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"Between Similitude and Dissimilitude": Supporting Family Reminiscence with Non-Photorealistic Visualizations of Past Places

Keio University Graduate School of Media Design

Johnson Leu

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by Johnson Leu

Thesis Supervisory Committee:

Professor Masahiko Inakage	(Principal Supervisor)
Professor Naohito Okude	(Co-Supervisor)
Professor Keiko Okawa	(Co-Supervisor)

Thesis Review Committee:

Professor Naohito Okude	(Committee Chair)
Professor Keiko Okawa	(Member)
Professor Ichiya Nakamura	(Member)
Professor Ellen Yi-Luen Do	(Member)

Doctoral Thesis Abstract

"Between Similitude and Dissimilitude": Supporting Family Reminiscence with Non-Photorealistic Visualizations of Past Places

Category: Design

Reminiscence is the mental process of recalling past experiences and allows one to rediscover personal narratives that can be passed from one generation to another. In the industrialized and urbanized societies where face-to-face contacts between family members are infrequent, sharing personal stories becomes an important activity to support the development of empathy and the strengthening of family relationship and identity. Current researches in the area of assisted reminiscence generally focus on utilizing existing materials, such as historic media contents, to evoke memory recall. However, materials relevant to one's experiences, may not necessarily exist for some people to engage in reminiscence.

This research explores the concept of supporting reminiscence for Taiwanese family reunions with visuals of virtually reconstructed past places. Researches have suggested that places play important roles in our episodic memories as the fundamental context of perceived experiences, and representations of places may evoke the recall these memories. However, places can change or disappear, and without adequate historic references, images of reconstructed past places may present uncertainties and inaccuracies. In this research, we propose a visualization process, STREMIS, which utilizes historic aerial survey photographs as main source of reference for reconstruction, and non-photorealistic rendering in Chinese ink wash painting style as the visual expression for abbreviation of uncertainties. These images

provide visual hints for viewers to revisit their past neighbourhoods and rediscover forgotten stories.

The concept of STREMIS visualization has been proven through user studies using methods of photo elicitation, participatory observation, and interview with Taiwanese families at home reunion settings. The findings demonstrate that the visualizations can evoke sharing of personal stories and description about the past, and support engaging intergenerational communications among family members. The family interaction experience with the support of these visualizations has been reported as pleasant. The outcomes of this design research provide glimpse of the potentials in creating visualizations based on historic topographic data to support memory recall and storytelling. The research makes contribution in assisting family reminiscence for groups who previously have little access to relevant materials, and may provide reference for future content designers in considering the roles of place, memory, and artistic expression to engage audience's interactive experience.

Keywords: Reminiscence, Storytelling, Memory, Place, Family, Visualization, Intergenerational Communication, Virtual Reconstruction, Non-Photorealistic.

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Johnson Leu

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The road to Ph.D. is a monomyth in which the protagonist and antagonist are the selves within. It is a self-discovery of one's limit and inner most weakness. It is a humbling journey to learn about the accumulated knowledge of humanity, and how much of the reality remains unknown. In the end, this dissertation matters not in its contribution, but as a product of the experience of the time, place, and people.

Throughout this journey, I am most grateful to my life's partner, best friend, and wife Jiani, who not only made sacrifice to support this endeavor, but also provided intellectual and critical challenges that drove its completion. I am also thankful to my families, whose supports remedied the frustrations and obstacles that I experienced as a researcher, a professional, and an expatriate living in Japan, and transformed the struggles into motivations, determinations, and a better man in me.

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Introduction

"It is the stabilizing persistence of place as a container of experiences that contributes so powerfully to its intrinsic memorability. An alert and alive memory connects spontaneously with place, finding in it features that favor and parallel its own activities. We might even say that memory is naturally place-oriented or at least place-supported."

Remembering – By Edward S. Casey

Memories, experiences, and personal stories are often remembered along with the places in which they occurred. Seeing old photographs or visiting our old neighbourhoods can spontaneously make us recall past events that we may feel compelled to share with people. This act of reminiscing past experiences and sharing stories supports the passing of knowledge, strengthening of social relationships, and development of empathy between the storyteller and listener. In a family context, storytelling helps the communication of family legacies from one generation to the next, establishