and the small darkroom Bai Lizhang built at home after Bai Di and her sister were born. As Bai Di recalls, developing photographs became a shared family ritual. My grandmother, Bai Di, and her sister would participate in the process by mixing chemicals, hanging prints, and watching images slowly appear under red light. This memory is significant because it frames photography as a domestic, sensory, and collective practice. The process of making photographs involved touch, smell, waiting, darkness, light, and shared attention. It also shows how image-making already existed in my family as an embodied form of memory work before the emergence of digital media.

Bai Lizhang also designed a small cat logo for the family photographs, inspired by the family's pet cat. The logo included the family's address, Longtan Beili, Building 7, Unit 4, Floor 10, turning each photograph into both an image and a trace of home. This detail became important to Revisitation because it links photography, domestic space, and family identity through a small graphic mark. The cat logo also connects to the broader use of cat imagery in the project, where cats appear as emotional guides, memory traces, and subtle links between physical and virtual spaces.

In the VR environment, Bai Lizhang's archive is expressed through interactions centered on the piano, selected photographs, sound-based elements, and domestic traces of creative

practice. One example is a photograph documenting his involvement in the Beijing UFO Research Association. According to Bai Di's recollection, he served as an executive member of the association. This detail appears as a triggered fragment associated with objects placed near the piano, functioning as part of a personal and associative memory structure. Another central interaction is based on my final memory of him. When the user touches the piano, an ASCII-based video sequence is activated, derived from the last time I saw him playing piano in a nursing home before his passing. Due to Alzheimer's disease, his playing had become fragmented, yet the gesture of playing remained meaningful. This moment is translated into a text-based visual sequence composed of words related to our relationship and shared memory. In parallel, I reinterpreted a scanned musical score associated with his interests by reconstructing and performing it as a recorded song. Through this process, static archival traces become sound-based and moving-image experiences.

The third cluster of materials concerns Bai Xiongyuan. His archive connects private family memory with public history, although it survives in fragmented and uneven forms. He served as a military instructor and later as a professor of physical education at Peking University, and his traces are scattered across family photo albums, university archives, and my uncle Fang Biao's book 问道北大 (Seeking the Way at Peking University) (方, 2022). Bai Xiongyuan was Cai Yuanpei's colleague at Peking University and was appointed by Cai as Director of Physical Education at the university (蔡, 2003). He later served as Chief Instructor of the Beiping Student Corps during the early 1930s, a role that placed him at the intersection of education, physical training, student mobilization, and military politics. This part of the archive was developed

through family photographs, partial historical documents, family accounts, field visits, and materials prepared with the assistance of Fang Biao.

Fang Biao's contribution focused especially on the interpretation of a calligraphic work given to Bai Xiongyuan by Cai Yuanpei. This calligraphy is displayed in the physical exhibition and also appears in the VR environment as a readable archival object. In the exhibition, audiences can read a bilingual booklet explaining the calligraphy, its inscription, its historical context, and its survival within the family. In the VR environment, the same material is translated into a layered reading interaction, allowing users to access both a short contextual introduction and a longer page-by-page explanation.

The booklet explains that the inscription was personally dedicated to Bai Xiongyuan, whose courtesy name was Jin Tao, and that the language of the dedication indicates a private gift instead of a public or ceremonial work. It also situates the calligraphy within the political danger of 1937, when Beijing was under Japanese occupation and Bai Xiongyuan had been injured, arrested, and unable to leave the city. The calligraphy never entered a public archive or museum collection. During the Cultural Revolution, it was hidden by the family to avoid risk, and the version shown today is a restored and remounted copy repaired with Fang Biao's assistance. In Revisitation, the calligraphy is treated as a fragment of family-held memory, connecting Cai Yuanpei, Bai Xiongyuan, Peking University, political danger, and private acts of care across generations.

After interviewing Fang Biao, I followed his suggestion to visit Bai Xiongyuan's birthplace in Miyun Tanying. This field visit became an important part of the ethnographic

research because it revealed the distance between family memory, local history, and the present-day landscape. Tanying has changed significantly, and most visible traces of the period associated with Bai Xiongyuan have disappeared. The remaining historical marker I encountered was a stone lion from that earlier period, while the surrounding buildings and spatial environment had largely been replaced. I also interviewed local museum staff, who provided broader historical context about Tanying, especially its relationship to Mongol and Manchu banner history, but offered limited information directly connected to Bai Xiongyuan's life.

This field visit also complicated the question of ethnic and historical identity within the family archive. Bai Xiongyuan was born in Tanying, a place connected to Mongol and Manchu banner communities, and some media accounts later described him through his Mongol ancestry. According to family accounts, however, he did not strongly identify with this ethnic framing. Fang Biao recalled that Bai Xiongyuan became angry when reports described him as a descendant of the Mongol "Golden Family," because he believed his achievements came from education, discipline, and personal effort, rather than inherited ethnic status. This tension is important to the project because it shows that family history is shaped by conflicting identities, inherited narratives, and the ways people choose to define themselves.

A central component of the ethnographic research was the recording of more than ten hours of interviews with family members, including Bai Di and Fang Biao. These interviews captured spoken narratives, pauses, gestures, and the surrounding domestic environment. I also recorded 360-degree video interviews, although these materials are not yet integrated into the current VR prototype due to scope and technical constraints. They remain an important direction

for future development, particularly for expanding the spatial and immersive dimensions of memory narration.

The organization and selection of these materials became an important part of the research process. I first grouped the archive according to family member, time period, location, media type, and possible spatial relationship. Photographs, videos, documents, voice recordings, physical objects, and field notes were reviewed together to identify recurring themes, including domestic life, artistic practice, migration, historical rupture, media technology, and intergenerational care. I then considered which materials could function meaningfully within a VR environment. Some materials became background context, such as room layout, atmosphere, and historical setting. Some became middle-ground elements, such as furniture, lighting, sound, and domestic details. Others became foreground interactions, such as the television, piano, photographs, booklet, calligraphy, and selected documents.

The selection process was guided by several criteria. I prioritized materials that carried strong spatial, sensory, or emotional associations; materials that revealed differences between family members' memories; and materials that could be translated into interaction without reducing them to simple illustration. I also considered ethical and practical limits, including privacy, consent, historical uncertainty, and technical feasibility. Some materials were excluded because they were too private, too difficult to verify, or too complex to translate within the scope of the prototype. Other materials were kept as future possibilities, such as the 360-degree interviews, because they require more careful technical and ethical integration.

As a researcher, I am also a family member within the archive I study. I approach the project as a daughter, granddaughter, great-granddaughter, designer, and researcher. This insider position gives me access to intimate stories and personal materials, but it also requires careful reflection on how memories are selected, represented, translated, or omitted. Family memories are shaped by emotion, silence, contradiction, disagreement, and the different ways relatives remember the same person, object, or event.

This ethnographic context directly shapes the design of the VR archive. Interviews and family conversations provide factual information, but they also provide emotional cues, spatial details, sensory associations, and narrative tensions. A remembered object, a room layout, a sound, a photograph, a graphic mark, or a particular phrase can become the starting point for an interaction. In this way, Revisitation translates family voices into spatial and sensory forms through reconstructed rooms, object triggers, voiceover, sound, image, and fragmented media.

By foregrounding ethnographic materials in this way, Revisitation positions family memory as a shared and multi-voiced archive. The project brings together personal recollection, family testimony, archival fragments, and field research, allowing different perspectives to coexist within the same spatial environment. This approach supports the broader goal of the thesis: to explore how VR can preserve family memory as an embodied, emotional, and participatory experience.

Chapter 3: Methodologies and Methods

3.1 Methodological Orientation

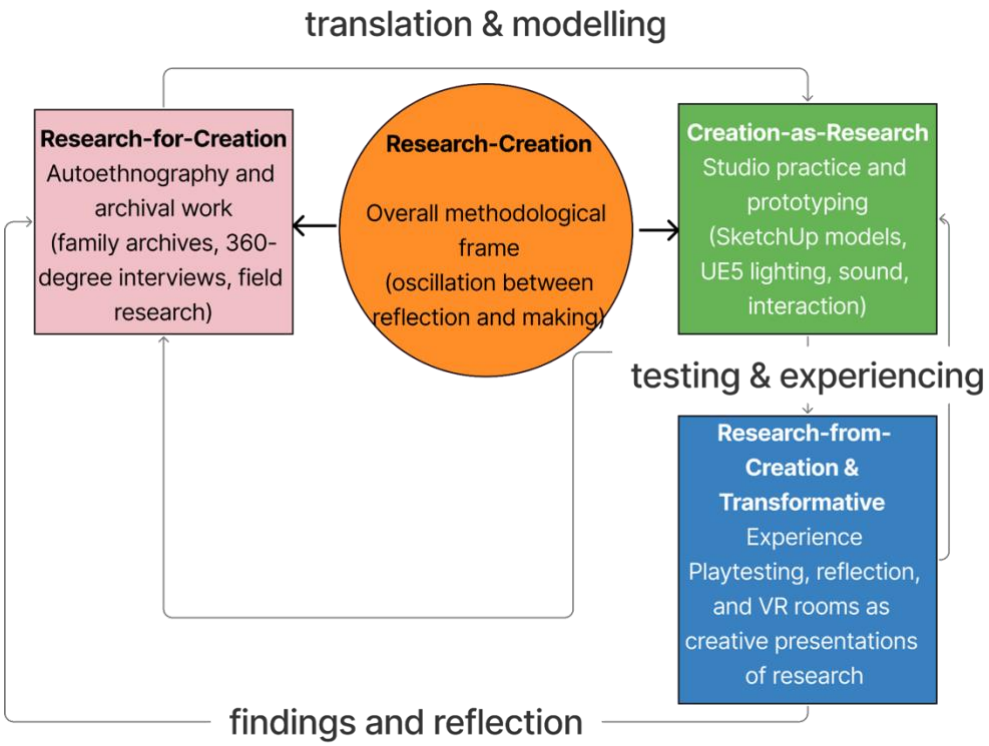


Figure. 1 Research-creation modalities in this project. (compressed version)

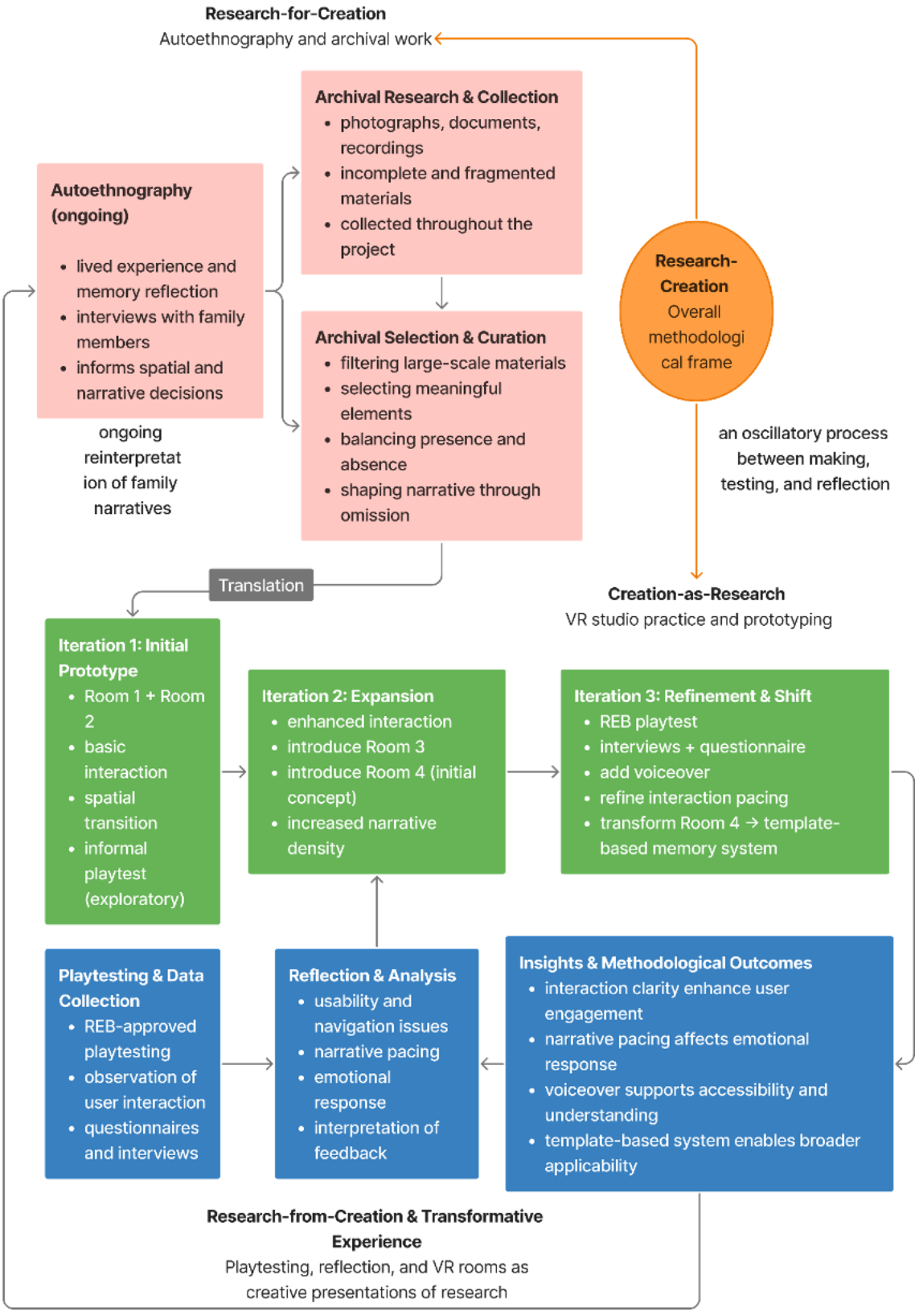


Figure. 2 Research-creation modalities in this project. (detailed version)

This thesis adopts a qualitative, practice-based research approach that integrates research creation and autoethnography as its overarching methodological framework. The virtual reality work functions as the primary site of inquiry, where questions of memory, space, and family history are investigated through iterative making. Creative practice and analytical reflection operate as a continuous and interconnected process.

Research creation provides the central methodological structure. Following Chapman and Sawchuk (2015), the project approaches creative practice as a mode of knowledge production that emerges through engagement with materials, technologies, and situated experiences. The construction of virtual domestic environments from family archives functions as a process of thinking through spatial atmosphere, embodied interaction, and the affective conditions of remembering. Design decisions such as lighting, object placement, sound design, and interaction scripting operate as investigative acts that reveal how memory is activated, shaped, and experienced within immersive environments.

Within this framework, the methodology is structured across three interconnected phases: Research-for-Creation, Creation-as-Research, and Research-from-Creation & Transformative Experience. These phases operate in parallel and are connected through an oscillatory movement between making, testing, and reflection.

The Research-for-Creation phase is grounded in autoethnography and archival work. Autoethnography is ongoing throughout the project and includes lived experience, memory reflection, and interviews with family members. These processes inform both spatial reconstruction and narrative

development. Archival research involves the collection of photographs, documents, recordings, and fragmented materials gathered over time. Due to the scale and incompleteness of these materials, the project emphasizes archival selection and curation. This includes filtering large datasets, identifying meaningful elements, balancing presence and absence, and shaping narrative through omission. Archival work functions as an interpretive process, where family narratives are continuously reconfigured through an oscillation between remembering, selecting, and reframing.

The Creation-as-Research phase unfolds through iterative VR prototyping within a studio based practice. The first iteration establishes an initial prototype consisting of two virtual rooms with basic interaction and spatial transitions, accompanied by informal exploratory playtesting. The second iteration expands the system by enhancing interaction design, introducing a third room, and developing an initial concept for a fourth room, while increasing narrative density. The third iteration focuses on refinement and conceptual shift, incorporating REB approved playtesting, interviews, and questionnaires. This stage introduces voiceover elements, refines interaction pacing, and transforms the fourth room into a template based memory system designed for broader applicability. Across these iterations, the process follows an oscillatory pattern in which each cycle of prototyping feeds back into subsequent design decisions.

The Research-from-Creation & Transformative Experience phase centers on playtesting, data collection, reflection, and analysis. REB approved playtesting generates qualitative data through observation of user interaction, questionnaires, and interviews. This data is analyzed in relation to usability and navigation issues, narrative pacing, emotional response, interpretation of feedback, and

the selection and omission of archival materials. The analytical process itself operates through an oscillation between user experience and design interpretation. These reflections lead to methodological insights and outcomes, including improved interaction clarity, enhanced user engagement, the influence of narrative pacing on emotional response, the role of voiceover in supporting accessibility and comprehension, and the development of a template based system that extends beyond a single family archive.

Across all phases, the methodology operates as an oscillatory process of making, testing, and reflection. Iterative loops connect prototyping, user feedback, and conceptual revision. Early prototypes inform subsequent design decisions, while playtesting outcomes reshape both interaction design and archival interpretation. This continuous oscillation enables the project to evolve through cycles of expansion, refinement, and abstraction. Knowledge emerges through the dynamic relationship between creation, experience, and interpretation.

The following sections elaborate on the specific methods employed within this framework, including archival and fieldwork practices, iterative VR prototyping, embodied spatial investigation, and user centered evaluation through playtesting.

3.2 Autoethnography

This phase of the project uses autoethnography and archival work within a research-creation framework. I position myself simultaneously as a researcher, family member, and future participant within the VR environments. Autoethnography here functions as both a writing practice and a design

method for deciding what to collect, how to listen, what to translate, and what to leave unresolved. Rather than treating family memory as stable data, this method approaches memory as recollection, physical trace, contradiction, and omission.

The autoethnographic process began with systematic digitization and field-based research. I scanned more than four thousand family photographs, many of which include handwritten notes that record dates, places, and descriptions. I also catalogued physical objects such as cameras, paintings, certificates, calligraphy, and personal documents. In parallel, I conducted field research in Beijing, visiting family homes and neighborhoods associated with my mother and grandparents. These site visits informed the reconstruction of the first three VR environments, where spatial layout, environmental sound, light, and material textures are grounded in lived or remembered spaces.

This field-based approach does not extend uniformly across all environments. The fourth space was originally considered as a reconstruction of my great-grandfather's living environment, but it could not be reliably recreated due to incomplete records and the absence of direct experience. Instead of producing a speculative reconstruction, I shifted this space toward a constructed and abstract archive-like environment. This decision reflects an important methodological principle of the project: missing information is not treated simply as a problem to be filled, but as a condition that shapes the form of the archive.

Listening is also approached as an active design process. Family interviews, oral histories, and recorded conversations do not enter the VR environment as direct documentation alone. They are

selected, translated, condensed, recomposed, and redistributed through voiceover, music, ambient sound, and triggered audio sequences. Because most interviews were conducted in Mandarin Chinese while the VR experience is presented in English, voiceover becomes a process of translation as well as narration. All voiceover is recorded in my own voice, but it does not function as a singular or authoritative perspective. It operates as a mediated layer that carries fragments derived from interviews, archival materials, and family accounts.

This process of listening and translation also informs the sound design of the VR environments. Telephone ringing, layered voices, ambient noise, footsteps, animal sounds, and musical fragments are used to evoke memory through sequence and atmosphere. These audio elements do not simply explain events. They create conditions for recollection, allowing users to encounter memory through sensory cues, temporal layering, and spatial association.

To move between archive and environment, materials are organized into spatial and perceptual layers. The background layer establishes historical context and temporal framing. The middle-ground layer defines domestic space and atmosphere through layout, lighting, and sound. The foreground layer identifies specific objects and actions that become interactive, such as the piano, television, photographs, documents, and calligraphy. This layered system supports selective transformation, allowing materials to become interactive according to their narrative and emotional significance.

Throughout the process, I maintained field notes, reflective journals, and schematic sketches that trace how memories move from archive to spatial scene. The work of selection is itself

autoethnographic. It determines which memories become visible, interactive, backgrounded, or omitted. Disagreements between relatives, missing materials, damaged photographs, and uncertain histories are not resolved into a single authoritative version. They remain part of the narrative structure and inform the project's use of abstraction, fragmentation, and non-linear interaction.

This process operates as an oscillatory movement between collecting, interpreting, selecting, prototyping, and transforming materials. Insights from prototyping and playtesting feed back into archival decisions, shaping what is retained, modified, or omitted. By treating autoethnography, archival work, listening, and translation as part of research-creation, this phase connects the labor of scanning, recording, visiting, interviewing, and selecting directly to the design of the VR environments. It enables multiple perspectives on shared memory (RQ1), supports the development of accessible and adaptable design structures (RQ2), and positions abstraction, fragmentation, and reinterpretation as active strategies for engaging with memory (RQ3).

3.3 Research-Creation

Within this project, research-creation operates as the main practice-based framework through which I explore, translate, and test family memory in virtual reality. I treat each design decision as a situated experiment that examines how memory can be activated through space, sound, and interaction. Following Chapman and Sawchuk, I understand research-creation as a set of overlapping modalities: research for creation, creation as research, research from creation, and creative presentations of research (Chapman & Sawchuk, 2015). These modalities unfold through an oscillatory movement between reflection, making, testing, and revision.

Research for creation builds on the archival and autoethnographic processes outlined in Section 3.2 and focuses on how I prepare selected materials for spatial translation. I interpret floor plans, photographs, and oral accounts into three domestic environments corresponding to different generations. These environments are grounded in lived or remembered spaces. At the same time, the absence of verifiable spatial information for my great-grandfather's living environment led me to adopt a different approach. Instead of reconstructing a speculative interior, I developed the fourth environment as a template-based archival space. This shift establishes research for creation as a process that includes both reconstruction and the recognition of its limits.

Creation as research takes place through my construction of VR environments and interaction systems. Using SketchUp and Unreal Engine 5, I developed spatial layouts and introduced interaction through object-based triggers. Actions such as picking up a photograph, pressing a television switch, holding a camera, or brushing a canvas structure show how users engage with memory. I design these interactions in relation to bodily position and movement. Users may sit in front of a television to watch a performance, stand while examining objects on a table, or walk across a room to approach different points of interaction. I treat these variations in posture and movement as part of the design, shaping attention, pacing, and the perception of space.

Creation also serves as a site for exploring abstraction. I introduced a transitional entry environment, constructed as a galaxy-like spatial field with a door as a threshold, to establish a shift in perceptual and temporal orientation before users enter domestic space. This abstract layer frames memory as something entered through movement. I extend this approach in the fourth environment,

which functions as an archive-like system that allows users to insert and experience their own materials. Through these design decisions, I use abstraction as a method for structuring experience.

Research from creation emerges through technical constraints, system behaviour, and user feedback. Early VR builds revealed performance limitations, especially when I used complex lighting and real-time effects. Testing across different hardware conditions showed that these issues were linked to rendering capacity, which led me to shift toward lighter assets and more efficient structures. This directly informs my focus on accessibility and replicability. Observations from the SPARK exhibition and subsequent playtesting sessions further identified issues of interaction clarity and pacing. Participants often hesitated when locating interactive objects and preferred shorter, distributed moments of engagement. I incorporated these findings into adjustments in interaction density, timing, and the use of sound as a guiding element. I use layered audio sequences, including voiceover, ambient sound, and constructed sound events, to direct attention and support recollection.

Creative presentations of research are realized through the VR environments themselves. These environments function as sites where memory is encountered through embodied interaction. Users engage with space through sitting, standing, walking, and handling objects, and these actions shape how meaning is formed. Watching a television sequence while seated produces a different temporal experience from moving through a room or interacting with objects at close range. I treat these embodied conditions as part of the design, structuring how memory is perceived, segmented, and sustained. The progression from domestic environments to a template-based archive space introduces a

shift from situated memory to participatory systems, allowing the work to extend beyond a single-family context.

Across these modalities, the project follows an oscillatory process rather than a fixed sequence. Archival material informs spatial construction, prototyping introduces constraints and new questions, and user feedback reshapes both interaction design and narrative structure. I carry these insights forward into subsequent iterations. This ongoing oscillation between research for, as, and from creation defines how knowledge is generated in this project and prepares the ground for the detailed prototype analysis in Chapter 4.

3.4 Research Ethics

Because this project involves user playtesting and the collection of participant feedback, ethical approval was obtained from the Research Ethics Board (REB) at OCAD University prior to conducting the study (REB approval #102789). The study follows the ethical guidelines outlined in the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS 2). Ethical considerations were particularly important for this project because it combines immersive technology, personal archival materials, and voluntary participant feedback.

Participants in the playtest were recruited from the university community and public exhibition visitors who were interested in experiencing the VR prototype. A total of approximately eight to twelve participants were invited to take part in the study. All participants were required to be at least eighteen years old and comfortable using VR equipment. Individuals who reported severe motion sickness,

epilepsy, or other medical conditions that could be affected by VR exposure were excluded from participation in the research component of the study, although they could still experience the VR demonstration informally.

Before participating, individuals were asked to review and sign an informed consent form explaining the purpose of the research, the procedures involved, potential risks, and their rights as participants. The playtest consisted of three primary components: a short VR interaction session, a questionnaire about usability and experience, and an optional follow-up interview. Participation typically lasted between twenty and thirty minutes.

To protect participant privacy, all collected data were anonymized. Participants were assigned codes rather than recorded by name, and no identifying personal information was included in the research dataset. The VR system only recorded a screen capture of the virtual environment rather than capturing participants' faces or physical surroundings. Optional photographs or video recordings of hand movements were taken only with participant consent and were designed to avoid capturing facial features. If any identifying features appeared accidentally, they were removed or blurred before storage.

All digital data, including questionnaire responses, coded interview audio, observation notes, and VR screen capture files, were stored in encrypted cloud storage provided by OCAD University. Access to this material was limited to the principal investigator and the faculty supervisor. Data will be retained for

one year following the completion of the thesis and then permanently deleted. Any paper documents, such as signed consent forms, will be scanned for secure storage and subsequently destroyed.

Participation in the study was entirely voluntary. Participants could decline any recording option, skip questions, or withdraw from the study at any time without penalty. As a small token of appreciation, participants were offered a non-monetary gift, such as a printed sticker or digital artwork related to the project. The incentive was optional and not tied to completion of the research activities.

The poster, invitation letter, consent form, information sheet & safety note, VR playtest feedback survey, and interview script used in the study are included in the appendices of this thesis.

Chapter 4: Project/Prototype Documentation

4.1 Prototyping Approach and Research-Creation Framework

The development of this project unfolded through a series of iterative prototypes that gradually shaped both the technical structure and the conceptual methodology of my thesis. Each stage served as a way to think through making and to understand how intergenerational memory might be translated into embodied digital experience. Rather than designing a single polished environment from the beginning, I approached the project as a layered process. Early prototypes allowed me to experiment with physical metaphors of memory, collaborative participation, and AI-assisted spatial visualization. Later prototypes focused on building fully immersive VR rooms that align with the sensory and emotional qualities of lived family experiences. This chapter documents these stages as a continuous design trajectory, highlighting how each prototype revealed new questions, shaped the next iteration, and gradually clarified the direction of the VR archive.

The prototypes reflect an evolving understanding of how memory can be activated, spatialized, and embodied. They also reveal the methodological tension between reconstruction and interpretation. While some family spaces could be recreated based on photographs, floor plans, and oral accounts, others required imaginative engagement due to incomplete documentation. The iterative process allowed me to negotiate this tension while refining my technical pipeline and interaction strategies.

4.2 Prototype One: What We Carry Across Generations – Suitcases of a Family's Memory

Figure. 3 Documentation of the handmade box prototype and its structural details.

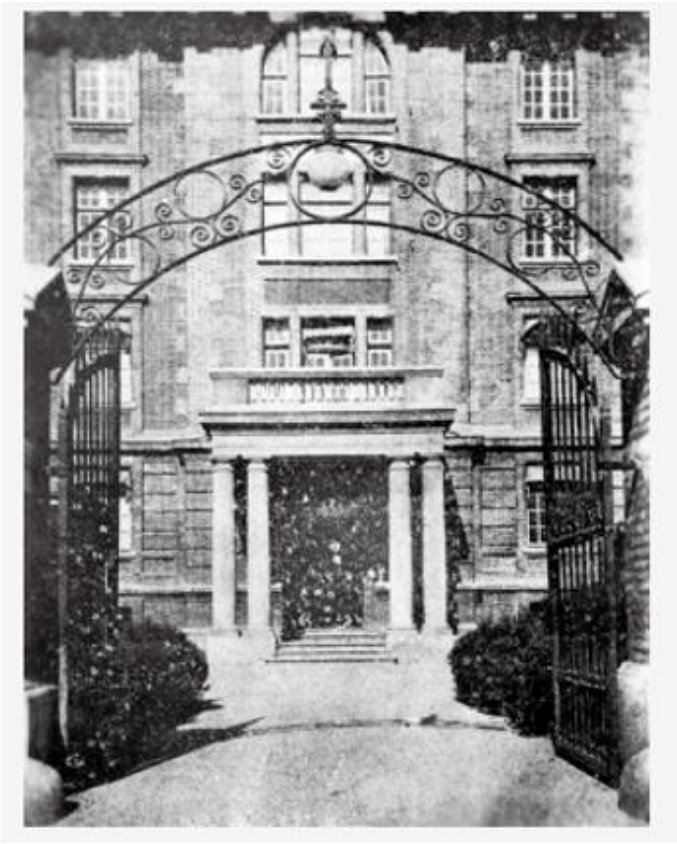


Figure. 4 Figure 4 Historical photograph of the Honglou Site Group.

Note. Image sourced from Honglou Site Group (Beijing Municipal Party History Research Office & Beijing Local Chronicles Compilation Committee Office, n.d.). Retrieved from (*《红楼旧址群》-北京大学红楼-遗址遗迹-合集-京网-中共北京市委党史研究室-北京市地方志编纂委员会办公室*, n.d.)

Figure. 5 Box prototype tested in physical space with staged and real-world interactions.

Note. Staged photograph edited by the author to evoke the visual style of the 1919 Peking University Red Building. Photographs by author. Model: Jiaxin (Flora). Visuals were generated using ChatGPT tools based on an author-written prompt.

Figure. 6 Documentation of the handmade briefcase prototype and its structural details.

Figure. 7 Staged archival scene and physical interaction tests with the briefcase prototype.

Note. Photographs by Yudi Cao. Model: Jiaxin (Flora). The background design and image editing were produced using a prompt written by the author to evoke the visual style of 1990s Shenzhen. Visuals were generated using ChatGPT tools; no external reference images were used.

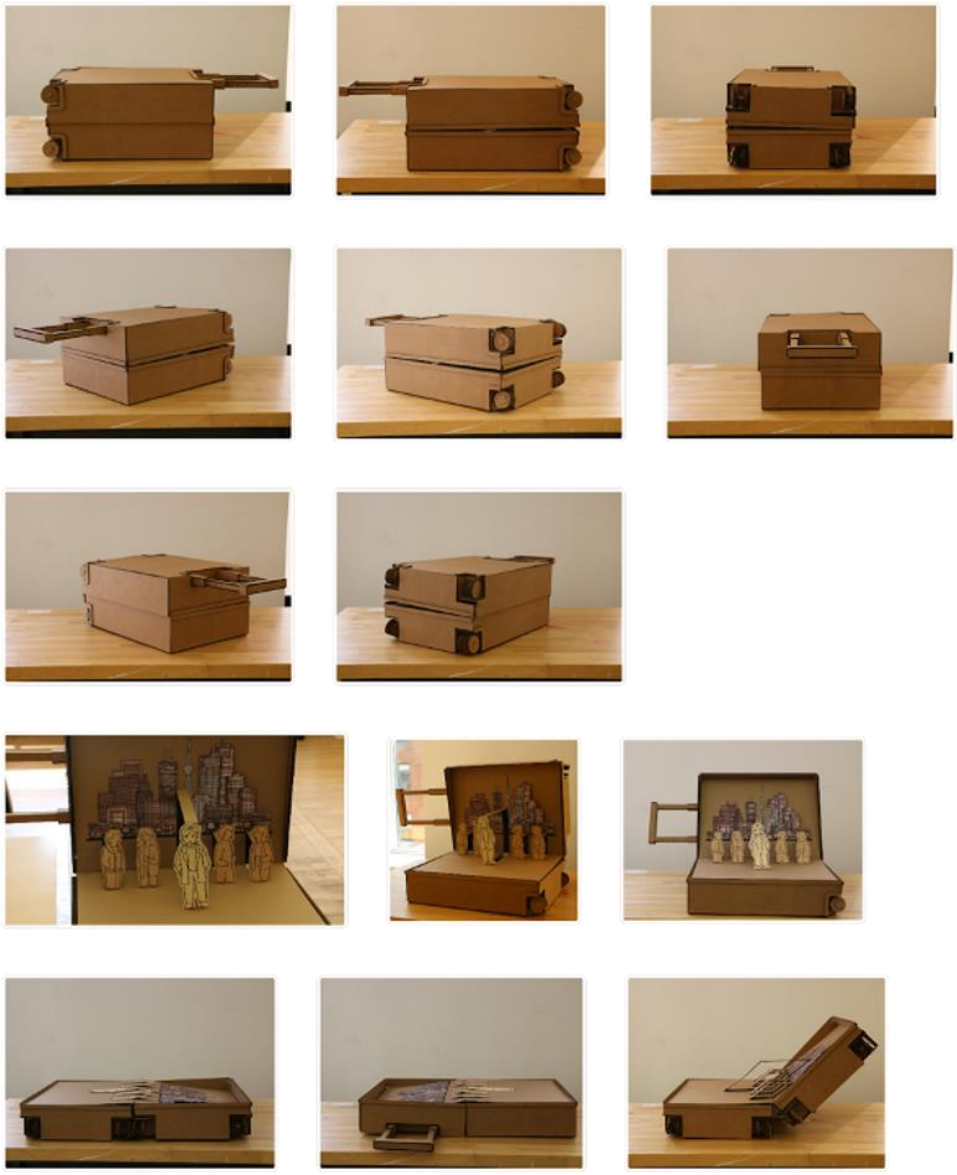


Figure. 8 Documentation of the handmade suitcase prototype and its structural details.

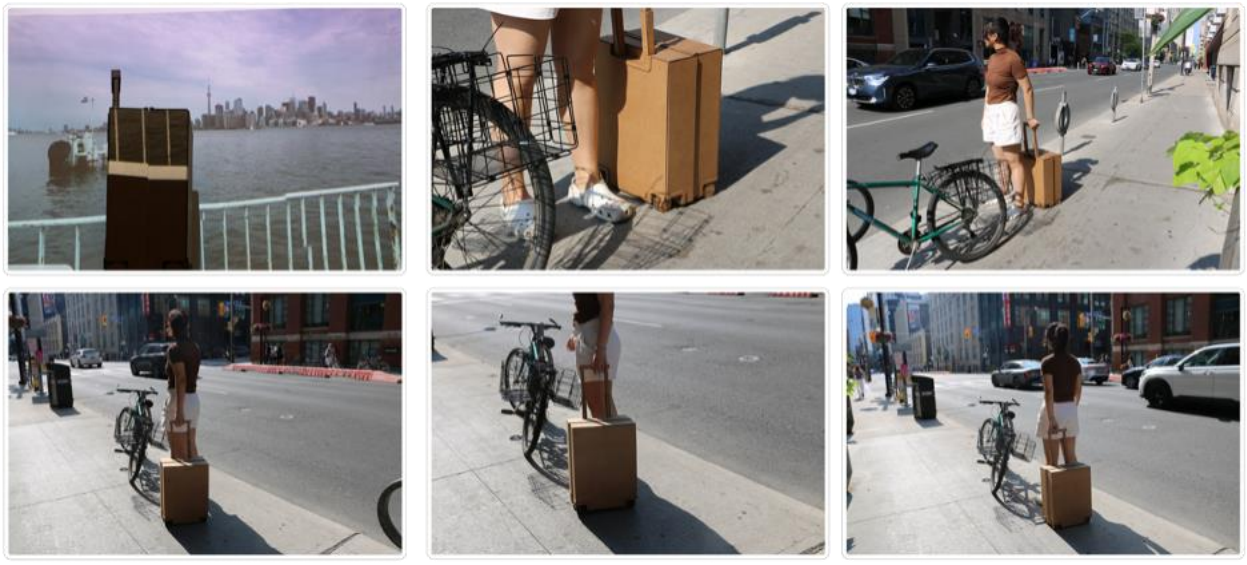


Figure. 9 Physical interaction tests with the suitcase prototype in downtown Toronto.

Note. Photographs by Yudi Cao. Model: Jiaxin (Flora).

Prototype One was developed during the Thinking Through Making course in Summer 2025 and became the first material exploration of how intergenerational memory might be translated into spatial and tactile form. The project, titled *What We Carry Across Generations: Suitcases of a Family's Memory*, focused on the suitcase as a narrative and symbolic object. It offered an early opportunity to understand how physical making could support the conceptual aims of my thesis on memory, migration, and embodied archiving.

concept

Repetition: Not a mechanical duplication, but a reenactment imbued with emotional intensity.
Translation: Refers to a transformation of meaning — not a simple transmission, but a re-presentation through changes in form or medium.
Iteration: Experimental repetition and revision, progressing toward a clearer and more refined expression.

"Moving" is not merely the relocation of objects from one space to another — it is a process of translating memory, identity, and family relationships. It is a tangible practice that layers repetition, translation, and iteration. Each move represents a disassembly and reconstruction of the family archive.

Correspondences Between the Conceptual Framework and the "Moving Process"

Moving ≠ Logistics → Moving = Embodied Translation of Memory

Why is moving a suitable subject for this?
Because moving is not only a spatial act of repetition, but also a translation of identity and memory, and, more importantly, an ongoing process of experimenting with and reconstructing the narrative of family history — an act of iteration.

Concept	Embodiment in the Moving Process	Relation to the Concept
Repetition	Moving involves a "patterned" set of actions. Every move includes repeated operations: packing, carrying, sorting, relocating, and unpacking. Though the steps are similar, they may differ in emotional tone, context, or meaning depending on the family, time, and location.	Repetition can reflect how memory is reenacted — e.g., how habitual memory-related actions such as "packing" or "carrying" change based on time or space. These shifts highlight the emotional or narrative significance of repetition.
Translation	Each move reflects a change in life circumstances. The idea of "home" is reinterpreted with every relocation. The house's meaning transforms based on time, space, and cultural perceptions.	This can be understood as conceptual translation: turning past events, objects, or emotional anchors into new spatial and structural interpretations. For example, a "stone" could be recontextualized as a travel souvenir.
Iteration	In reality, moving always requires adjustments (especially when things don't go as planned). Reorganizing and repacking reflect a kind of iterative process of trial and error. During moving, objects may be placed, removed, or rearranged multiple times until a satisfactory order is achieved.	Iteration can be seen as a response to feedback or failure. Each repacking is a revision. These revisions reflect evolving needs and conditions — e.g., a room being rearranged three times as part of adaptation.

Figure. 10 Correspondences between the moving process and the conceptual framework of embodied family memory.

The starting point for this prototype was an interest in how family histories are carried across time through both personal belongings and the emotional weight embedded in everyday objects. My own family's history contains several migrations across three generations, and each move reshaped the way home, identity, and memory were understood. This prototype asked how these generational transitions

could be expressed through a form that audiences could open, touch, and examine. The suitcase served this purpose naturally. It is an object associated with departure and arrival, with packing and unpacking, and with the intimate contact between people and the belongings they choose to carry with them. It also functions as an archive that silently holds traces of past environments and experiences.

Figure. 11 Documentation of troubleshooting, working process, and material exploration for Prototype One.

Through this lens, we created three cardboard suitcases. Each corresponded to one generation. The first suitcase represented my great-grandfather's early twentieth-century relocations within Beijing, which unfolded across several significant places, beginning in Miyun's Tanying Mongolian Autonomous Township and later moving toward central Beijing and eventually the residential quarters of Peking University. These shifts marked the major transitions in his life, from serving as a young military officer

to becoming a university educator, and later experiencing professional setbacks shaped by the political conditions of the time. Rather than presenting a full biographical account, the suitcase condensed these turning points into a single spatial moment, using the material language of the pop-up diorama to reflect the movement, instability, and reorientation that defined his generation. The second suitcase visualized my mother Bai Di's relocation from Beijing to Shenzhen during the 1990s, capturing the atmosphere of rapid urban change and the early years of her career in television. The third suitcase depicted my own move from China to Toronto as an international student. These suitcases opened into pop-up dioramas that depicted specific moments from each generational journey. The dioramas were constructed through paper engineering techniques, cardboard modeling, and visual reconstructions informed by family photographs and oral histories. When opened, each suitcase revealed a layered scene that conveyed both spatial depth and emotional tone. The unfolding mechanism of the pop-up structures made the memories feel active and situated, rather than static illustrations.

Working with cardboard influenced the meaning of the project. Cardboard is a material that is structurally simple, easily cut, and modest in appearance. It cannot fully mimic the durability or texture of leather suitcases, yet its fragility resonated with the nature of family memory itself. Many family stories are partial, worn, or vulnerable to loss. The material's limitations became a conceptual asset because the imperfections of the suitcases reflected the imperfections of memory. At the same time, the hands-on process of cutting, folding, and assembling the cardboard highlighted the labour involved in restoring and reinterpreting generational narratives.

The contents of each suitcase reflected different historical and emotional worlds. My great-grandfather's suitcase included a pop-up representation of Peking University's Red Building, reconstructed from archival photographs and generative imagery. My mother's suitcase featured a scene inspired by 1990s Shenzhen, a period shaped by her work in early television and performance. My own suitcase depicted my arrival in Toronto, emphasizing the unfamiliarity and transitional nature of that moment. The process of designing these dioramas helped me articulate how memory could be translated from lived experience into spatial form. It also introduced the idea of layering foreground, mid-ground, and background elements to create scenes that hold emotional context, narrative cues, and environmental texture. This layered method eventually shaped the VR compositional structure I use in later prototypes.

Although the three suitcases provided a strong conceptual and visual foundation, the interaction remained limited. Users could open the suitcase, look at the diorama, and interpret the scene, but they could not influence or extend the narrative. The experience was contemplative rather than participatory. These limitations revealed the need for future prototypes to incorporate more active forms of engagement, where memory could be triggered through gesture, movement, or decision-making rather than passive observation.

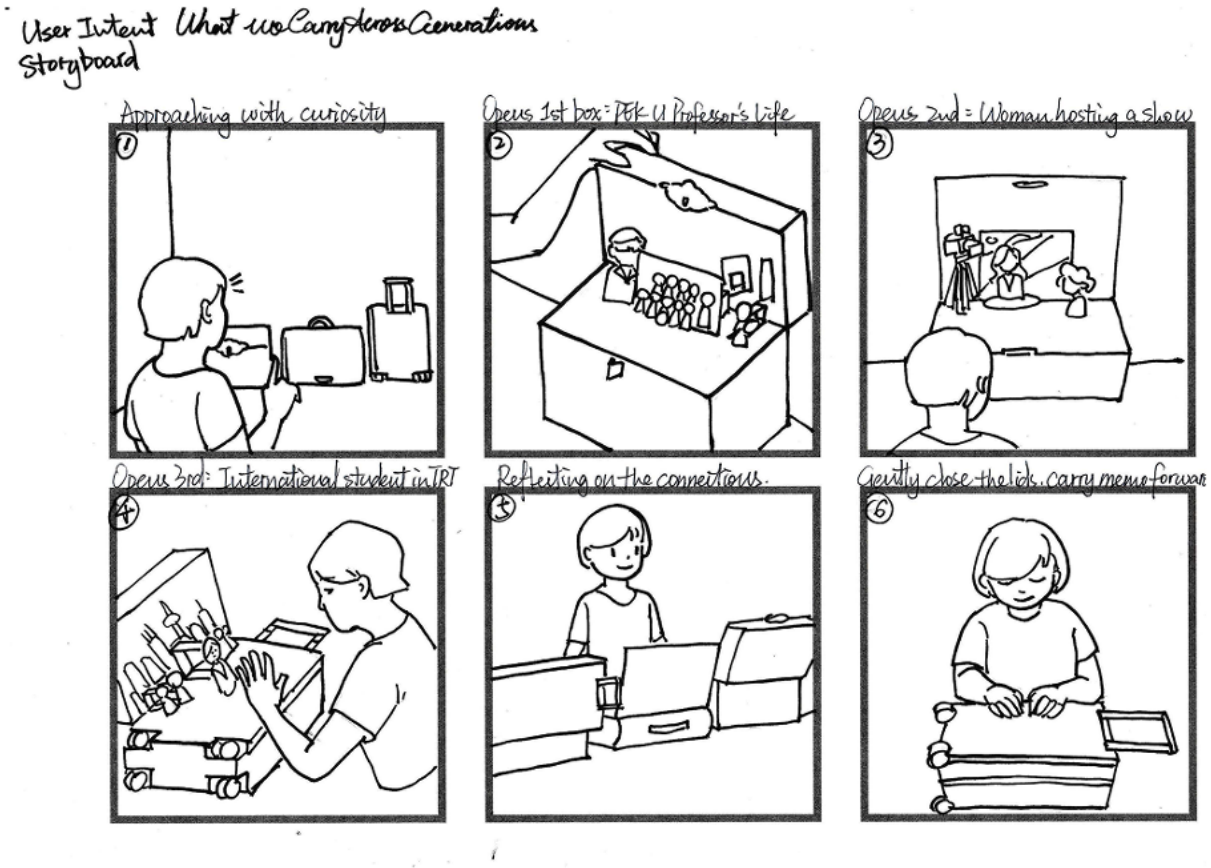


Figure. 12 Storyboard illustrating user intent.

Despite its simplicity, this first prototype played a significant role in shaping the thesis. It confirmed that memory can be spatialized and embodied in ways that exceed written or photographic documentation. It also provided a low-tech method for understanding how personal histories can be expressed physically. Most importantly, it foregrounded the emotional dimension of intergenerational storytelling, giving me a clearer sense of how a digital archive might feel rather than only how it might look. Through the suitcases, memory became an environment that one could enter, unfold, and hold.

This shift from representation to embodied encounter set the foundation for the more complex interactive systems that followed.

4.3 Prototype Two: AI-Assisted Pre-visualization of Memory Space

The Second prototype explored how generative AI could support the early conceptualization of the VR memory archive by providing rapid visual sketches of spatial atmosphere and temporal transformation. Unlike the first two prototypes, which were grounded in physical making and participatory interaction, this stage served as a way to visualize ideas before committing to the labour-intensive process of building full environments in Unreal Engine. Rather than treating AI as a creative agent, I used these tools as planning instruments to test the mood, composition, and temporal logic of my thesis project.

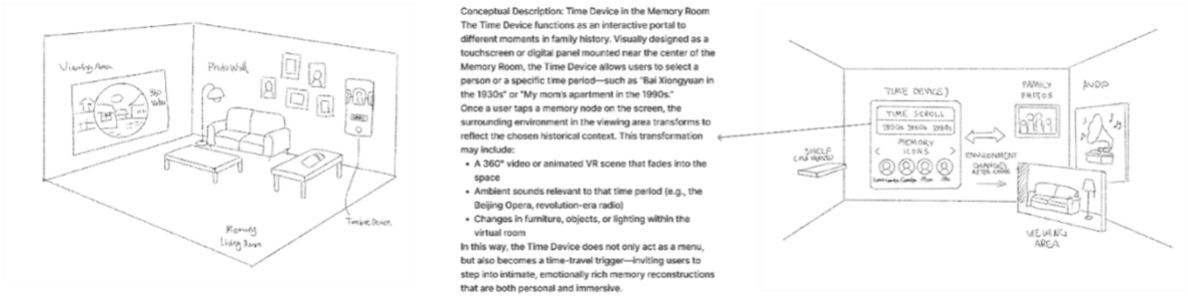


Figure. 13 Thesis concept sketch of the interactive archive living room

Figure. 14 DALL·E-generated visual concept rendering

Figure. 15 Failed result — the 360 portal was represented merely as a glowing circle on the wall.

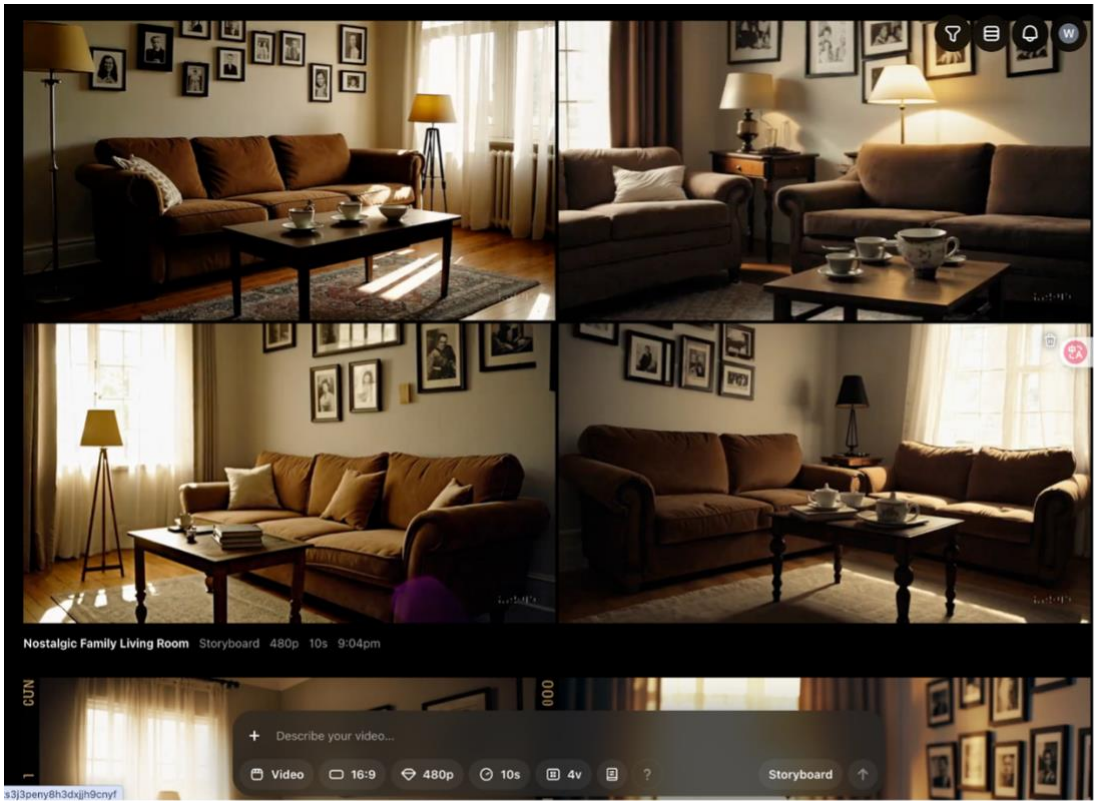


Figure. 16 Screenshot of Sora-generated living room

To begin shaping the memory living room that would later appear in VR, I produced hand-drawn sketches of the space, focusing on spatial layout, object placement, the position of the 360-degree portal, and the wall where a timeline interface might eventually exist. These sketches helped me clarify the architectural relationships between elements and provided a reference for the next step, which involved using generative AI to visualize how these elements might look in motion. The sketches captured the conceptual core of the room, but AI tools allowed me to see light, texture, and transformation unfold over time, something that drawings alone could not achieve.

I used OpenAI's video generation tool Sora to create short visual studies of the environment. Since the system generates only brief clips, I approached the process as modular scene design. I produced a series of small visual moments that collectively suggested how the living room might shift across decades. One clip showed the base environment: a warm, intimate living room filled with framed photographs. Another imagined how a circular portal might open into a past environment. A third depicted the room adopting 1990s aesthetics, with a CRT television, floral-patterned furniture, and yellowish ambient light gradually appearing. Although the generated scenes did not always match historical accuracy or architectural details, they conveyed an emotional palette and temporal rhythm that helped me see how transitions might function in VR.

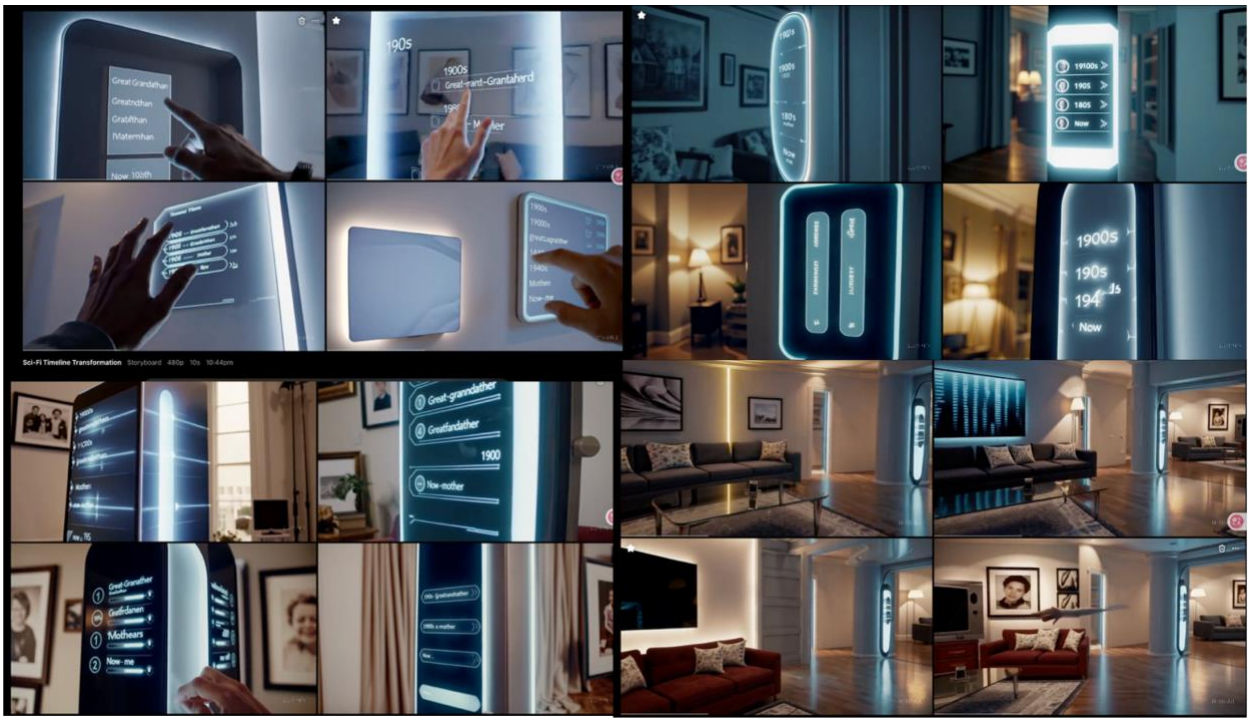


Figure. 17 Time machine Menu

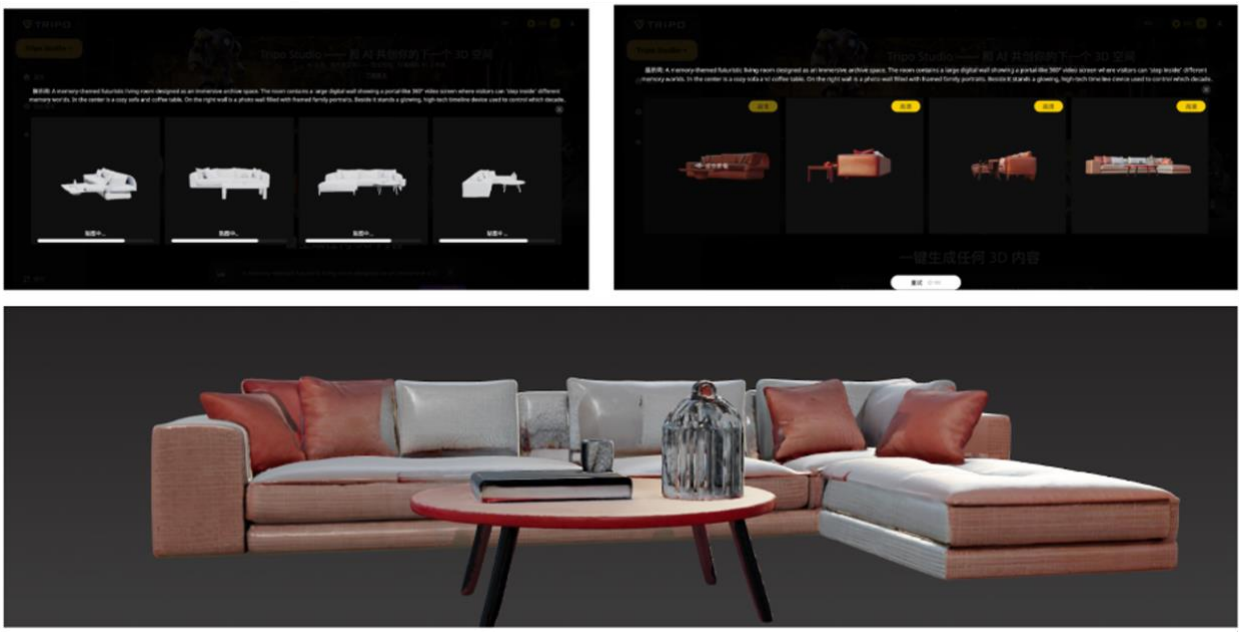


Figure. 18 Output of Blender scene generated from ChatGPT's Python code

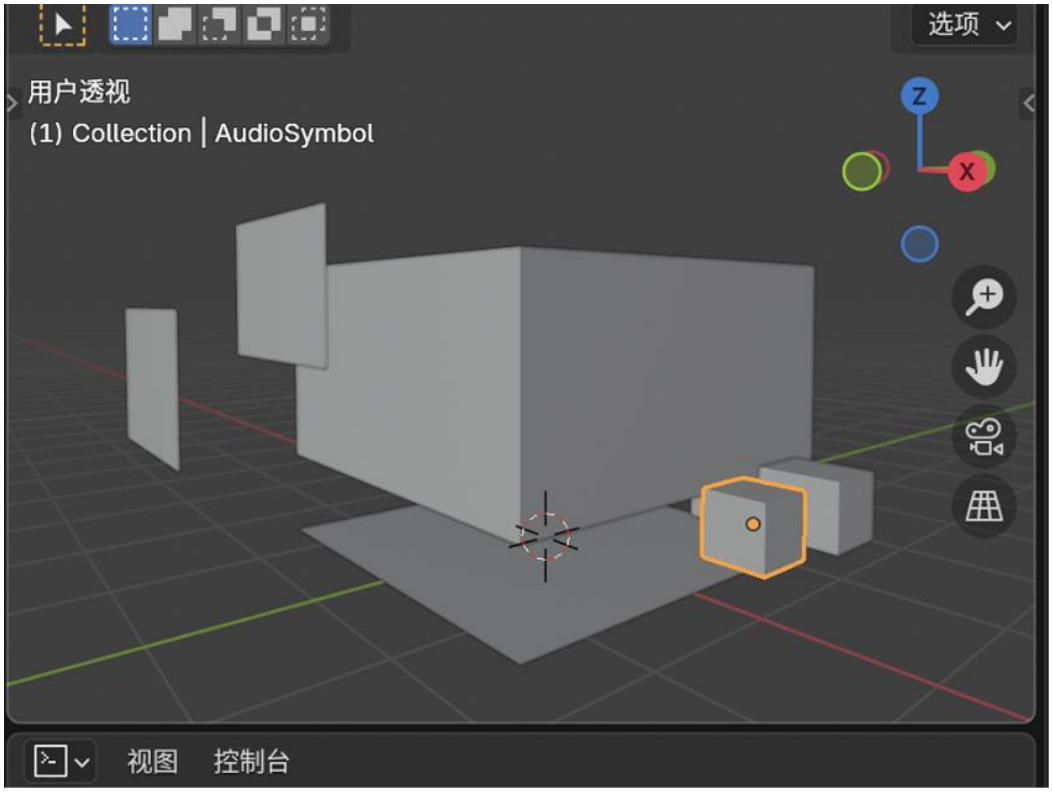


Figure. 19 Output of Blender scene generated from ChatGPT's Python code

Before generating these videos, I experimented with AI-assisted 3D modelling tools such as Tripo and Blender code generation, hoping they might produce a rough spatial model. These attempts resulted only in disconnected furniture pieces or simple geometric shapes without meaningful interior logic. This made it clear that while AI can support atmospheric exploration, the actual construction of coherent memory environments still requires intentional spatial design. This realization reinforced the importance of my earlier sketches, which remained the structural basis for the visual studies generated by Sora.

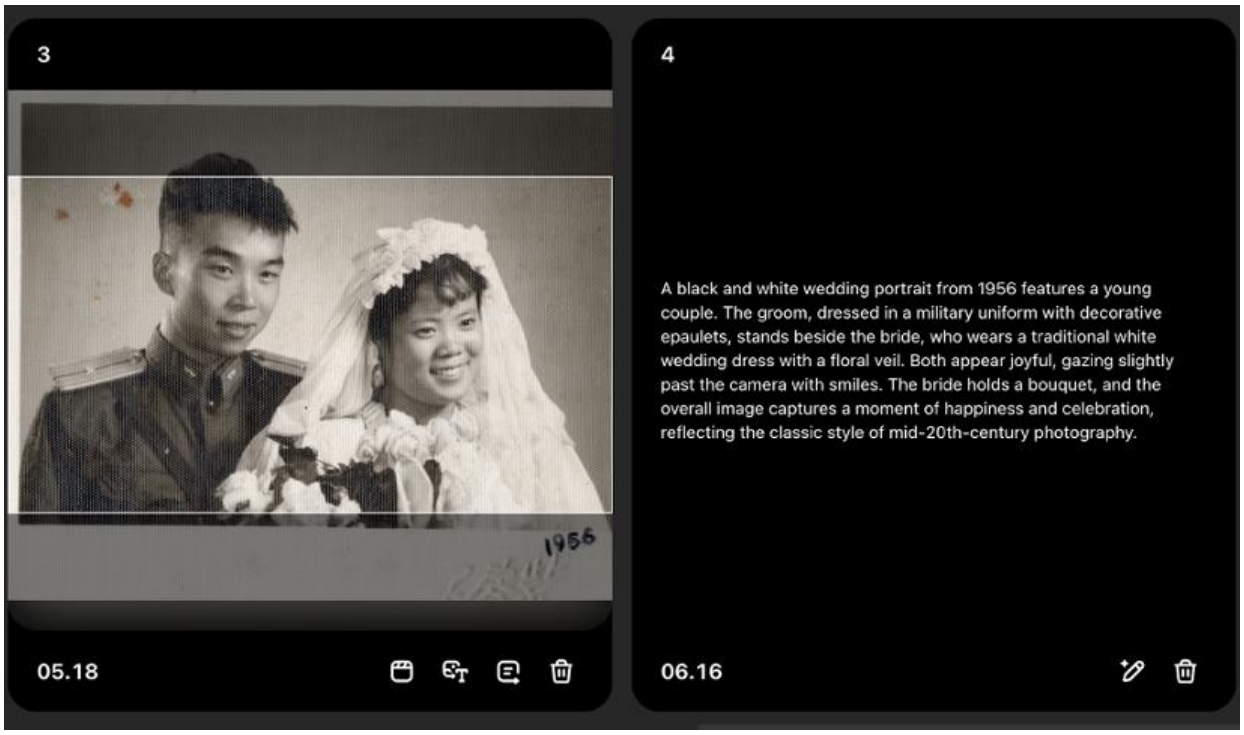


Figure. 20 Example of Sora's automated interpretation workflow, showing a 1956 family wedding photograph and the system-generated descriptive text. The juxtaposition illustrates how the AI reframes personal archival material through generic visual assumptions.

Using AI also allowed me to test ideas that may become relevant later in the project. For example, when I uploaded my grandparents' wedding photo, Sora produced a brief animation that made their faces move. The result was imperfect, but it opened a new line of possibility. It made me consider whether, in future iterations, some of the archival photographs in the VR rooms could shift subtly or come to life when approached, creating a sense of presence without fully reconstructing an entire scene. I am still deciding whether this approach aligns with the emotional tone I want to create, but seeing the animated photograph sparked an interest in integrating small, quiet forms of dynamism into the archive.

Although this prototype did not directly influence the technical structure of the VR prototype that followed, it offered something equally important. It allowed me to see the project before it existed. AI-generated videos became a quick form of pre-visualization and helped me experiment with temporal pacing, color palettes, and transitional effects. These small visual tests clarified how the memory portal might work, how the living room could shift between decades, and how atmosphere contributes to narrative meaning. The process ultimately reinforced my role as the author and designer. I used AI to explore possibilities, but I was the one selecting, editing, and shaping these fragments into a coherent direction.

Prototype Three therefore functioned as an intermediary space between drawing and VR production. It provided a way to test emotional tone and transformation logic, and it helped me imagine

how memory could appear through light, texture, and subtle motion. This conceptual groundwork allowed the next prototype to focus on building a more stable and embodied VR environment grounded in real movement, touch, and spatial presence.

4.4 Prototype Three: First VR Environment and the Beginning of the Working Archive

Prototype Three marked the true beginning of building my VR memory archive. It was the first time that earlier conceptual sketches, physical cardboard prototypes, and AI generated visual tests were translated into a working virtual space that people could actually inhabit. In this stage I was no longer only thinking about how memory might be experienced, but was confronted with the practical work of constructing an environment that could run in real time, respond to user actions, and hold traces of family history. The process required intensive technical learning, constant troubleshooting, and a willingness to revise my assumptions about how interaction and atmosphere should function in VR. It was also the point at which the conceptual, technical, and experiential dimensions of my thesis finally started to align.

I entered this phase with only basic familiarity with Unreal Engine 5, so the first weeks were dedicated to self directed learning. I followed numerous YouTube tutorials and online guides that explained how to set up VR templates, import geometry, configure lighting, build simple blueprints, and define collision. Most of these resources were written for games or architectural visualization. They

assumed a fast pace of movement, clear goals, and highly optimized environments designed for spectacle. My project, in contrast, asked for slow exploration, domestic intimacy, and open ended wandering. This meant that I had to read these tutorials critically and adapt them to a very different context. The learning process revealed three major gaps that would shape this prototype. There was a technical gap, where my desire for atmospheric light and detail collided with performance limits. There was a conceptual gap, where standard VR interaction patterns did not match the logic of a family archive. There was also an expressive gap, since I was still figuring out how memory should feel when it becomes spatial and embodied rather than written or spoken.

The first VR room I built was my grandparents' modern apartment in Beijing, the place where they lived after retirement and where I spent much of my own childhood. To reconstruct the architecture, I used floor plans and photographs from a second hand housing listing that closely matched the original unit. The apartment is in a higher floor building and when the windows are open you can hear the sound of traffic from the busy street outside. These details entered the model as both spatial and acoustic reference points. In SketchUp I recreated the main layout, then furnished it according to my embodied recollection and my mother's descriptions. For me this room is associated with later visits, quieter days, and the period when the family felt relatively stable after many earlier relocations. (Lécuyer, 2009)

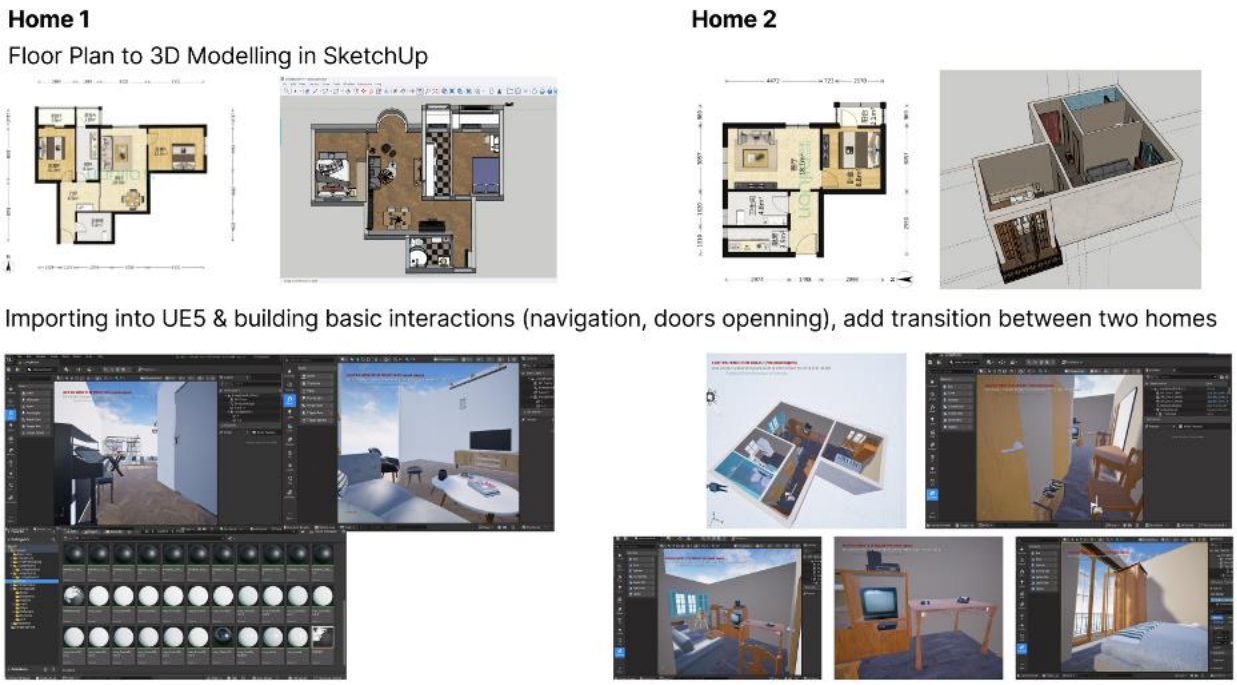


Figure. 21 Development process of two generational home environments from floor plans to VR interaction prototyping.

I imported this model into Unreal Engine using Datasmith and at first the environment looked promising on the desktop. I followed several architectural visualization tutorials that recommended elaborate lighting setups. I added an animated cycle of sunlight, multiple point lights, reflections, and heavy post processing effects to create a soft and cinematic atmosphere. On a flat screen this looked close to what I imagined. However, when I attempted to run the project in VR, the headset stalled on the loading screen, then broke into a grid of tiny pixelated squares and crashed. The default Unreal VR template loaded without any issue, which meant that my level was far too heavy for the system to handle.

This failure forced me to confront the technical reality of VR development. I spent days reading crash logs, disabling lights, reducing shadows, and turning off effects. Each time I removed a visual feature I tested the headset again, trying to identify which element pushed the project past its limits. Through this process I learned that the visual softness I associated with memory did not automatically translate into a workable VR scene. If I wanted an archive that could be walked through at all, I had to redesign the environment in a more frugal and efficient way. Optimization became a form of translation. I was not abandoning the emotional qualities I wanted, but I had to find a different technical language for them.

During this period I also tried to design my first interaction system. My initial idea was to install a time machine menu inside the living room. Users would approach a floating interface and select a decade or a family member in order to move between rooms. This structure mirrored the way many digital archives and databases function. When I built a rough version of the menu and tested it in the headset, it immediately felt wrong. The interface looked as if it belonged to a flat screen application rather than a lived in apartment. It interrupted the illusion of being in a domestic interior and pulled the user back into a mode of clicking and selecting that belongs to desktop computing. The more I experimented with it, the more I realized that this kind of interaction contradicted the embodied and sensory orientation of the project. Later feedback from instructors and peers, who pointed out that menus tend to flatten VR experiences, confirmed what I was already sensing. This led to a clear conceptual decision. In this archive, interaction should begin from objects and gestures inside the room rather than from abstract menus. (Dourish, 2001)

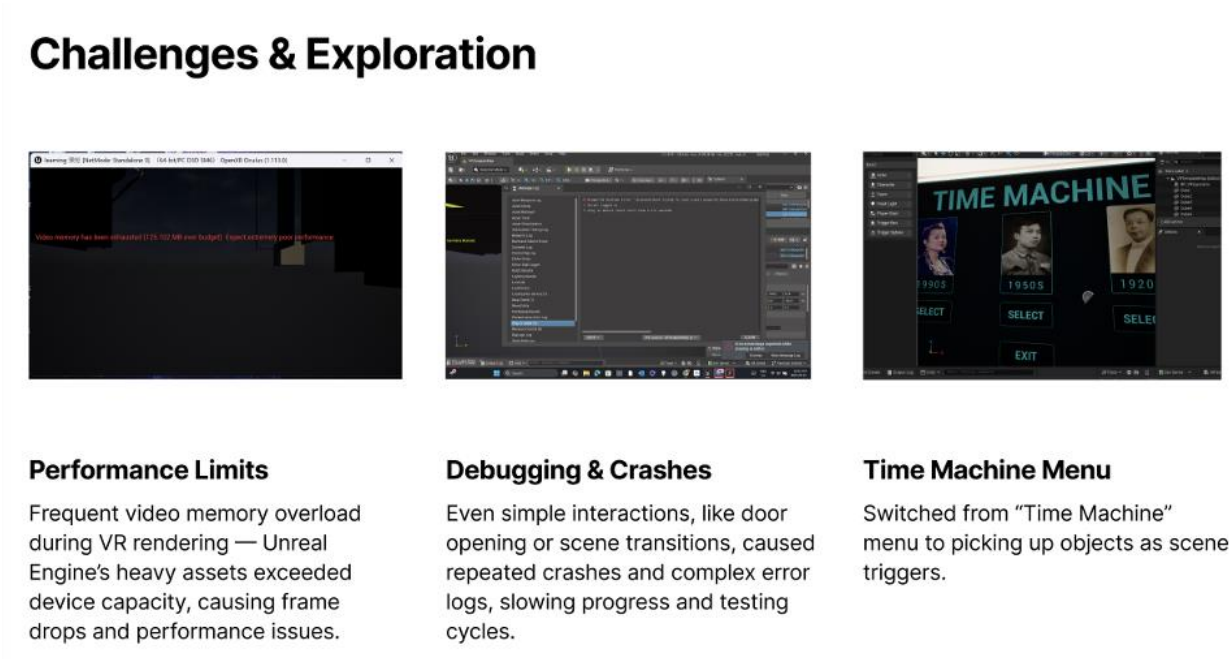


Figure. 22 Unreal Engine screenshots illustrating VR development challenges: performance overload, debugging crashes, and the initial Time Machine interface.

As a result, I removed the time machine panel and replaced it with a simple object based trigger. On a table in the living room, there is a framed photograph of my grandfather as a young man. When the user reaches out and picks up this photograph, a Blueprint sequence starts a short delay and then loads the next level. The action of holding the image becomes a quiet ritual that connects one space to another. This design is consistent with the way memory is often activated in everyday life, when a single object unexpectedly opens a path back to another time.

Before this transition could function properly, the environment itself had to become stable. After multiple crashes and failed builds, I decided to delete the overloaded level entirely and rebuild from a fresh VR template. I imported the room again, this time without post processing volumes or animated

skies. I tested basic locomotion first, then began to add interaction and sound. The Datasmith import did not automatically generate collision, which resulted in users passing through walls and furniture. I manually enabled complex collision settings for the floor, walls, and larger pieces of furniture until walking felt plausible and the body no longer slipped into surfaces. At the moment when I could walk across the living room, stop by a table, and turn without passing through a chair, the space stopped feeling like a floating model and began to feel like a place.

Once the first room reached a stable state, I constructed the second room. This environment is based on the old apartment where my grandparents lived as a young couple in the 1960s. It is located in an older style residential building with no elevator, only staircases, and a small communal courtyard outside. The building still exists, although it has been sold and is no longer part of our daily life. This room carries a different layer of family memory. It is connected to my mother's childhood and also to my own early years. When I was in kindergarten, my grandparents would sometimes take me to temple fairs from this home, and I would occasionally spend one or two days a week there visiting them. The outside environment is quieter than the modern apartment. When you open the window you hear birds and the soft sounds of a small yard rather than continuous traffic. In SketchUp I rebuilt this space using floor plans from second hand housing listings along with family stories and my own impressions. It is not a generic historical set, but a specific domestic unit that has held several decades of everyday life.

In this second room I modeled the analog television by hand. Instead of using a generic flat screen, I created a thick cathode ray tube set with a four by three screen ratio and a solid body that matches the televisions I remember from my childhood. For me this object carries both historical and emotional

accuracy. It belongs to the period when television was a central shared medium in the living room. In the VR environment, when users walk toward the television, it first emits static and white noise. When they press the physical button on the model, the static clears into a four by three video montage of my grandfather across different stages of his life. This is one of the earliest points in the prototype where gesture, sound, image, and memory converge into a single, timed experience.

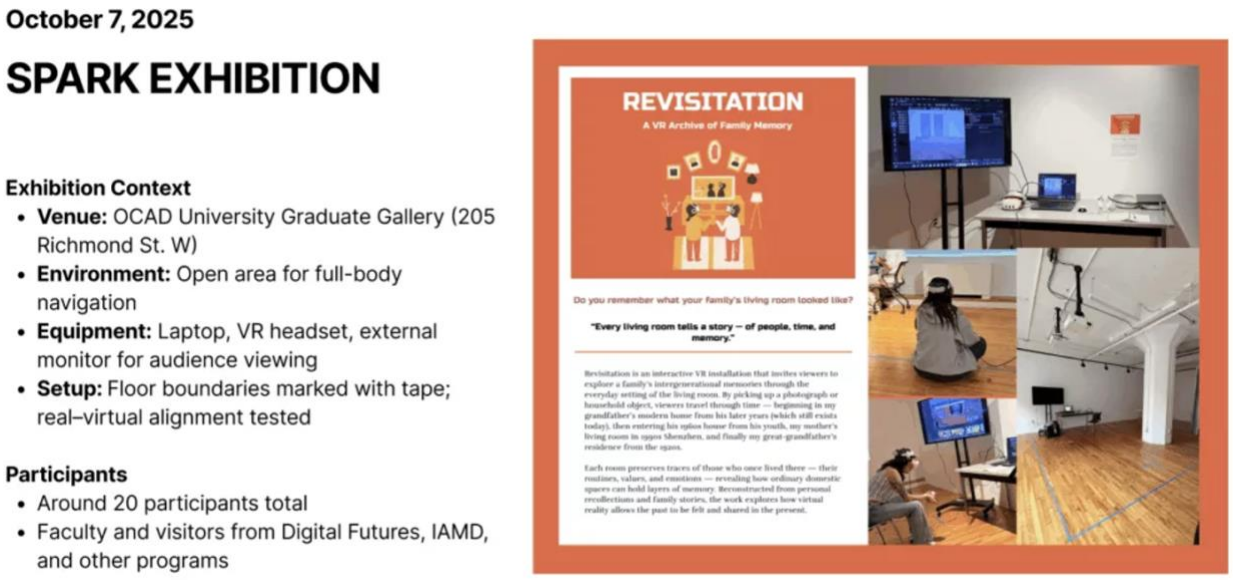


Figure. 23 Exhibition poster and installation setup for the SPARK 2025 presentation of Revisitation.

By the time I prepared for the SPARK 2025 exhibition, the VR prototype had finally reached a level of stability that allowed users to walk through both rooms and experience the transition between them. I installed the work in the Graduate Gallery at 205 Richmond, calibrated the tracked area, and aligned the virtual orientation with the physical space. A monitor mirrored the headset view so that others could watch while someone was inside the environment. From a functional standpoint, this version achieved

my immediate goal. It loaded reliably, the collision behaved as expected, and the main interaction of picking up the photograph and moving to another room worked consistently.

However, showing the prototype publicly also made its limitations very clear. Many visitors commented that the rooms felt too clean and new. The walls, furniture, and objects lacked the small marks, scratches, discolorations, and accumulated traces that signal a place has been lived in for many years. This revealed an important gap between architectural reconstruction and lived atmosphere. I had focused on getting the geometry correct and the basic lighting working, but I had not yet developed the material evidence of time. For a project that centres on memory, this absence is significant. It made me realize that I need to design signs of aging and everyday use into the environment, rather than treating the rooms as idealized models.

Another limitation concerned the structure of interaction. At SPARK, each room contained only one primary interactive element. Aside from opening a door or moving around, users could only pick up the photograph or activate the television. Several participants expressed a wish to touch more objects or discover more fragments of the archive. Their reactions confirmed that my current foreground layer, which I define as the set of objects that users can directly manipulate, was too thin. In contrast, the background and mid ground layers were more developed. Background refers to architectural style, room layout, and the overall category of dwelling. It signals the era and social context. Mid ground refers to environmental cues such as lighting, ambient sound, surface textures, and density of objects. It shapes emotional tone and atmosphere. Foreground consists of specific items that can be picked up, triggered, or used to move between scenes. In this prototype the background was present and the mid ground

partially established, but the foreground was restricted. This imbalance made the archive feel more like a demonstration than a fully explorable space.

The pacing of interaction also proved to be an issue. The television video sequence was perceived as too long for a single activation. Participants often looked away or shifted their attention before it ended. This experience suggested that in VR, interactions need to be shorter, more fragmentary, and multiple rather than asking the user to commit to one extended sequence. This insight aligns with the way memory often appears in discontinuous fragments rather than as a continuous narrative. In future iterations, I plan to break longer videos into several smaller clips and distribute them across different objects or viewing moments.

Finally, this prototype exposed a curatorial challenge. Over the past year I have accumulated a large amount of archival material, including thousands of photographs, long oral history interviews, documents, and objects. It is not possible or even desirable to import everything into VR. SPARK made it clear that I need a more systematic way of narrowing down the archive and assigning each fragment to a specific layer. Background elements will express the historical and social setting of each room, for example the type of building, its height, and its sonic environment. Midground elements will build the emotional and sensory mood through light, texture, and ambient sound. Foreground elements will be the smaller set of interactive objects that trigger transitions, reveal stories, or play short memory scenes. This layered approach is not yet complete, but it provides a framework for organizing future iterations.

Prototype Four therefore marks the beginning of the working archive, not because it is polished, but because it reveals what must change. It established a basic structure of two linked rooms, an object triggered transition, and an initial balance between movement, sound, and gesture. At the same time, it highlighted the need to add lived in traces, increase the number and variety of interactive objects, adjust the rhythm and duration of interactions, and refine how archival material is distributed across background, midground, and foreground. It also opened the possibility that later stages of the project may evolve into a template that could help other families build their own VR memory rooms without advanced technical knowledge. In this sense, Prototype Four is both a first working environment and a diagnostic tool that points toward the more layered, embodied, and adaptable archive I aim to build next phrase.

4.5 Reorienting the Prototype Toward the Research Questions

Following the technical and conceptual challenges identified in Prototype Four, this phase shifts toward refining how memory is structured, accessed, and experienced in relation to the research questions. Section 4.4 established a functional VR system and identified its limitations. This section focuses on organizing interaction, narrative, and media into a coherent structure that aligns with the conceptual and methodological direction of the project.

To support this reorientation, I developed a structured overview of the prototype in its current form. The following tables map the interaction structure across the introductory threshold and the four rooms, outlining how each object operates in terms of interaction type, trigger, media output, and narrative function. This overview presents the archive as a system of interconnected interactions, where

spatial movement, embodied gesture, and media fragments work together to produce memory as an experiential process.

The tables also function as an interaction design schema. Each object operates as a node within a network of actions and responses. Interaction follows a consistent logic: the user performs an action, the system responds through media, and a narrative function is activated. This structure enables the archive to operate procedurally. Memory is activated through engagement, movement, and selection across the environment.

This system clarifies the relationship between background, midground, and foreground layers identified in Prototype Four. Background elements define spatial and historical context. Midground elements shape the atmosphere through light, sound, and material presence. Foreground elements consist of interactive objects that trigger transitions, reveal narratives, or activate memory fragments. The tables make these layers explicit by showing how each object contributes to a specific form of engagement within the archive.

The structured mapping also addresses the three research questions introduced in Chapter 1. First, the distribution of interactions across multiple objects and rooms allows users to enter the archive through different pathways and encounter memory at different depths. This supports the exploration of how embodied VR environments can accommodate multiple perspectives within intergenerational memory. Second, the consistent organization of interaction types, triggers, and media outputs contributes to the development of a reusable and adaptable design framework. The tables demonstrate

how a VR archive can be structured in a way that is systematic, scalable, and accessible for non-technical users. Third, the inclusion of abstraction, partial reconstruction, and non-linear interaction supports the use of experimental design strategies to activate memory. Sensory cues, fragmented media, and embodied actions work together to produce moments of recollection within the environment.

This overview serves as a navigational and conceptual framework for the prototype. It defines how the system operates at a structural level and provides a reference for understanding the detailed design decisions that follow. The next sections examine each room and its interactive elements in depth, focusing on how individual interactions function within this system and how they contribute to the overall experience of the archive.

Introductory Level (Before Room 1)				
Object	**Interaction Type**	**Trigger**	**Media Output**	**Narrative Function**
Door + Transitional Environment	Spatial transition (door opening)	User opens the door	Abstract visual transition	Creates a sense of temporal passage through abstraction, preparing the user to enter the archive as a space of memory.

Table. 2 Interaction structure of the introductory level, showing the door-triggered transition into the VR memory archive.

Room 1 – Grandfather's Apartment (2010s)

Post-retirement home in Beijing

Object	Interaction Type	Trigger	Media Output	Narrative Function
Piano	Touch / use	User interacts with piano	ASCII video	Reconstructs fragmented memory through text-based visual transformation; functions as a sonic and emotional anchor in the room.
Book on Piano	Pick up/ hold	User grabs the book	Audio + video	Reconstructs a fragment of my grandfather's archive through translation, musical playback, and vocal performance. The interaction re-enacts the original score as a time-based experience, where recollection is produced through interpretation, repetition, and intentional incompletion.
Cat Sculpture	Pick up / hold	User grabs the object	Audio + image	Evokes an embodied childhood memory through sound cues, encouraging imagination rather than direct representation.
Television (2010s Drama Clip)	Object interaction	User activates television	Video playback + voiceover	Introduces my mother's later screen identity through a television drama, establishing her professional role within a public media context.
Birthday Cake	Object interaction	User touches cake	Audio playback	Marks a moment of remembrance through ritual, connecting celebration with loss and temporal reflection.

Room 1 – Grandfather's Apartment (2010s) ***Post-retirement home in Beijing***				
Hanging Calligraphy + Booklet	Focus / proximity + Open / browse	User approaches or touch the booklet	Text overlay + voiceover	Provides layered historical context through both ambient text and optional reading, supporting different levels of engagement with politically sensitive material.
Grandfather's Photograph when he was young	Pick up	User lifts photograph	Scene transition	Acts as a temporal gateway, linking personal memory to spatial progression.

Table. 3 Interaction structure of Room 1 (Grandfather's Apartment, 2010s), outlining object-based interactions and memory-driven media outputs.

Room 2 – Family Apartment (1960s) ***Grandparents' early home and mother's childhood environment in Beijing***				
Object	**Interaction Type**	**Trigger**	**Media Output**	**Narrative Function**
Family Photo Album	Open / browse	User touches the album	Sequential images	Supports nonlinear exploration of family memory through accumulation.
Camera + Wedding Photo	Pick up / use	User uses the camera	Animated imagery	Merges recording and witnessing, allowing users to re-enact a past moment.

Room 2 – Family Apartment (1960s) ***Grandparents' early home and mother's childhood environment in Beijing***				
Television	Object interaction	User activates television	Video playback	Presents a biographical narrative of my grandfather's early life, introducing his personal history and situating his experiences within a broader historical context.
Painting (Canvas)	Tool-based interaction	User uses brush	Image reveal	Reveals memory through embodied gestures, emphasizing process over instant visibility.
Photograph of Mother (Childhood)	Pick up	User lifts the photograph	Scene transition	Transitions between generations, linking childhood memory to spatial movement.

Table. 4 Interaction structure of Room 2 (Family Apartment, 1960s), presenting interactions related to early family life and intergenerational memory.

Room 3 – Mother's Apartment (1990s) ***Mother's early adulthood and professional life in Shenzhen***				
Object	**Interaction Type**	**Trigger**	**Media Output**	**Narrative Function**
Telephone	Pick up / answer	User answers phone	Audio + subtitles	Reveals the emotional labor of mediated communication, where repeated calls from viewers blur the boundary between public role and private life.

Room 3 – Mother's Apartment (1990s) ***Mother's early adulthood and professional life in Shenzhen***				
Television	Object interaction	User activates television	Video playback + voiceover	Situates my mother's identity within public media and performance, with voiceover providing contextual framing of her roles and screen presence across time.
Scattered Photos & Newspapers	Pick up / read	User interacts with items	Images + scanned text	Enables reconstruction of a public career through dispersed media fragments, emphasizing accumulation and partial visibility.
Certificates (Study Room)	Pick up / read	User interacts with items	Scanned documents + voiceover	Presents records of recognition alongside voiceover narration, connecting institutional validation with personal reflection and lived experience.
Cat Paw Prints	Environmental guidance	User follows path	Spatial transition	Guides movement through subtle environmental cues, linking memory to embodied navigation within the space.

Table. 5 Interaction structure of Room 3 (Shenzhen Apartment, 1990s), showing media interactions connected to my mother's public career and mediated communication.

Room 4 – Archive Space (Contemporary) ***Minimal exhibition environment for open-ended archival engagement***				
Object	**Interaction Type**	**Trigger**	**Media Output**	**Narrative Function**
Blank Photo Album (Archive Interface)	Open / browse	User touches album	Empty pages + optional voiceover	Introduces the possibility of extending the archive beyond the presented material, positioning the user as a potential contributor who can imagine inserting their own family memories into the system.

Table. 6 Interaction structure of Room 4 (Archive Space), introducing an open-ended archival interface for user participation.

4.5.1 Abstraction as an Entry Condition

Following the structured overview of the interaction system, abstraction emerges as one of the key design strategies within the prototype. It plays a central role in shaping how users enter and engage with the archive at both perceptual and conceptual levels. Following the public presentation of Prototype Four and the feedback it generated, I began to deliberately reorient the project toward a direction more closely aligned with my research questions. While the earlier stages of development focused on achieving technical stability and basic interaction, this phase marked a renewed emphasis on abstraction and aesthetic experience as central components of how memory is entered and navigated in VR. In particular, this shift responds directly to my third research question, which examines how

abstraction and non-realistic sensory interaction might function as active design strategies within a VR archive, enabling forms of memory engagement that exceed linear or single-narrative structures.

One of the first changes I introduced was the design of a new introductory level that precedes the domestic environments. Rather than placing users immediately inside a recognizable living room, I wanted to create a threshold space that would signal a transition across time. This decision reflects my broader interest in framing memory not as a static repository of information, but as a process of passage, anticipation, and gradual immersion. The threshold does not communicate specific historical content; instead, it prepares the user perceptually and bodily for entry into the archive.

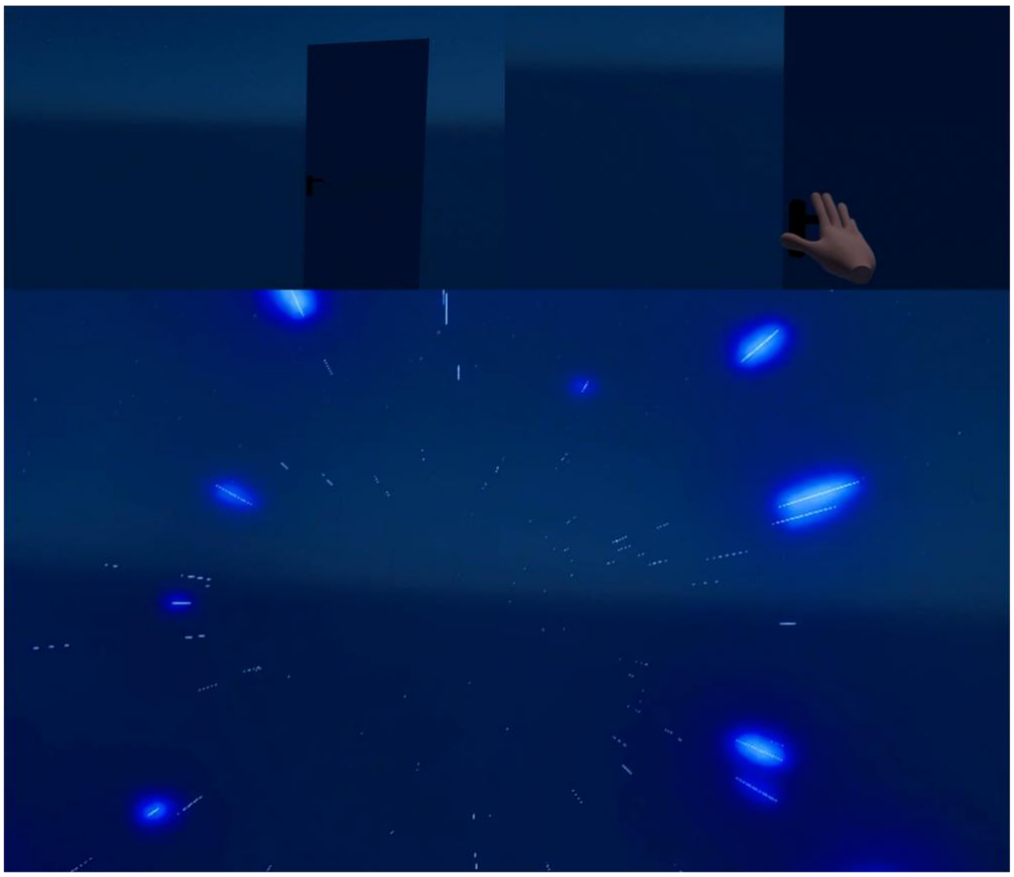


Figure. 24 Entry sequence of the initial VR level.

For this entry sequence, I chose the visual language of a galaxy and star-filled space combined with a single door. The stars do not represent a literal cosmology but operate as an abstract temporal field. When the player approaches and opens the door, the surrounding environment begins to shift. Particle effects emerge around the user, gradually forming linear trajectories that extend forward, producing a sensation of accelerated movement through space. This brief transit moment functions as a perceptual bridge between abstraction and domestic specificity. After passing through this corridor of motion, the player arrives in the first living room environment.

This design serves several interconnected purposes. Conceptually, it separates everyday space from the memory archive, establishing entry as an intentional act rather than a seamless continuation of ordinary life. Experientially, it shifts the user's attentional mode, preparing the body for changes in scale, pacing, and sensory focus before entering a domestic interior. Aesthetically, it allows abstraction to coexist with realism, framing the realistic rooms as destinations rather than default states. In this way, abstraction operates not as decoration, but as an active structuring device that shapes how memory is approached and encountered.

This shift toward abstraction does not replace the domestic environments developed in Prototype Four; instead, it reframes them. The galaxy level functions as an entry condition that foregrounds memory as something one moves into through embodied action rather than something that simply appears. As a methodological adjustment, this opening sequence integrates abstraction, embodied movement, and temporal transition as foundational elements of the archive experience. At the same time, introducing this abstract layer also began to surface practical questions related to my second

research question, particularly regarding how such transitions might remain lightweight, accessible, and adaptable across different technical conditions. These tensions between abstraction, performance, and accessibility would soon become central to the next phase of development.

4.5.2 Technical Friction, Hardware Limits, and the Question of Accessibility

While this new abstract entry sequence allowed me to explore atmosphere and temporal transition more explicitly, it also reintroduced technical instability that echoed earlier stages of the project. After completing the particle effects and transition logic, I tested the level using my own VR headset on a laptop-based setup. Once again, the system began to stutter, freeze, and eventually crash in a manner similar to my earlier lighting-related failures. The abstract environment that appeared stable on the desktop proved unreliable in immersive playback.

Figure. 25 Screenshot of performance instability during VR testing.

To isolate the cause of the issue, I shared the project with a friend who tested the same build on a desktop computer with a dedicated high-performance GPU. On this system, the transition sequence ran smoothly, with no visible lag or crashes. This contrast strongly suggested that the instability was not caused by a logic error in the blueprint system but by the rendering limitations of my own hardware. The laptop GPU was unable to sustain the particle density and real-time effects required by the abstract scene.

This experience forced me to confront an unresolved tension within my research questions, particularly the second: how to develop a VR archive framework that is not only conceptually meaningful, but also lightweight, replicable, and accessible to families without technical expertise or

high-end equipment. If a core part of the experience could only function reliably on powerful desktop systems, then the project risked becoming exclusionary at a structural level. The abstract aesthetic that supported my third research question, exploring non-realistic sensory interaction as an active design strategy, was now in direct negotiation with the practical constraints outlined in my second question.

Rather than treating this limitation as a purely technical inconvenience, I began to understand it as a productive constraint that clarified the direction of the project. It highlighted the need to distinguish between abstraction as visual excess and abstraction as strategic reduction. In other words, abstraction within this archive cannot depend on computationally intensive spectacle alone. It must operate through carefully chosen cues, restrained effects, and compositional decisions that can survive across different hardware conditions.

This moment also reframed my understanding of accessibility. Accessibility is not limited to interface clarity or ease of navigation, but extends to the material conditions under which the archive can exist. The hardware required to run the experience becomes part of the design problem. As a result, I began to reconsider how abstract transitions, atmospheric effects, and sensory cues could be redesigned to remain expressive while reducing computational load. This shift laid the groundwork for treating the VR environment as a flexible template capable of adaptation across different technical contexts.

4.5.3 Optimization, Abstraction, and Prototype Refinement

After encountering performance limitations in earlier prototypes, I initiated a focused optimization process. Assets that required real-time rendering were replaced with pre-rendered or lightweight

alternatives. Overall visual quality was reduced, and video files were heavily compressed. Although minor latency remains, the environment now runs reliably. These technical adjustments led to a conceptual shift in the project, moving away from real-time visual effects toward a more abstract representational strategy based on video, audio, and still imagery.

Rather than abandoning interactivity, I refined it. Interaction remains centered on embodied actions such as touching or picking up objects, but these interactions are now structured across three perceptual layers, as outlined in my earlier research. Background elements establish the historical and social context of each room through architecture, spatial scale, and ambient sound. Midground elements shape emotional and sensory atmosphere using light, texture, and sonic tone. Foreground elements consist of a limited set of interactive objects that trigger transitions, reveal narratives, or activate short memory scenes. This layered approach reduces computational load while clarifying how memory is spatially and emotionally encountered in VR.

In the first living room, based on my grandfather's apartment around 2010, I embedded an ASCII video transformation within the piano. The work is derived from footage of the last time I saw my grandfather playing the piano in a nursing home. His fragmented performance was transformed into an ASCII-based video rendering composed of characters that reorganize to form his image. This piece was dedicated to his memory.

The transformation draws on the poetic logic of a webpage as a room. Through typewriter-style text animation and the programmed behavior of individual characters, fragments of his final piano piece are

reconstructed rather than replayed. Rhythm, color, and visual instability evoke warmth, trembling, and the rupture of memory. The piano functions as a foreground object that activates a short memory scene, while the ASCII video operates simultaneously as visual content and structural metaphor.

My grandfather, Bai Lizhang, was a retired professor at Beijing University of Technology and my earliest artistic influence. His home contained oil sketches, photographs, videotapes, and a piano that quietly occupied the corner of the living room. He documented everyday life through creative practice rather than verbal narration. As he aged, he experienced cognitive decline that disrupted language and continuity of memory. When I last visited him in 2022, he was living in a nursing home. Although physically weakened, he attempted to play the piano for me. The melody was fragmented, but the gesture of playing remained. Shortly afterward, a COVID outbreak spread through the facility. He developed a high fever and passed away at the age of ninety. I was in Toronto and unable to say goodbye.

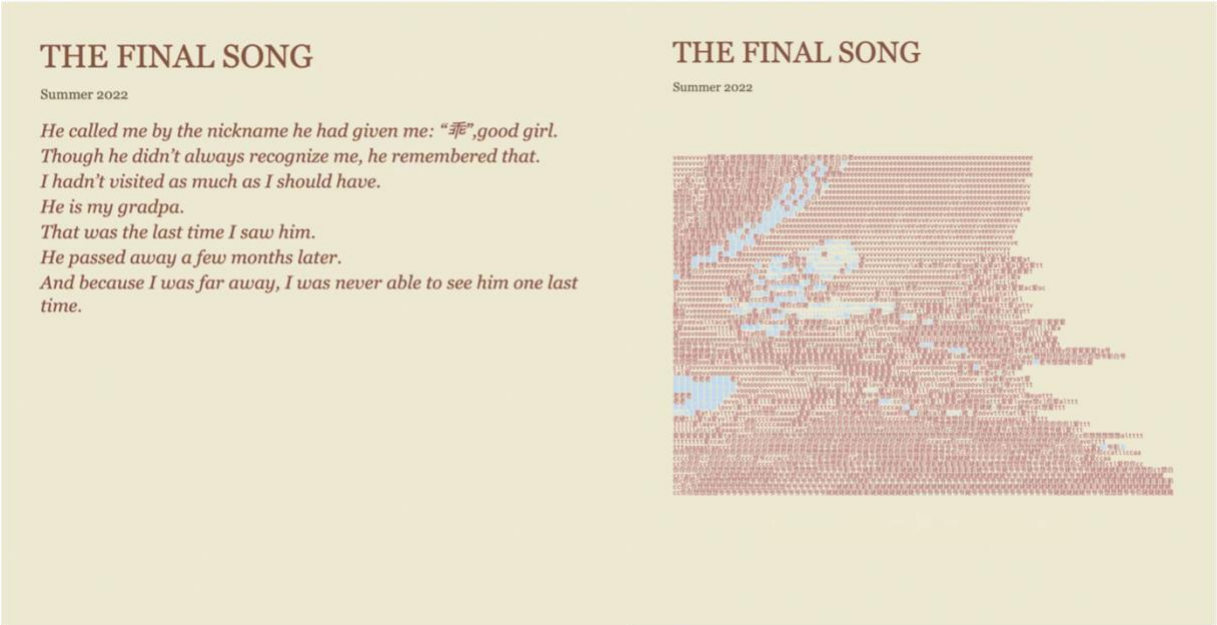


Figure. 26 Screenshot from the ASCII-based video triggered by interaction with the piano.

Using p5.js, I originally created an interactive ASCII video in which his image is composed of words associated with our relationship, including "乖" (a childhood nickname given to me by my grandfather, reflecting my family's wish for me to behave well despite being mischievous), "120" (the emergency number in China, referencing his hospitalization during COVID-19), "老白" (a familiar name used by other family members to address him), "理彰" (his given name), "姥爷" (my way of addressing him as my grandfather), and "想你" (an expression of longing that reflects my feelings after his passing). "cat" (a reference to his appearance, as he often wore silver-framed glasses and smiled with narrowed eyes, resembling the cat he kept), "爱 / love" (representing affection within our relationship), and "雨荻" (my formal name, which he gave me). Due to the technical limitation that p5.js cannot be directly embedded within Unreal Engine 5, this work was recorded as video and imported into the environment as a media asset. While this translation removed real-time code interaction, it preserved the visual logic of the ASCII

transformation and allowed it to function within the VR space. The piano thus operates as a foreground object that activates a recorded memory scene, maintaining the conceptual relationship between code, image, and remembrance.

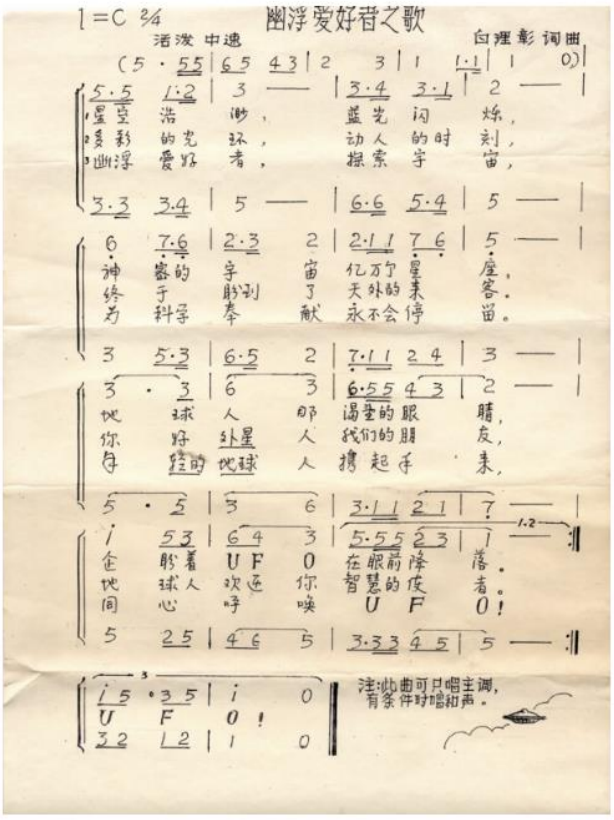
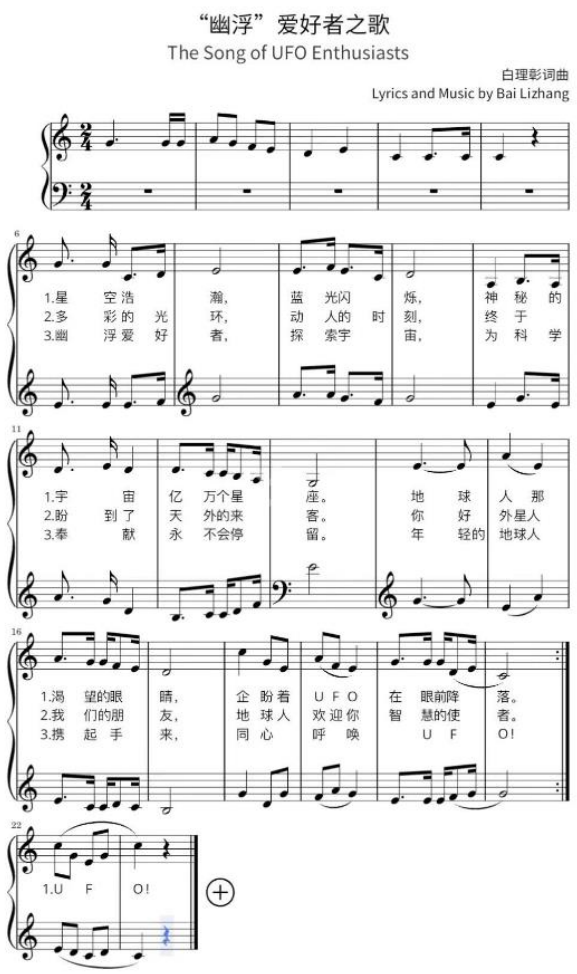


Figure. 27 Archival photograph of Bai Lizhang (my grandfather) at the Beijing UFO Research Association Second Archive Room, alongside a handwritten numbered musical notation (jianpu) composed by him.

In addition to the ASCII video embedded in the piano, I introduced a second interaction involving a book placed on top of the piano. This interaction is based on a scanned archival fragment that combines a handwritten numbered musical notation (jianpu) and a photograph of my grandfather standing in

front of the “Beijing UFO Research Association Second Archive Room.” In the photograph, he is holding a book, which became the conceptual anchor for this object in the VR environment.



“幽浮”爱好者之歌

The Song of UFO Enthusiasts

lyrics

星空浩瀚，蓝光闪烁，
神秘的宇宙，亿万个星座，
地球人那渴望的眼睛，
期盼着 UFO 在眼前降落。

Translation

The vast starry sky, blue lights flicker,
A mysterious universe filled with countless constellations.
The longing eyes of people on Earth
Wait for a UFO to land before them.

多彩的光环，动人的时刻，
终于盼到了天外的来客，
你好，外星人，我们的朋友，
地球人欢迎你，智慧的使者，UFO。

Translation

Colorful halos, a moving moment,
At last, the visitor from beyond has arrived.
Hello, extraterrestrial, our friend,
People of Earth welcome you—
messenger of wisdom, UFO.

幽浮爱好者探索宇宙，
为科学奉献永不会停留，
年轻的地球人携起手来，
同心呼唤 UFO。

U-F-O!

Translation

UFO enthusiasts explore the universe,
Devoted to science, never stopping.
Young people of Earth join hand in hand,
Calling out together for UFO.

Figure. 28 Digitally transcribed version of the handwritten score, converted into Western staff notation, and English translation of the song lyrics derived from the original handwritten composition.

To activate this material, I translated the handwritten jianpu into Western staff notation and digitized the lyrics into a playable score. The composition was then processed through a piano playback

system that generates sound based on the notated rhythm and pitch. Following this generated structure, I recorded my own vocal interpretation of the song. This process transforms a static archival fragment into a time-based audio experience, allowing the material to be heard rather than only seen.

The interaction is triggered when the user approaches or engages with the book. A video sequence appears in front of the viewer, combining the voiceover, the piano playback, and subtitles that provide an approximate English translation of the lyrics. The composition is structured as a repeating cycle, consisting of three iterations of the same melodic phrase. I chose to perform only the first two vocal passages, leaving the third iteration without a sung voice. This partial completion introduces a gap in the sequence, inviting the participant to listen more closely or to mentally complete the missing layer.

This design extends the project's exploration of recollection through reinterpretation. The original archive does not contain a complete recording of the song. Instead, the work reconstructs a possible sonic form through translation, performance, and digital mediation. By presenting the final iteration without voice, the interaction emphasizes absence and participation, allowing memory to emerge through what is not fully given.

In the same living room, I placed a small cat sculpture representing "猫猫姐姐" (cat-cat sister), the white cat who lived with my grandfather. In my childhood memory, whenever my grandfather opened his mouth to sneeze, the cat would immediately run away. To evoke this moment, I designed an audio sequence triggered by interaction with the sculpture. The sound unfolds in layers, beginning with a cat

meow, followed by a sneeze, the rapid sound of cat paws striking a wooden floor, and finally the sound of a vase shattering. These sounds suggest motion and consequence without visual depiction.

A still photograph of 猫猫姐姐 appears in front of the viewer. The image is intentionally non-animated. Rather than reconstructing the event fully, the work invites the participant to imagine the scene through sound and memory. This decision reflects my broader approach to the archive as inherently fragmented. Not all memories persist as complete sequences. Some remain as traces that rely on imagination and affect to become meaningful.

This strategy aligns with the project's broader methodology, which treats the archive not as a site of total reconstruction but as a space where absence, incompleteness, and affect function as essential forms of record.

4.5.4 Layered Disclosure, Political Context, and Voluntary Engagement

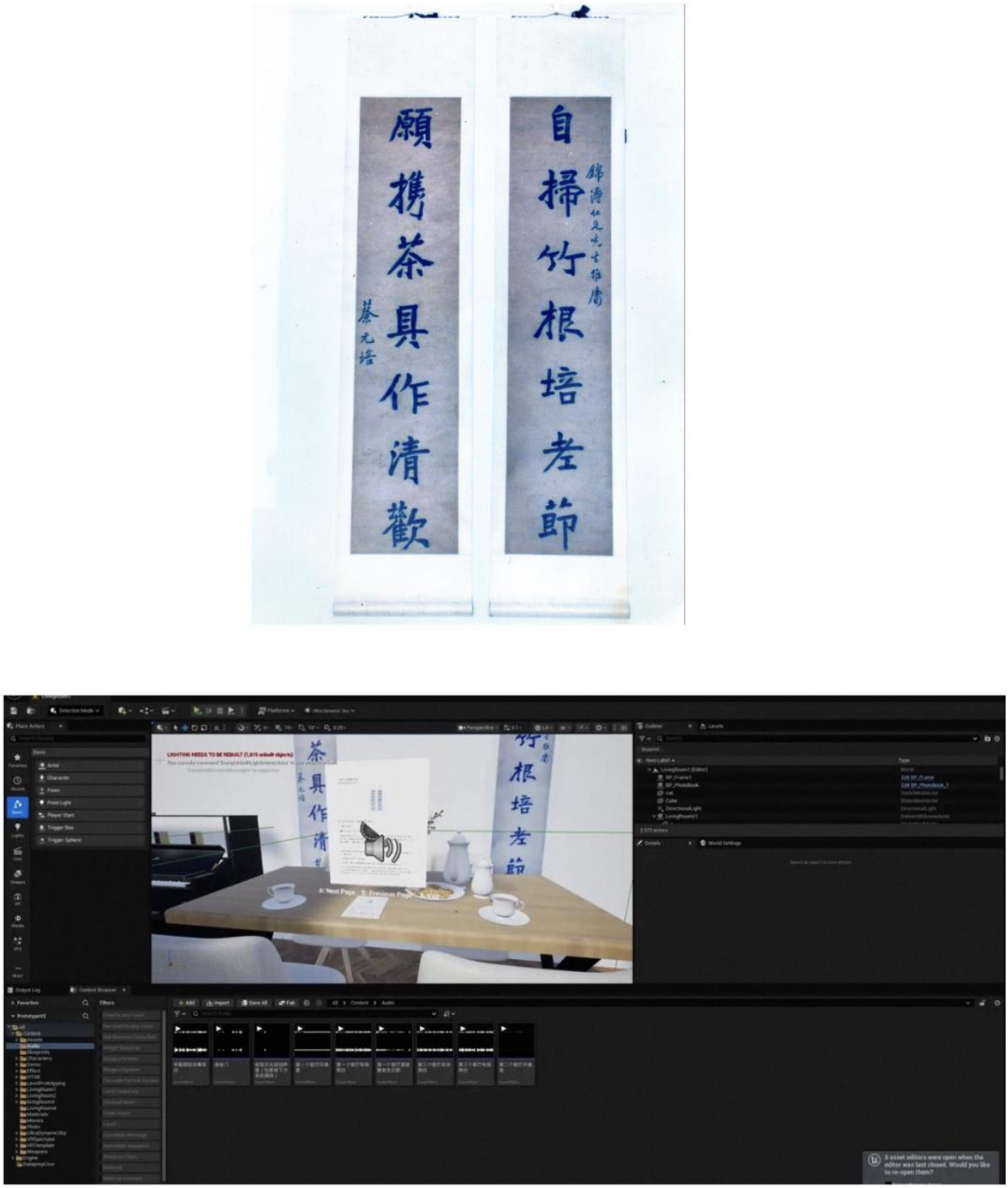


Figure. 29 The original calligraphic inscription by Cai Yuanpei (top) and its reconstructed placement within the first living room in the VR environment (bottom).

Another important design decision in this phase concerned the integration of a calligraphic inscription by Cai Yuanpei, which has long been displayed in my grandfather's living room, hanging behind the dining table. Within the domestic space, this object has always existed quietly as part of everyday life. Translating it into the VR archive required careful consideration, not only in terms of interaction design, but also with respect to political context, ethical disclosure, and audience choice.

Figure. 30 Screenshot of the booklet placed on the dining table within the first living room.

In the VR environment, the inscription is positioned in the same spatial relationship to the dining table as it occupies in the physical apartment. When users approach the calligraphy, a short overlay appears, presenting a translated excerpt of the text along with a brief explanatory subtitle. This initial layer identifies the work as a private inscription written by Cai Yuanpei and dedicated to "锦涛仁兄先生雅属," clarifying that "Jin Tao" (锦涛) is the courtesy name of Bai Xiongyuan, my great-grandfather.

The wording indicates that the calligraphy was personally written and gifted, rather than intended for public display or ceremonial circulation. This interaction is intentionally lightweight and non-intrusive, allowing the inscription to remain embedded within the domestic atmosphere rather than transforming it into a didactic exhibit.

Because the inscription is inseparable from a politically sensitive historical background, I chose not to present its full context through the initial overlay alone. Instead, I introduced a second, optional layer of engagement through a small booklet placed on the dining table. Users who wish to learn more may choose to pick up and read this booklet, while others can continue to experience the room without interruption. This design choice reflects a deliberate strategy of layered disclosure, allowing users to move between different depths of historical engagement according to their own curiosity and readiness.

For readers of this thesis who may not encounter the VR environment directly, it is important to clarify the content of this booklet and its role within the archive. Titled A Private Inscription, the booklet functions as a compact archival document that contextualizes the calligraphy as both a family-held memory object and a trace shaped by political risk. It begins by presenting the original text of the couplet,“自扫竹根培老节，愿携茶具作清欢,”along with an English translation. The booklet explains the cultural significance of bamboo as a symbol of integrity and resilience, and interprets the phrases “自扫竹根”and“清欢”as expressions of quiet moral cultivation and egalitarian companionship rather than achievement or power.

The booklet then situates Cai Yuanpei as one of the most influential educators in modern Chinese history and a foundational advocate of academic freedom and intellectual pluralism. It emphasizes that these principles were not abstract ideals, but positions that carried real risk during periods when political allegiance often preceded scholarly judgment. The text introduces Bai Xiongyuan as both a trained military officer and an educator at Peking University, noting his appointment as director of physical education and his later role as chief instructor of the Beiping Student Corps. This dual identity placed him under heightened political and military scrutiny during the 1930s.

A central section of the booklet reconstructs the historical conditions of Beiping in 1937, following the Marco Polo Bridge Incident and the beginning of full-scale war. It describes how the city fell under military occupation, making neutrality impossible for educators and intellectuals associated with student organization or public mobilization. Within this context, the booklet recounts how Bai personally led students to support the 29th Army, was seriously injured during a Japanese air attack, and was subsequently arrested, released, and arrested again while unable to leave the occupied city. It is under these conditions that Cai Yuanpei wrote the inscription while in Hong Kong and arranged for it to be sent back to Beijing. The absence of a date on the calligraphy is explained as a deliberate safety measure rather than an oversight, since traceable timelines could have exposed its recipient to further danger.

The booklet concludes by explaining how the inscription survived precisely because it remained outside official archival systems. During the Cultural Revolution, the family deliberately hid the work to avoid risk, preventing it from being preserved under ideal conditions. The version presented today is a restored and remounted copy, repaired with the assistance of family descendant Fang Biao, and is

currently kept in my maternal grandfather's home. This framing is critical to its role in the VR archive. The calligraphy is not presented as an authoritative historical document but as a fragment of family-held memory that connects institutional values, political pressure, and the persistence of private care across generations.

By separating the interaction into a brief, ambient subtitle and an optional, in-depth booklet, the prototype models a flexible framework for handling politically sensitive or complex historical material within a domestic VR archive. Users who are primarily engaged with spatial atmosphere and personal memory can remain at the surface layer, encountering the calligraphy as part of everyday life. Those who wish to engage more deeply with its political and historical implications can actively choose to do so. This approach directly supports my second research question by demonstrating how layered information structures can form a replicable and accessible design principle for families with different comfort levels, histories, and disclosure preferences.

At the same time, this interaction structure supports my first research question by allowing different users and potentially different family members to encounter and interpret the same object at varying depths. Rather than enforcing a single narrative, the archive accommodates multiple modes of engagement, producing layered and potentially divergent understandings of intergenerational memory. In this sense, the calligraphy functions not only as a historical artifact, but as a mediator between personal remembrance, political context, and embodied choice within the VR environment.

To further support this layered engagement, I introduced an audio component linked to the booklet interaction. When users pick up the booklet and begin to turn its pages, a corresponding voiceover is triggered, reading the content aloud in synchrony with the text. Each page is associated with a specific audio segment. As users move forward or backward through the booklet, the voiceover updates accordingly, stopping immediately and transitioning to the next segment when a new page is selected.

This design addresses practical issues of legibility and accessibility within the VR environment, where text can be difficult to read due to resolution, distance, or user positioning. It also accommodates participants who may experience reading fatigue or other barriers to extended textual engagement. By allowing users to listen while reading, the booklet becomes a multimodal interface that combines visual and auditory channels.

At the same time, the voiceover extends the methodological idea of “how to listen” within the archive. The act of listening is not limited to recorded interviews but is embedded into the way historical material is encountered and interpreted. The narrated text introduces pacing, tone, and emphasis, shaping how the political and personal dimensions of the inscription are received. The experience shifts from silent reading to an embodied form of listening that unfolds in time, reinforcing the presence of the archive as something that is both read and heard.

Importantly, this audio layer remains optional and responsive to user action. Users can choose to engage with the booklet purely visually, or they can rely on the voiceover as a guide. The system does not enforce a fixed sequence or duration of engagement. Instead, it supports a flexible movement

between reading, listening, and navigating, aligning with the broader strategy of layered disclosure that structures this interaction.

For the purposes of this thesis, the full content of the booklet is documented in Appendix G, allowing readers to access the complete textual material outside of the VR environment while maintaining its contextual role within the interactive archive.

4.5.5 The Family Photo Album: Material Traces and Archival Incompleteness

In the second room, I introduced a scanned version of my family photo album as an interactive object. The album is modeled as an old-style physical book placed within the living room environment. It shows visible signs of wear. The cover is slightly damaged, some pages are bent, and several photo slots are empty. Unlike a freely manipulable object, the album is not flipped through by direct hand gestures. Instead, users turn pages using a button on the VR controller, which advances the album one page at a time.

All the photographs inside the album were originally shot on film. Many of them are black and white prints, while others were manually hand-colored after development. Some were developed in professional photo studios, while others were developed at home by my grandfather, my grandmother, and later by my mother and aunt. According to my mother's recollection, the entire family participated in developing photographs. My grandfather built a small darkroom inside the apartment and designed a small cat-shaped logo to stamp on the right bottom of certain prints. The family had a strong affection for cats, especially my mother, who raised cats from childhood.

The album documents the life of my grandfather's family across several decades. It contains images of him in his youth, photographs of his comrades and friends, portraits of my grandmother, and later images marking the births of my mother and aunt. As the user advances through the album page by page, time unfolds in a controlled, sequential rhythm. Rather than encouraging rapid scanning or free manipulation, the button-based interaction introduces a measured pace that mirrors the deliberate act of looking through an old family album.

Importantly, the album is incomplete. Some photographs are missing, while others are damaged or faded. These absences are not digitally repaired. The empty slots and deteriorated prints remain visible in the VR environment. The wear of the material object reflects both the passage of time and the fragility of private archives. In this sense, the album does not present memory as total or authoritative. Instead, it makes visible the partial, vulnerable, and uneven nature of family-held documentation.

This object supports my first research question by allowing different users to engage with the same images at their own pace, forming individual interpretations through embodied, time-based interaction. At the same time, the album contributes to my second research question by demonstrating a simplified and accessible interaction model. Using a controller button to turn pages avoids complex hand tracking or gesture recognition, making the interaction more reliable across different hardware conditions. Rather than diminishing the experience, this constraint helps stabilize the archive while preserving its tactile and temporal qualities.

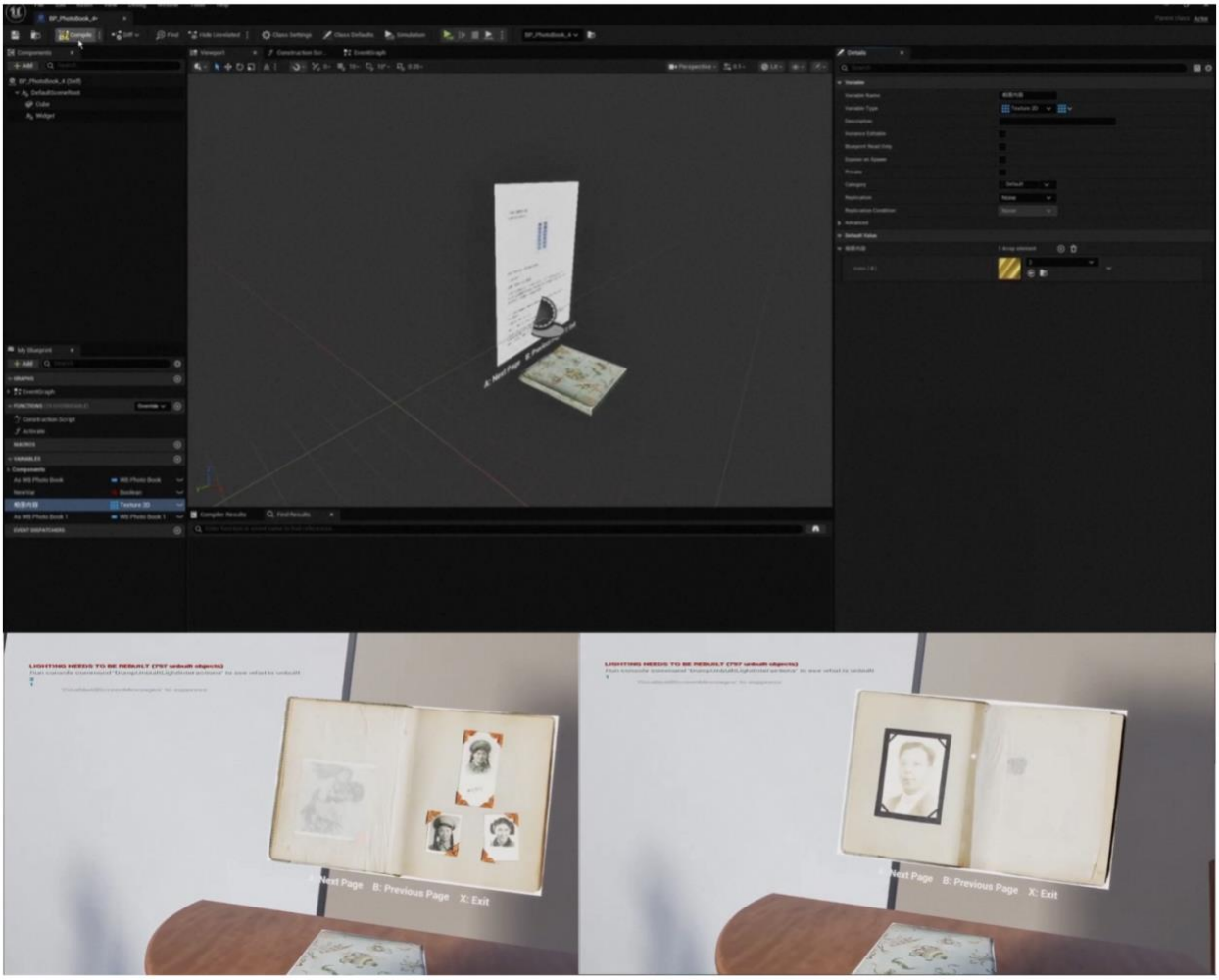


Figure. 31 Screenshot of the interactive family photo album within the VR environment. The album allows users to browse archival photographs page by page through embodied interaction.

4.5.6 The Camera: Re-enacting the Wedding Photograph

On the table in the second living room, I placed a modeled analog camera as an interactive object. This camera references the period in which my grandparents' wedding photograph was taken and echoes the photographic culture that shaped much of the family archive. When the user picks up the

camera in VR, the environment in front of them shifts. A moving image of my grandfather and grandmother's wedding portrait appears suspended within the user's field of vision.

Figure. 32 Screenshot of the interactive analog camera placed in the second living room.

The original photograph was static. In this prototype, I used an AI-based video generation tool, Sora, to animate the still image, allowing subtle movements to emerge from the archival photograph. The figures appear to breathe gently, shift slightly, or blink, producing a quiet sense of temporal activation. This transformation does not aim to simulate historical accuracy. Instead, it explores how non-realistic sensory intervention can function as a design strategy within the archive, aligning with my third research question.

The interaction continues when the user presses the shutter button on the VR controller. At that moment, the animated sequence freezes and the image becomes fixed within the camera interface. This

action symbolically re-performs the act of photographing. Rather than simply watching an archival image, the user participates in capturing it. The gesture creates a layered temporal structure: a present-day user reenacts the act of photographing a past moment that has already been mediated through AI animation.

This interaction was designed to intensify embodied presence. By requiring the user to lift the camera and actively press the shutter, the archive shifts from passive viewing to performative engagement. The user does not merely observe the wedding photograph as an external historical artifact. Instead, they momentarily occupy the role of the photographer, generating a sense of proximity to the event. The effect is not meant to collapse historical distance, but to create a controlled illusion of temporal crossing that makes the archive experientially immersive.

At the same time, the use of AI-generated animation raises questions about mediation and reinterpretation. The wedding photograph is no longer a stable document. It becomes a hybrid artifact that blends historical image, algorithmic intervention, and user interaction. This layered transformation reflects the broader premise of the project: that VR archives do not simply preserve memory, but reactivate and reinterpret it through embodied, technological processes.

Through the camera interaction, the second room extends beyond reconstruction of domestic space and enters the domain of performative memory. The object functions as a bridge between still image

and moving time, between documentation and re-enactment, and between private family history and immersive technological experience.

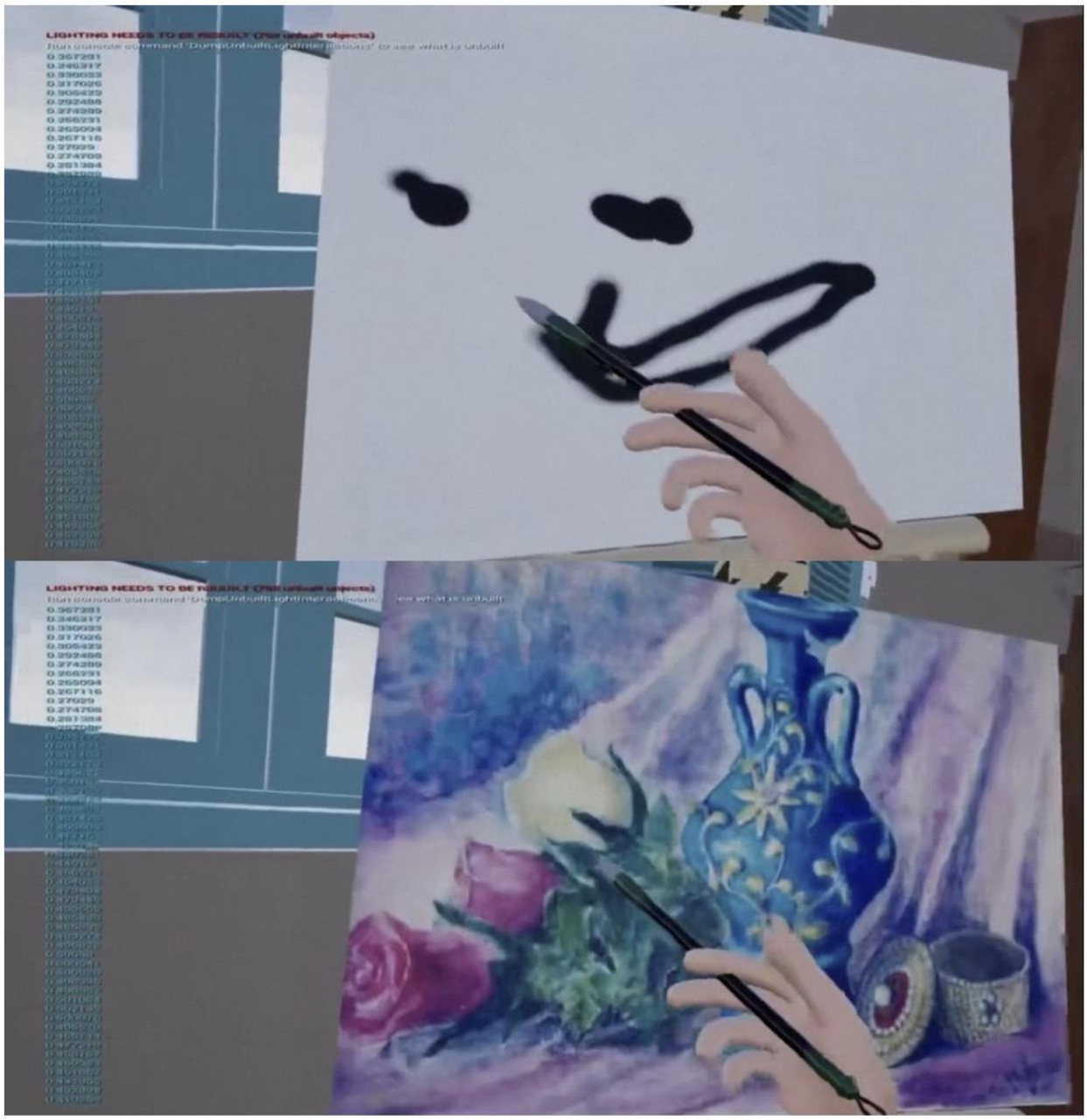


Figure. 33 Screenshot of the interactive canvas in the second living room. Initially appearing blank, the canvas reveals an image gradually as the user performs brushing gestures across its surface.

The image that appears is based on my grandfather's paintings, which he created during his spare time throughout his life. Rather than presenting the finished painting immediately, the interaction requires the user to engage in a repeated, physical motion. Each gesture reveals a portion of the image, allowing the painting to materialize slowly through embodied action. The user does not simply view the artwork but participates in its reappearance.

This interaction draws attention to the process of making rather than the final result. The gradual emergence of the painting mirrors the way memory often surfaces through repeated engagement and physical involvement. The design emphasizes gesture, duration, and bodily rhythm, aligning with my first research question by activating memory through embodied experience rather than representational display. At the same time, the interaction remains deliberately simple and lightweight, relying on basic collision detection and gesture recognition rather than complex simulation, supporting my second research question concerning accessibility and replicability.

The canvas also introduces a quiet form of abstraction. The act of painting does not recreate the historical moment in which the original artwork was made. Instead, it stages a symbolic reenactment of creative labor, allowing the user to access memory through action rather than observation. In this sense, the canvas functions as a performative interface that reveals memory through movement.

4.5.8 Photograph as Portal: Transitioning to the Third Living Room

Figure. 34 Screenshot of the framed photograph in the second living room.

The final interactive object in the second living room is a framed photograph of my mother as a child. The photograph is positioned within the domestic space in a manner consistent with how family portraits are typically displayed. Unlike the album or the camera, this photograph does not invite prolonged interaction. Its function is transitional.

When the user picks up the photograph, the environment responds by initiating a scene change. The second living room fades, and the user is transported into the third living room, which reconstructs the room my mother lived in during the 1990s while working in Shenzhen. This transition marks a generational shift within the archive, moving the user from my grandparents' domestic environment into my mother's early adult life.

Using a personal photograph as the trigger for spatial transition reinforces the logic established earlier in the archive. Movement between rooms is not governed by abstract menus or timelines, but by intimate objects that carry personal significance. The photograph operates as a spatial key, allowing memory to unfold through touch and proximity rather than navigation commands.

This interaction supports my first research question by enabling different family members or users to experience generational transition through a shared object, while still bringing their own interpretations and emotional associations to the moment. It also contributes to my second research question by demonstrating a consistent, object-based transition framework that can be replicated across different family archives without requiring technical expertise. Rather than introducing a new interface, the archive extends an existing interaction logic, reinforcing coherence and accessibility.

Together, the canvas and the photograph complete the second living room as a site of both activation and transition. One interaction invites slow, creative engagement with memory through gesture, while the other enables movement across time and space. These objects establish a rhythm that alternates between dwelling within memory and passing through it, preparing the user for the next generational environment.

4.5.9 The Telephone: Intrusion, Public Voice, and Private Boundaries

In the third living room, which reconstructs the apartment where my mother lived in Shenzhen during the 1990s, the first interaction encountered by the user is a ringing telephone placed near the

entrance. Upon entering the room, the phone begins to ring continuously. The user is given a simple choice: to answer the call or to ignore it.

If the user picks up the telephone, a layered audio sequence begins to play. The voices are drawn from interviews with my mother about her experiences working as a television host during that period. At the time, viewers frequently obtained the station's phone number and called her directly to speak about their personal problems, admiration, or emotional distress. While some callers simply expressed appreciation for the program, others repeatedly attempted to contact her in ways that intruded into her private life.

The audio collage presented in the VR environment combines several types of calls. Some voices represent viewers seeking emotional advice:

"Ms. Bai, hello. I've been feeling really troubled lately.

I've fallen for a colleague, but she keeps acting hot and cold toward me.

I honestly don't know what to do."

Others echo more intrusive interactions:

"Ms. Bai, I'm a big fan of yours.

I really love your program.

Do you think we could go out for a meal sometime?"

Additional fragments convey emotional dependence:

"I haven't been able to sleep at all…

Ms. Bai… could you please help me?"

Rather than presenting these calls individually, the voices are edited into overlapping fragments that gradually accumulate. The overlapping audio creates a sense of pressure and confusion, reflecting the way repeated calls began to blur together in my mother's memory. The sound environment becomes increasingly dense, producing an atmosphere of emotional intrusion rather than clear communication.

At the end of the sequence, the voices abruptly stop. A soft sigh is heard, followed by the sound of a telephone line disconnecting. This moment references my mother's decision to eventually unplug the telephone in order to reclaim a boundary between her professional identity and her personal life.

If the user chooses not to answer the call, the audio sequence does not play. The phone continues ringing briefly before stopping, allowing the participant to proceed through the room without encountering the recorded voices. This branching interaction introduces a small but meaningful decision point within the archive. The user's choice determines whether they directly experience the sonic pressure associated with my mother's public role.

The spoken dialogue remains in Mandarin Chinese to preserve the authenticity of the original encounters. English subtitles appear at the bottom of the user's field of view to provide translation for non-Chinese-speaking participants. This bilingual presentation reflects the cross-cultural position of the

archive itself, which is being developed in Canada while documenting memories rooted in Chinese domestic and media environments.

Through this interaction, the telephone functions as more than a historical prop. It becomes an interface through which users encounter the tension between public visibility and private life. Within the broader structure of the VR archive, the object introduces a different type of memory trigger. Whereas earlier interactions in the project are activated through visual objects such as photographs, paintings, or musical instruments, the telephone foregrounds voice, intrusion, and emotional labor as part of the family's lived history.

4.5.10 Scattered Photographs and Newspapers: Fragments of a Public Career

Figure. 35 Screenshot of scattered photographs and newspaper clippings on the table in the third living room.

After the telephone interaction, users are free to move through the living room and explore the surrounding environment. One of the most visually prominent areas appears in the small kitchen space adjacent to the telephone. On the table, numerous photographs and newspaper pages are scattered across the surface, forming an informal collection of media traces from my mother's professional career during the 1990s.

The photographs document different moments from her work as a television host and performer. Some images show her seated in front of studio cameras during program recordings. Others capture her participation in public events, media activities, or gatherings with colleagues. Several photographs include group portraits with other presenters, actors, or well-known figures within the broadcasting and entertainment industry of that period. These photographs collectively reveal fragments of her public identity as it appeared on screen and within professional networks.

Mixed among these photographs are several newspaper pages. These include published interviews, media coverage, and short articles connected to my mother's work in television and performance. Some articles document her appearances in television programs or public events, while others contain short texts she wrote herself that were later published in newspapers. Unlike the photographs, which primarily communicate visual impressions of her professional life, the newspaper pages reveal how her work was framed and interpreted within public media discourse.

In the VR environment, both the photographs and the newspaper pages function as individually interactive objects. Users can pick up each item, rotate it, and examine it from different angles. The

materials are intentionally left without extensive captions or explanatory text. Instead of guiding the viewer through a fixed narrative, the archive encourages users to observe and interpret these fragments through visual clues such as clothing, studio environments, printed headlines, or accompanying images.

The objects are deliberately scattered rather than arranged in a neat archival order. This arrangement reflects the way personal media materials often accumulate informally within domestic environments. Photographs, clippings, and documents may remain loosely gathered in drawers, envelopes, or on tables rather than being systematically catalogued. By reproducing this condition within VR, the archive foregrounds the everyday and sometimes chaotic nature of personal documentation.

Within the layered interaction structure of the project, these photographs and newspaper pages operate as foreground objects that support exploratory interaction without triggering a specific narrative sequence. Unlike the telephone, which delivers a concentrated auditory experience, these materials allow users to browse freely and gradually assemble an understanding of my mother's professional identity through multiple fragments.

By enabling users to physically handle these images and printed pages, the VR environment recreates a familiar archival gesture: the act of sorting through photographs and newspaper clippings on a table. Through this tactile form of engagement, participants encounter the traces of a public career not as a linear biography but as a collection of partial documents that must be pieced together through observation and interpretation.

4.5.11 The Certificates: Preserved Recognition and Dormant Archives

Figure. 36 Screenshot of award certificates and documents placed within the study room of the third living room.

Another interactive element in the third living room appears in the study room adjacent to the main space. When users enter this room, they encounter a bookshelf displaying a series of framed certificates and awards. These documents were awarded to my mother throughout her performing and broadcasting career, including recognition for television hosting, participation in radio dramas, stage performances, and short comedic sketches.

Many of these certificates date from a period when official awards were still handwritten or manually prepared rather than digitally printed. Their visual form reflects a different media culture of recognition, where institutional validation was recorded through calligraphy, stamped seals, and formal

paper documents. The awards represent both national and regional acknowledgments of her professional work within the broadcasting and performance industry.

After my mother later returned to Beijing, these certificates were carefully preserved but no longer publicly displayed. Instead, they were stored in a suitcase and remained there for many years. Their presence in the VR environment therefore reconstructs a set of materials that existed physically but remained largely unseen in everyday life. The archive does not invent new objects; rather, it reactivates items that had been preserved yet dormant.

Within the VR space, each certificate can be picked up and examined individually. Users are able to hold the document, rotate it, and inspect the details of the paper surface. Because the original certificates are written entirely in Chinese, an English voiceover accompanies the interaction. When a user lifts a certificate, a short audio narration briefly explains the type of award or performance context associated with the document.

The voiceover intentionally remains concise rather than providing extensive historical explanation. Its purpose is not to construct a complete biography, but to provide enough contextual information for viewers unfamiliar with Chinese language and media culture to understand the significance of the documents. In this way, the archive balances accessibility with interpretive openness.

Compared with the scattered photographs in the kitchen area, which invite visual interpretation without textual guidance, the certificates introduce a slightly more structured form of archival mediation. They represent formal recognition within my mother's professional career and therefore

carry a different archival status. At the same time, their long period of storage in a suitcase underscores how professional achievements can become quietly hidden within personal life. By allowing users to rediscover these certificates through interaction, the VR archive brings these dormant traces of recognition back into experiential visibility.

4.5.12 The Television: Broadcast Performance and Optional Viewing

Figure. 37 Screenshot from the 1990s televised comedic sketch Dislocation (脱臼).

Note. The image shows the stage setting and broadcast framing typical of variety performances of that period, in which my mother performs as a doctor. This clip is embedded in

the television within the third living room and can be activated through user interaction, allowing viewers to encounter her early on-screen performance within its original media context.

Another interactive object in the third living room is the television set placed in the center of the space. The model reproduces the type of television commonly found in Chinese households during the 1990s. When the user approaches the television and presses the physical power button on the device, the screen activates and begins to play a recorded video clip.

The video shows a short comedic sketch in which my mother performs the role of a doctor treating a woman who has dislocated her arm. During the scene, the patient's husband accompanies her into the clinic, while another male patient with a neck injury sits nearby. Because the man's neck is immobilized, he can only look straight ahead, unintentionally staring at the woman while she partially removes her clothing so the doctor can treat her shoulder. This situation creates a moment of misunderstanding and awkward humor, which forms the central comedic tension of the performance. The sketch later received recognition and awards during that period of her career.

Since the original performance is in Mandarin Chinese, short English subtitles are displayed at the bottom of the viewer's field of vision in VR. These subtitles do not translate the entire script but instead provide a brief explanation of the situation and the central comedic misunderstanding. This allows viewers who do not understand Chinese to grasp the general narrative of the scene while preserving the original audio performance.

Unlike many other interactions in the archive, the television sequence is intentionally optional. Users may choose to sit in the physical exhibition space outside the VR boundary and align their view with the television, watching the performance as if seated in a living room. Alternatively, they may leave the video playing and continue exploring the room without completing the sequence.

This optional structure reflects the everyday role of television within domestic environments. Television viewing often unfolds as a background activity rather than a required event. By allowing participants to decide whether to watch the entire clip or move on, the archive recreates this casual relationship between media consumption and daily life.

Figure. 38 Screenshot from the 2010s television drama Teahouse, in which my mother performs the role of Pang Si Nainai.

In addition to the 1990s comedic sketch presented in the third living room, a later television drama performance by my mother, from the 2010s, is embedded in the television of the first living room. This room is based on my grandfather's apartment, where this television drama was frequently played. When the user approaches the television and presses the physical power button, the video is activated. A short voiceover, recorded in English, accompanies the clip to provide contextual information for viewers who may be unfamiliar with the cultural and narrative background of the performance.

The video shows a scene from a television adaptation of Teahouse, the well-known play written by Lao She. In this production, my mother performs the role of Pang Si Nainai, a character associated with the residual power of the feudal class. Through her actions and demeanor, the character reflects forms of social hierarchy and exploitation that persist during periods of political and cultural transition.

The placement of these two clips across different rooms establishes a temporal contrast within the archive. The television in the first living room functions as an introduction to her professional identity, offering a glimpse of her later-stage screen presence within a historically significant drama. When users later encounter the 1990s comedic sketch in the third living room, this earlier performance is recontextualized. The contrast between the two roles highlights shifts in performance style, genre, and historical context, while also revealing the continuity of her presence across different stages of her career.

Rather than presenting a complete biography, these television fragments operate as situated media traces. They allow users to encounter her professional life through moments of viewing that are

embedded within domestic space, reinforcing the relationship between everyday environments and mediated memory.

4.5.13 Cat Footprints: Guiding Movement Through Domestic Space

After exploring the living room, users may notice a series of small black cat footprints on the floor. These footprints lead away from the main living space toward the bedroom area of the apartment.

Figure. 39 Screenshot of cat footprints on the floor of the third living room.

The footprints reference another detail from my mother's life during her years in Shenzhen: she also kept a pet cat during this period. Rather than representing the animal directly, the archive uses the traces of its movement to guide the user's navigation. The footprints function as a subtle environmental cue rather than a formal interface.

By following the trail across the floor, users are gradually guided toward the bedroom. This interaction relies on spatial curiosity rather than explicit instruction. The participant does not receive textual directions or menu prompts. Instead, movement is encouraged through a small visual trace that suggests the presence of another living being within the domestic space.

This design approach reinforces the broader interaction logic of the project, where navigation emerges through objects and environmental traces rather than through graphical user interfaces.

4.5.14 The Archive Room: Toward a Participatory Memory Template

When the user moves through the bedroom and continues forward, the environment transitions into a fourth room that functions as an archive space. Compared with the previous rooms, which reconstruct specific family environments, this room is intentionally more minimal and modular in its design. The archive room represents a shift from personal reconstruction toward a more generalized framework that other families might eventually use to document their own memories.

In the center of the room sits an interactive photo album similar to the one introduced earlier in the second living room. However, in this context the album functions differently. Rather than presenting existing archival material, it becomes a participatory interface.

Visitors are invited to imagine inserting their own photographs into the album and recording a short voice narration associated with the image. Through this interaction, participants can experience how personal memories might be added to the archive and later encountered by others. The goal is not to

build a complete archival system during the exhibition but to allow users to briefly inhabit the process of constructing a memory archive themselves.

This final room therefore extends the project beyond a single family narrative. It introduces the possibility that the framework developed in this thesis could eventually operate as a template through which different families document their own stories. By transforming the album from a fixed historical object into an interactive storytelling device, the archive room demonstrates how personal memory and collective participation might coexist within the same VR structure.

Chapter 5: Conclusion / Future Work

5.1 Conclusion

This thesis explored how virtual reality can function as a medium for constructing an interactive family archive, focusing on how memory is experienced, activated, and reinterpreted through embodied interaction. The project was motivated by the limitations of conventional archival practices, which often prioritize factual accuracy and visual reconstruction while overlooking the emotional, fragmented, and subjective nature of family memory.

Through the development of the VR prototype Revisitation, this research demonstrates that memory can be structured as a system of interactions distributed across space, objects, and media. Instead of relying on a single narrative sequence, the archive operates through embodied engagement, where users activate memory by moving, touching, and navigating the environment. This shifts the understanding of archives from repositories of information to experiential systems.

The process of building the prototype also revealed how technical constraints shape conceptual decisions. Early attempts to create highly detailed environments and cinematic lighting resulted in performance failures in VR, including system crashes and instability. These limitations led to a shift toward optimization and abstraction, where memory is represented through selective detail, sound, and fragmented media rather than complete visual reconstruction. This transition became a defining strategy of the project, aligning technical feasibility with conceptual exploration of memory as partial and interpretive.

At the same time, the process required continuous selection and transformation of archival material. Rather than attempting to include all available family records, I developed a layered structure that distributes content across background, midground, and foreground elements. Spatial environments provide historical and emotional context, while a limited set of interactive objects activate specific memory fragments. This approach reflects an understanding of the archive as curated and incomplete, where meaning emerges through interaction rather than total representation.

The research questions outlined in Chapter 1 are addressed through both design and implementation. Embodied interaction allows multiple perspectives of family memory to coexist, as users engage with different objects and follow different pathways. The structured interaction framework establishes a model that can be adapted for other users, contributing to more accessible approaches to VR-based memory preservation. The use of abstraction and non-linear interaction demonstrates how memory can be activated through sensory and interpretive strategies, allowing significant moments to emerge without requiring a fixed or linear narrative.

The evaluation of the prototype, based on observations during the SPARK exhibition and REB-approved playtesting sessions, further informed the development of the project. Users were able to navigate the environment and engage with memory fragments, while also identifying issues related to visual detail, interaction density, and pacing. These observations directly shaped the transition from Prototype Four toward a more structured interaction system presented in Chapter 4, including adjustments to interaction clarity, object accessibility, and the distribution of media across the environment.

Taken together, this thesis addresses the narrative, technical, and collaborative gaps identified at the beginning of the research. It proposes a model in which memory is experienced as layered, partial, and embodied; a workflow that reduces technical barriers for personal VR archives; and a system that can be extended to include multiple users and perspectives. The project demonstrates that VR can support new forms of family memory preservation by combining spatial reconstruction, interaction design, and sensory media into an adaptable and experiential archival system.

5.2 Evaluation, REB Playtesting, and Limitations

The evaluation of this project is primarily qualitative, based on REB-approved playtesting sessions, participant interviews, and observational analysis conducted during both controlled testing and public exhibition. The playtesting sessions involved approximately 15 participants with diverse backgrounds and varying levels of familiarity with VR, among whom 8 participants took part in follow-up interviews. Most participants were between their twenties and thirties, with several participants in their forties and fifties. This range allowed the study to capture differences in perception, interaction, and comfort across age groups.

Participants also represented varied professional and experiential backgrounds. Some had experience with video games or interactive media, while others came from art and design disciplines. Several participants had no prior experience with VR or creative technologies and approached the system as first-time users. This diversity was important for evaluating both accessibility and interpretability of the archive. The evaluation focused on observing how participants navigated the

environment, interacted with objects, and responded to the structure of the archive, rather than measuring performance through quantitative metrics.

A key finding from the playtesting sessions is the central role of space in memory reconstruction. Many participants expressed a strong interest in recreating their own past living environments, particularly in relation to experiences of relocation and the loss of physical spaces. In contrast, the importance of objects varied across users. Some participants valued detailed artifacts and personal belongings, while others considered them less essential. This indicates that spatial structure functions as the primary layer of memory within the archive, while objects operate as flexible and subjective elements that support individual engagement.

User feedback also revealed differences in interaction accessibility. Participants with prior experience in VR or 3D environments were generally able to navigate and manipulate objects with ease. In contrast, first-time users often encountered difficulty when attempting to pick up or control objects. In response to this issue, I adjusted the interaction system by increasing the snapping sensitivity of objects, allowing them to attach more easily to the controller. This modification reduced the level of precision in object manipulation but significantly improved usability. Feedback also highlighted the importance of consistency in interaction design. The page-turning interaction, which uses controller buttons to navigate between pages, was widely understood and preferred by participants. As a result, this interaction logic was applied consistently across similar interfaces in the prototype.

Motion comfort emerged as another variable factor. Participants who were familiar with 3D environments reported minimal discomfort, while others experienced motion-related unease during navigation. This variation indicates that VR accessibility remains dependent on user familiarity and suggests that movement design and interaction pacing require further refinement to support a broader range of users.

At the same time, the evaluation process highlights several limitations of the current prototype. The integration of 360-degree interview recordings was not achieved within the scope of this project, although these recordings were completed as part of the research. As a result, the archive currently presents a limited number of voices and does not yet fully support multi-perspective engagement through recorded presence. The template-based system introduced in the final room remains conceptual and has not yet been developed into a functional framework for user-generated content.

Technical constraints also limited the implementation of more advanced embodied interactions. Early exploration included the possibility of aligning physical and virtual space, such as allowing users to sit on real-world objects and trigger corresponding events in VR. Due to time and system constraints, this form of spatial mapping was not realized. In addition, performance limitations required the reduction of visual detail and the use of pre-rendered media, which influenced both the aesthetic and technical direction of the project.

These findings demonstrate that iterative testing and user feedback play a critical role in shaping the design of VR archival systems. They also identify clear directions for further development, particularly in

expanding multi-perspective content, improving interaction accessibility, and strengthening the relationship between physical and virtual experience.

5.3 Future Directions

Future development of Revisitation extends across user experience design, embodied interaction, system accessibility, spatial reconstruction, and participatory memory-making. The defence and post-exhibition revision process clarified that the next stage of the project should not only focus on adding more archival content, but also on improving the stability, legibility, and accessibility of the experience.

One important direction is the refinement of UX design, especially in relation to sound, memory triggers, and navigation. In the current prototype, voiceover, environmental audio, and triggered sound sequences play an important role in shaping interpretation and emotional engagement. Participants often relied on sound to understand context and connect with memory fragments. However, sound could be developed further as a stronger spatial and transitional guide. For example, the opening sequence, including the star-field passage and the door interaction, could include additional ambient movement sounds, spatialized audio, door-related cues, and gradual changes in sound texture. These sound layers would help guide users from the abstract entry space into the domestic memory environment and make the transition between memory, time, and space more immersive.

The design of memory triggers also requires further refinement. In the current prototype, selected objects activate photographs, sounds, texts, videos, or visual changes. However, some interactions remain difficult to activate consistently. For example, the television interaction was still difficult to

trigger during external testing. This suggests that trigger zones, interaction distance, controller input, and feedback systems need to be made more legible. Future versions could use larger and more forgiving trigger areas, clearer visual cues, subtle lighting changes, short confirmation sounds, or haptic feedback to help users understand when an object is interactive and whether an interaction has been successfully activated. This would also reduce the need for verbal explanation or written instruction, allowing the environment itself to communicate interaction possibilities.

Navigation is another practical and conceptual challenge. After the exhibition, teleportation controls were added to make the project easier to test remotely by the external examiner. This addition provided a practical way to move through the VR environment without relying only on physical walking, but it also introduced new technical problems. During external testing, the user could still fall out of the map in some situations, which suggests that navigation boundaries, collision settings, and floor calibration require further refinement. Future iterations should improve the stability of teleportation, strengthen collision and boundary systems, and provide clearer guidance about when users should physically walk, teleport, or use controller-based movement. Since the project focuses on embodied family memory, navigation should feel connected to the act of moving through a remembered domestic space. Movement design is therefore both a usability issue and a conceptual part of the archive.

A second major direction is the development of the project into a more accessible template-based system. The current prototype functions primarily as a personal case study, built from my own family archives, interviews, and reconstructed domestic spaces. The final room introduces the idea of a reusable template, but this system is not yet fully functional for non-expert users. The development

process made this limitation especially clear. Learning Unreal Engine, optimizing assets, debugging VR interactions, and preparing the project for exhibition required significant technical labour. This experience became one of the project's most important findings: if the process is difficult for a designer, it would be even harder for a family member who simply wants to preserve personal history.

Future work will therefore focus on simplifying the workflow. This may include a clean GitHub release, removal of private family data, a blank-slate project file, reusable interaction presets, a folder-based structure for importing images, audio, video, and text, and a comprehensive user manual. The goal is to make the template and its instructions work together, allowing users to begin constructing their own family memory environments without needing advanced knowledge of Unreal Engine. In this sense, the template is not only a technical file, but a structure for translating personal archives into spatial and interactive forms.

Another future direction is the integration of spatial mapping, OpenXR-based alignment, and more physically grounded interaction design. The current prototype relies primarily on controller-based input, which creates a distance between bodily action and physical experience. Future iterations could connect real-world objects to virtual interactions more directly, allowing physical elements such as chairs, tables, books, or framed photographs to function as interaction nodes. When users sit down, touch surfaces, or pick up objects in physical space, corresponding events could be triggered within the VR environment. This approach would strengthen the relationship between bodily movement and memory activation, while familiar object-based gestures could improve accessibility for users without prior VR experience.

The project may also continue exploring the migration from 2D archival material into 3D space. Emerging tools such as 3D scanning, photogrammetry, and Gaussian Splatting may support more efficient ways of reconstructing domestic environments from photographs, videos, and existing objects. However, the goal of this project is not perfect visual realism. Following the project's interest in the poetics of fragmentation, the gaps, distortions, and partial forms that appear when 2D images move into 3D space may become meaningful design elements. These imperfections can express the unstable and mediated nature of memory, where recollection is shaped by time, technology, and interpretation.

Real-time voice interaction also introduces a possible direction for future development. With the development of large language models, it may become possible to integrate an AI-driven character within the VR environment that functions as a narrator or guide. This system could provide contextual explanations, respond to user questions, and reveal additional layers of information dynamically. For this project, such a feature would require careful ethical consideration, especially when working with family memory, deceased relatives, and sensitive personal histories. Future development would need to define clear boundaries between guidance, interpretation, and representation, so that AI supports the archive without replacing the voices and agency of family members.

Finally, Revisitation may develop toward a more participatory model of shared memory. At this stage, the experience is primarily designed for one user at a time. Future versions could allow family members to enter the archive together as avatars, revisit spaces in real time, add new stories, and respond to each other's memories. This would shift the archive from a private reconstructed environment toward a living social space where family history can be discussed, revised, and co-created.

Taken together, these future directions show that the next stage of Revisitation is both practical and conceptual. Improving sound, triggers, navigation, and template accessibility would make the system more stable and usable. Exploring spatial mapping, 2D-to-3D migration, AI-guided interaction, and shared presence would extend the project's larger research question: how can family memory remain active, embodied, and open to reinterpretation across time?

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Appendices

Appendix A: Poster

Appendix B: Invitation Letter

Invitation To Participate In A Research Study For Revisitation: An Interactive VR Archive of Embodied Family Memory

Date:

Dear

You are invited to participate in a research study for Revisitation: An Interactive VR Archive of Embodied Family Memory. The purpose of this study is to explore how Virtual Reality (VR) can be used to design new methods for preserving and experiencing intergenerational family memory through immersive environments, interactive storytelling, and embodied participation.

As a participant, you will be asked to to review and sign the Consent Form before beginning the session. After providing consent, you will be invited to try a short VR experience that presents interactive memory environments, complete a brief questionnaire about your experience, and, if you wish, take part in an optional follow-up interview. You may also choose whether to allow non-identifiable VR screen-capture and optional hand/body gesture photos to support interaction-design evaluation.
Participation will take 20–30 minutes in total of your time.

Possible benefits of participation include experiencing an immersive VR artwork, contributing to the development of new methods for memory preservation, and helping improve VR interaction design. All attendees will also receive a small non-monetary appreciation item, such as a sticker or printed token.

There also may be risks associated with participation Some participants may experience mild discomfort from VR use, such as eye strain, dizziness, or temporary disorientation. You may pause or stop the VR session at any time. The VR area will be cleared for safe movement, and you will be reminded of your ability to stop if discomfort occurs.

If you have any questions about this study or require further information, please contact the Principal Investigator Yudi Cao or the Faculty Supervisor Haru Hyunkyung Ji, Ph.D. using the contact information provided above. This study has been reviewed and received ethics clearance through the Research Ethics Board at OCAD University [insert approval #]. If you have any comments or concerns, please contact the Research Ethics Office through research@ocadu.ca.

Principal Investigator:
Yudi Cao, MDes Candidate,
Digital Futures
OCAD University
416-876-0370 yudi.cao@ocadu.ca

Faculty Supervisor:
Haru Hyunkyung Ji, Ph.D.
Media Artist & Associate Professor,
EXAN Faculty of Art
OCAD University
(416) 977-6000 Ext. hji@ocadu.ca

Appendix C: Consent Form

Consent Form For Play Test

Date:
Project Title: Revisitation: An Interactive VR Archive of Embodied Family Memory

Principal (or Student) Investigator:
Yudi Cao, Graduate student
MDes Candidate, Digital Futures
OCAD University
(416) 876-0370; yudi.cao@ocadu.ca

Faculty Supervisor
Haru Hyunkyung Ji, Ph.D.
Media Artist & Associate Professor,
EXAN Faculty of Art
OCAD University
hji@ocadu.ca

PURPOSE

This study explores how people interact with a virtual reality (VR) prototype that preserves family memories through digital rooms, objects, and sounds. The goal is to understand three things:
(1) how different people experience and remember the same event inside a VR archive,
(2) which design choices make the system easy to use for people without technical skills, and
(3) how abstract visuals, sound, and interaction can help express emotional or hard-to-explain moments from family history.

In this play test, you will try an early version of the VR experience and share your thoughts about how clear, comfortable, and meaningful it feels. Your feedback will help improve the design and help the researcher learn how VR can support emotional, multi-voice, and personal forms of memory.

We plan to recruit about 8–12 participants. Participants must be 18 or older and comfortable using VR equipment. People who experience strong motion sickness or have conditions affected by VR will not be able to take part.

This study is part of a graduate thesis project in the Digital Futures program at OCAD University. There is no external funding or commercial use planned for this work, and there are no conflicts of interest.

WHAT'S INVOLVED

As a participant, you will be asked to review and sign the consent form and take part in the following steps:

1. Consent and Introduction (about 5 minutes)
You will be welcomed and given a simple explanation of the study. The researcher will describe the types of data that may be collected:

- VR screen-capture of the virtual environment (does not record your face or body),
- optional audio recording for the interview,
- optional photos or video of hand or body movements.
  You may decline any of these recordings and still join the VR test and questionnaire.

2. VR Play Test (10–15 minutes)
You will wear a VR headset and try a short interactive experience. The headset may record the virtual scene only. It does not capture your face, voice, or the room around you.

3. Optional Hand/Body Photo or Video Capture (2–5 minutes)
With your permission, a fixed camera may record your hand movements or posture to help evaluate interaction. The camera will avoid your face. If any facial features appear accidentally, they will be blurred. This step is optional.

4. Questionnaire (about 5 minutes)
You will complete a short survey about usability, comfort, and your experience inside the VR scene.

5. Optional Follow-up Interview (5–10 minutes)
You may choose to join a short interview about your experience. With permission, the interview may be audio-recorded, or the researcher can take written notes instead.

Participation will take approximately 20–30 minutes in total of your time.

There are no costs associated with participation. No demographic data beyond age and consent eligibility will be collected unless you choose to share additional information.

POTENTIAL BENEFITS
Possible benefits of participation include

Your participation may help improve the design of an interactive VR archive that supports memory, storytelling, and user experience. Your feedback may also help the researcher better understand how people interact with personal memory materials in virtual environments.

I cannot guarantee, however, that you will receive any direct benefits from participating in this study.

POTENTIAL RISKS

There also may also be risks associated with participation

This study involves minimal physical risk. As part of the VR experience, you may choose to engage in a small amount of slow walking within a controlled area. No fast, strenuous, or collision-prone movements are required.

Possible risks include:

- **Temporary effects commonly associated with VR use**, such as mild eye strain, slight disorientation, or light motion sickness.
- **Rare risk:** Individuals sensitive to flashing digital images may experience seizure-related symptoms, although this is uncommon.

Risk management measures include:

- The VR session will take place in a clear **2m × 2m** space.
- You will be asked to move slowly and stay within marked boundaries.
- You may pause or stop the session at any time.
- The researcher will monitor the session and stop the activity if you show signs of discomfort or instability.
- The session is short to limit VR-related fatigue.
- A rest area will be available, and nearby washroom locations will be provided.

There are **no expected long-term risks**.

CONFIDENTIALITY

All information you provide will be kept confidential. Your data will be stored using participant codes so that your name is not recorded in any dataset. No real names will appear in any notes, recordings, or research materials.

If you choose to participate in optional audio-recording or gesture video-recording, you may request to review or edit your recordings or interview notes at any time before they are analyzed. Only non-identifiable information will be kept. Hand/body photos and screen-capture recordings will avoid capturing your face; if any facial features appear by accident, they will be blurred before storage.

Data Storage
Scanned consent forms, questionnaire answers, coded interview audio, notes, gesture photos, and VR screen-capture files will be securely stored in OCAD University's encrypted cloud storage. No information will be shared with any external parties.

Access
Only the principal investigator (Yudi Cao) and the faculty supervisor (Haru Hyunkyung Ji) will have access to the coded data.

Retention and Disposal
All data will be kept for **1 year**, until the thesis is completed. After this period, all digital files will be permanently deleted from OCAD University's cloud storage. Any paper documents will be shredded immediately after being scanned and uploaded.

This study does not involve any situations requiring mandatory reporting (such as disclosures of child abuse). No identifying information will be released to any third party under any circumstances.

INCENTIVES FOR PARTICIPATION
Participants will be offered a small, non-monetary token of appreciation simply for attending the playtest session. They may choose either a small printed sticker related to the project theme or a digital thank-you image designed by the researcher. The incentive is optional, has minimal monetary value, and does not function as payment.

The incentive is not tied to task completion. Participants who choose to stop or withdraw at any point will still receive the same token of appreciation. They may also try the VR demo without participating in the research, so the incentive does not act as a motivator or form of coercion.

No personal information is required to receive the token.

VOLUNTARY PARTICIPATION

Participation in this study is voluntary. If you wish, you may decline to answer any questions or participate in any component of the study.

Further, you may decide to withdraw from this study at any time, or request withdrawal of your data prior to data analysis and you may do so without any penalty or loss of benefits to which you are entitled. Your choice of whether or not to participate will not influence your future relations with OCAD University [and/or other institutions/partners of the research] or the investigators [please include names] involved in the research.

To withdraw from this study, let PI know at any point during the study or you may contact Yudi Cao by email at yudi.cao@ocadu.ca

To withdraw your data from the study, please contact Yudi Cao by email at yudi.cao@ocadu.ca no later than February 28, 2026. If you request withdrawal by this date, All data collected until this point, including consent forms, questionnaire answers, VR screen-capture files, gesture recordings, interview audio, and notes, will be permanently deleted from OCAD University's encrypted cloud storage. Any paper documents will be shredded after deletion of the digital copies.

PUBLICATION OF RESULTS

Results of this study may be published in the researcher's master's thesis and deposited in the **OCAD University Open Research Repository**. Findings may also be shared through academic presentations or exhibitions at OCAD University. In all cases, data will be presented in aggregate form. Quotations from interviews will not be attributed to you without your permission.

Feedback about this study will be available in the final thesis, which will be uploaded to the OCAD University Open Research Repository (https://openresearch.ocadu.ca/) after completion in May 2026. Participants may also contact the principal investigator, Yudi Cao (yudi.cao@ocadu.ca), to request a summary of the findings.

CONTACT INFORMATION AND ETHICS CLEARANCE

If you have any questions about this study or require further information, please ask. If you have questions later about the research, you may contact the Principal Investigator Yudi Cao or the Faculty Supervisor (where applicable) Haru Hyunkyung Ji, Ph.D. using the contact information provided above. This study has been reviewed and received ethics clearance through the Research Ethics Board at OCAD University [REB approval # 102789].

If you have questions regarding your rights as a participant in this study please contact:
Research Ethics Board c/o Office of the Vice President, Research and Innovation
OCAD University
100 McCaul Street
Toronto, M5T1W1
416 977 6000 x4368
research@ocadu.ca

AGREEMENT

I agree to participate in this study described above. I have made this decision based on the information I have read in the Information-Consent Letter. I have had the opportunity to receive any additional details I wanted about the study and understand that I may ask questions in the future. I understand that I may withdraw this consent at any time.

A. Pre-Participation Check (Self-Confirmation)

Before beginning the VR session, please confirm:

1. I am 18 years old or older.

☐ Yes, I confirm
☐ No (you may try the VR demo informally, but cannot join the research)

2. I do not have a history of severe motion sickness, epilepsy, seizures, or other medical conditions that may be triggered by VR.

☐ Yes, I confirm
☐ No / Not sure (please discuss with the researcher before participating)

3. I understand that I may stop the VR session at any time if I feel dizzy, nauseous, or uncomfortable.

☐ Yes

4. I understand that the VR screen-capture only records the virtual scene and does NOT record my face, body, voice, or the room around me.

☐ Yes, I understand

5. I understand that photos or videos of my hands or body movements are optional and will avoid my face. If any part of my face appears by accident, it will be blurred.

☐ Yes, I understand

6. I understand that completing this self-screening form helps me determine if I meet the eligibility criteria for research participation.

☐ Yes, I understand

B. Participation in the Study

☐ Yes, I agree to participate in this research study.
☐ No, I do not agree to participate.
(If "No," you may still try the VR demo informally but will not be included in the research.)

C. Consent Options for Data Collection

1. VR Screen-Capture (non-identifiable; only the virtual scene is recorded)

☐ Yes, I agree to VR screen-capture. I understand how these recordings will be stored and destroyed.
☐ No, I do not agree to VR screen-capture.

2. Questionnaire (required for participation)

☐ Yes, I agree to complete the short questionnaire. I understand how these recordings will be stored and destroyed.
☐ No, I do not agree to complete the questionnaire.
(If "No," you cannot be included as a research participant but may still try the VR demo informally.)

3. Hand/Body Photo or Video (optional)

☐ Yes, I agree to hand/body photo or video recording. I understand my face will not be recorded, and any accidental facial features will be blurred before storage. I understand how these recordings will be stored and destroyed.
☐ No, I do not agree to hand/body recording.

4. Follow-Up Interview (optional)

☐ Yes, I am willing to participate in a short interview.
☐ No, I do not wish to participate in a follow-up interview.

If you said Yes, please indicate your preference:
Audio Recording (optional)
☐ Yes, I agree to audio-recording of the interview. **I understand how these recordings will be stored and destroyed.**
☐ No, I do not agree to audio-recording. Written notes may be taken instead.

The information you provide will be kept confidential, i.e. your name will not appear in any thesis or report resulting from this study. However, with your permission attributed quotations may be used.

Options, depending on study:
Shortly after the interview has been completed, I will send you a copy of the transcript to give you an opportunity to confirm the accuracy of our conversation and to add or clarify any points that you wish.

OR

☐ *Yes, I would like to hear more about the study. You may reach me by (provide contact information):*
Email:
Post:
Phone:

(Advice to the researcher: specify manner of reaching the participant – email, post, last phone/address)

☐ *No, I do not want to hear more about the study.*

Attributing quotes
In the case that you would like to attribute statements/quotations, consider placing a check box for participants so that they can indicate agreement. Be sure to discuss with them what it involves in terms of potential risk and benefit.

☐ Yes, I wish to be attributed for my contribution to this research study. You may use my name alongside statements and/or quotations that you have collected from me.

☐ No, I do not wish to be attributed for my contribution to this research study. You may not use my name alongside statements and/or quotations that you have collected from me.

Name: _____

Signature: _____ Date: _____

Thank you for your assistance in this project. Please keep a copy of this form for your records.

Appendix D: Information Sheet & Safety Note

Information Sheet & Safety Note

Project Title: Revisitation: An Interactive VR Archive of Embodied Family Memory
Researcher: Yudi Cao, MDes Candidate, OCAD University

Health & Safety Advisory

For your safety, please do not participate in this VR study if you have any of the following conditions:

- Prone to severe motion sickness.
- Impaired balance or conditions affecting physical safety.
- Heart conditions, pacemakers, or implanted medical devices.
- History of photosensitive epilepsy or seizures.
- Currently pregnant.
- History of serious anxiety disorder or post-traumatic stress disorder that may be triggered by VR.

During the Study

You may stop the VR session at any time if you feel discomfort (dizziness, nausea, eye strain, emotional distress).

Please remain aware of the play area boundaries.

Take breaks whenever needed.

Inform the researcher immediately if you feel unwell.

Voluntary Participation

Participation is voluntary. You may withdraw at any time without penalty.

Any data collected up to the point of withdrawal can be removed upon request (before Mar.3rd 2025).

Appendix E: VR Playtest Feedback Survey

VR Playtest Feedback Survey

Project Title: *Revisitation: An Interactive VR Archive of Embodied Family Memory*
Researcher: Yudi Cao, MDes Candidate, Digital Futures, OCAD University
Contact: yudi.cao@ocadu.ca

Introduction

Thank you for participating in the playtest of this thesis project.
This survey is designed to gather your feedback on the VR prototype to help improve the experience.

- **Time required:** approximately 5–10 minutes
- **Confidentiality:** Your responses will remain anonymous and used only for academic research.
- **Voluntary:** You may skip any questions you do not wish to answer.

Section A: Background

1. Age Range:
   - ☐ Under 18 (cannot participate)
   - ☐ 18–29
   - ☐ 30–44
   - ☐ 45–59
   - ☐ 60+
2. Have you used a Virtual Reality Headset before?
   - ☐ Yes
   - ☐ No
3. How would you describe your experience with interactive media (games, VR, AR, installations)?
   - ☐ Beginner
   - ☐ Intermediate
   - ☐ Advanced
   - ☐ Expert

Section B: Overall Experience

4. Overall, how enjoyable was the VR experience?
    - 1 ☐ Not enjoyable – 5 ☐ Very enjoyable

5. How engaging did you find the theme about family memory and cultural identity?
    - 1 ☐ Not engaging – 5 ☐ Very engaging

6. How would you rate the visual and aesthetic design of the VR environment?
    - 1 ☐ Very poor – 5 ☐ Very good
    - Please explain your rating: _____

7. How easy was it to interact with the VR environment (controls, navigation, clarity)?
    - 1 ☐ Very difficult – 5 ☐ Very easy
    - Please describe any difficulties: _____

8. Did you feel any discomfort (e.g., dizziness, nausea, eye strain)?
    - ☐ None
    - ☐ Mild
    - ☐ Moderate
    - ☐ Severe

Section C: Usability & Interaction

9. How clear were the instructions or guidance provided before and during the VR experience?
    - 1 ☐ Very unclear – 5 ☐ Very clear
    - Please explain your rating: _____

10. Did you ever feel confused about what to do next in the VR environment?
- ☐ Never
- ☐ Sometimes
- ☐ Often
- If yes, please describe the moment(s): _____

11. How intuitive did you find the interactions (controllers, gestures, menus)?
- 1 ☐ Not intuitive – 5 ☐ Very intuitive

12. Was the pacing of the experience comfortable for you (not too fast or too slow)?

- 1 Too slow – 5 Too fast
- Please explain: _____

Section D: Content & Sensory Design

13. How would you rate the **visual clarity and readability** of text, objects, or menus in VR?
- 1 ☐ Very poor – 5 ☐ Excellent

14. How effective were the **sound design and audio cues** in enhancing immersion?
- 1 ☐ Not effective – 5 ☐ Very effective
- Please explain your rating: _____

15. Did the VR environment feel immersive and believable?
- 1 ☐ Not immersive – 5 ☐ Very immersive
- Please describe what helped or disrupted immersion: _____

Section E: Emotional & Narrative Impact

16. Did the VR experience evoke any emotions for you (e.g., nostalgia, sadness, curiosity, connection)?
- ☐ Yes ☐ No
- If yes, which emotions? _____

17. Did the experience make you reflect on your own family, culture, or memories?
- ☐ Yes, strongly
- ☐ Somewhat
- ☐ Not really
- ☐ Not at all

18. Which part of the narrative or design felt most **memorable or meaningful** to you?
(Open-ended)

Section F: Technical Issues

19. Did you encounter any technical issues (lag, glitches, tracking problems, crashes)?

- ☐ No issues

- ☐ Minor issues
- ☐ Significant issues
- Please describe: _____

20. Was the physical play area (boundary, comfort, space) sufficient for the experience?
- ☐ Yes
- ☐ No (please explain): _____

Section G: Strengths, Weaknesses & Suggestions

21. What aspects of the VR experience did you enjoy the most?
(Open-ended)

22. What aspects did you enjoy the least or found confusing/distracting?
(Open-ended)

23. If you could change one thing to improve the experience, what would it be?
(Open-ended)

24. Do you have suggestions for additional content, features, or interactions that could make the experience better?
(Open-ended)

Section H: Final Feedback

25. Would you recommend this VR experience to others?
- ☐ Yes
- ☐ Maybe
- ☐ No

26. Any additional comments or feedback?
(Open-ended)

27. Would you be open to a follow-up interview or testing session?
- ☐ Yes (contact info: _____)
- ☐ No

Appendix F: Follow-Up Interview Script

Follow-Up Interview Script

Opening Script

"Before we begin, I would like to confirm your preferences regarding recording and your rights as a participant.

This short interview can be audio-recorded so that I can accurately capture your responses. Your name will not appear in any recording, transcript, or research materials. Your information will be coded using a participant number such as 'Participant 1.' Only the principal investigator and the faculty supervisor will have access to the recording.

The audio file will be securely stored in OCAD University's encrypted cloud storage and kept for up to one year, until the thesis is completed. After that, it will be permanently deleted.

If you prefer not to be recorded, I can take written notes instead. These notes will also be digitized and stored in the encrypted cloud, and the physical paper notes will be shredded immediately after scanning.

You have the right to stop the interview at any time for any reason.
You may also request the removal of your data after the interview.

If you decide later that you want to withdraw your data, please email me before **Mar 3, 2026**. At that time, all of your digital materials, including audio files, notes, gesture images, and transcripts, will be deleted from OCAD University's encrypted cloud storage. Any paper documents will be immediately shredded.

Before we begin, please let me know your preference:

(A) Audio recording, or
(B) Written notes only.

Do you have any questions before we start?"

Section A Overall Experience (General Impressions)

- How would you describe your experience inside the VR environment?
- What stood out to you the most? (This may include visuals, interaction, atmosphere, etc.)

Section B Usability & Interaction

- How easy or difficult was it to interact with objects in the scene?
- Were any gestures or interactions confusing or uncomfortable?
- Did you feel aware of the VR boundaries and your physical space?

Section C Sensory & Immersive Aspects

- How immersive did the environment feel to you?
- Did the lighting, sound, or spatial layout affect your sense of presence positively or negatively?

Section D Comfort & Accessibility

- Did you experience any discomfort, dizziness, or fatigue?
- Is there anything that could improve comfort during the session?

Section E Memory, Atmosphere & Interpretation (Aligned with your thesis)

- What kind of atmosphere or story did the VR environment communicate to you?
- Did the space feel emotionally meaningful or neutral to you?
- Were there moments where you felt connected, curious, or detached from the scene?

- Would you like to build your own family archive and use the forth room as a template?

Section F Design Feedback & Suggestions

- What would you like to see added, changed, or improved?
- Were there features that felt particularly intuitive or enjoyable?

Section G Closing

- Is there anything you would like to share about your experience that hasn't been covered?

Closing Script

"Thank you again for your time and feedback. Your responses will help improve the design and usability of the VR memory environment."

Appendix G: A Private inscription

一幅私人题赠的对联
A private inscription

自扫竹根培老节，愿携茶具作清欢。

—— 蔡元培 书

题赠「锦涛仁兄先生雅属」

“锦涛”为白雄远之字，“白雄远”为其名。“仁兄”“雅属”是传统文人书写中用于私人题赠的尊称与格式，表明此幅书法并非应酬或公开陈列之作，而是蔡元培私下、明确赠予白雄远本人的墨宝。

“To tend the bamboo’s roots and cultivate enduring integrity; to share simple joy through tea.”

– Calligraphy by Cai Yuanpei

Inscribed: “Respectfully dedicated to Jin Tao, my esteemed colleague”

1

"Jin Tao" is the courtesy name of Bai Xiongyuan. The expressions "仁兄" (esteemed brother) and "雅书" (respectfully dedicated) indicate that this work was personally written and gifted, rather than intended for public display.

写字的人
The calligrapher

蔡元培是中国近代最重要的教育家之一，曾任北京大学校长，是现代大学制度与学术精神的重要奠基者。他长期倡导"思想自由、兼容并包"，主张大学不应成为政治权力的工具，而应作为保护学术独立与人格尊严的空间。

在政治立场往往先于学术判断的时代，这一理念并非抽象主张，而是一种需要承担现实风险的选择。蔡元培与多位坚持独立立场的学者之间，保持着私下而持久的精神支持与理解。

Cai Yuanpei was one of the most influential educators in modern Chinese history and served as president of Peking University. He played a foundational role in shaping the modern Chinese university system and is widely associated with the principles of academic freedom, intellectual pluralism, and moral integrity in education.

At a time when political allegiance often preceded intellectual inquiry, Cai argued that universities should not function as instruments of state power, but as spaces that safeguard independent thought and ethical responsibility. This stance was neither abstract nor without consequence, and Cai maintained close, often private, relationships with scholars who shared this commitment.

受赠者：白雄远（字锦涛）
The recipient: Bai Xiongyuan (Jin Tao)

本幅题字的受赠者白雄远，字锦涛，是蔡元培在北京大学的同仁，也是我的曾祖父。
白雄远毕业于保定军校，具有少校军衔。1917年后留校任教，后由蔡元培聘为北京大学体育部主任。20世纪30年代初，学生军事训练逐步发展为全国性体系，他出任北平学生军总教官，统领并训练来自北京多所大学的学生力量。
在当时的历史语境中，既具军职背景、又能够组织和动员学生的知识分子，往往被视为具有高度公共影响力的人物，也因此承受更为直接而持续的政治与军事压力。

The recipient of this inscription, Bai Xiongyuan (courtesy name Jin Tao), was Cai Yuanpei's colleague at Peking University and my great-grandfather.
A graduate of the Baoding Military Academy, Bai held the rank of Major. After 1917, he remained in academia and was appointed by Cai as Director of Physical Education at Peking University. In the early 1930s, as student military training expanded into a nationwide system, he became Chief Instructor of the Beiping Student Corps, overseeing and training students from multiple universities across Beijing.
Within the historical context of the time, intellectuals who combined formal military rank with the capacity to organize and mobilize students were regarded as figures of significant public influence, and were therefore subject to heightened and sustained political and military scrutiny.

1937年，北平
Beiping, 1937

七七事变，又称卢沟桥事变，发生于1937年7月7日，是中国与日本之间全面战争的开始，也被普遍视为抗日战争的起点。

事变发生后，华北地区迅速进入军事占领状态，北平受到日军直接控制。凡与学生组织、公共动员或潜在抵抗相关的人物，均面临被逮捕、伤害甚至处决的高度风险。对教育者与知识分子而言，“保持中立”已不再是可行选项。

The Marco Polo Bridge Incident, also known as the Lugou Bridge Incident, occurred on July 7, 1937, near Beijing. It marked the beginning of full-scale war between China and Japan and is widely regarded as the start of the Second Sino-Japanese War.

Following this event, northern China rapidly fell under military occupation. Beijing came under direct control, and individuals associated with student organization, public mobilization, or potential resistance faced immediate danger. For educators and intellectuals, neutrality was no longer a viable position.

无法离开的城市
A city that could not be left

全面战争爆发后，白雄远亲自带领北京大学学生前往卢沟桥，慰问并声援第29军。途中遭遇日军飞机空袭，车辆翻覆，车中刺刀刺入其右肋，伤势严重，被紧急送往北平中央医院救治。

第29军撤出北平后，白雄远随即被捕。经教育界同仁多方营救得以出狱，但不久之后再次被捕。此时北平已完全处于日军占领之下，他无法离开这座城市。

After the outbreak of war, Bai Xiongyuan personally led Peking University students to Lugou Bridge to support the 29th Army. During the journey, the convoy was attacked by Japanese aircraft. The vehicle overturned, and a bayonet inside the vehicle pierced Bai's right side, causing severe injury. He was rushed to Beiping Central Hospital for emergency treatment.

After the 29th Army withdrew from Beijing, Bai was arrested. He was released through the intervention of fellow educators, but was later arrested again. By this time, Beijing was under full occupation, and Bai was unable to leave the city.

写在危险之中
Written under risk

正是在这样的处境中，蔡元培写下了这幅对联。当时北平已被日军占领，而蔡元培本人已辗转抵达香港。在得知白雄远受伤、被捕、无法脱身的消息后，蔡元培写下此字，并设法转送北平。

这并非礼仪性或纪念性的作品，而是在监控、危险与不确定性之中完成的一次私人精神支持。题字未署具体日期，并非疏忽，而是出于安全考虑：在占领环境中，任何可被追溯的时间线索，都可能带来额外风险。

在中国文化中，“竹”象征人格、气节与坚韧；“自扫竹根”指无需庇护、也无需见证的自我坚守；“清欢”则是一种拒绝以权力与成败衡量价值的平等关系。

It was under these conditions that Cai Yuanpei wrote this couplet. At the time, Beijing was under occupation, while Cai himself had already reached Hong Kong. Upon learning of Bai's injury, arrests, and inability to escape, Cai wrote this inscription and arranged for it to be sent back to Beijing.

This was not a ceremonial or commemorative work, but a private act of moral solidarity composed under surveillance and danger. The absence of a date was not an omission, but a necessity: in an occupied city, even a traceable timestamp could have placed its recipient at further risk.

In Chinese symbolism, bamboo represents integrity and resilience. "To tend the bamboo's roots" refers to quiet moral cultivation without protection or recognition, while "simple joy through tea" describes an egalitarian relationship grounded in mutual respect rather than power or achievement.

被保存下来的记忆
A memory kept

这幅题字为蔡元培私下题赠白雄远的个人墨宝，从未进入公共档案或官方收藏体系。

在文化大革命（1966–1976）期间，家族为避免风险将其刻意藏匿，也因此未能在理想条件下保存。今日所见版本，为经家族后人方彪协助修复并重新装裱后的样貌，目前存放于我姥爷的家中。

在此，这幅题字并非作为权威历史文献被展示，而是一段由家庭内部保存并延续的私人记忆。它连接着一所大学的精神、一位在政治压力中选择拒绝与坚守的学者，以及那些未被宏大叙事记录、却真实存在过的人生。

This inscription was a private gift and never entered public archives. During the Cultural Revolution (1966–1976), it was deliberately hidden by the family to avoid risk and could not be preserved under ideal conditions. The version shown here is a restored and remounted copy, repaired with the assistance of family descendant Fang Biao, and is currently kept in my maternal grandfather's home.

Here, the inscription is not presented as an authoritative historical artifact, but as a fragment of family-held memory. It connects the values of a university, the life of a scholar who chose refusal over compliance, and the many personal histories that remain absent from official archives, yet endure through private care and remembrance.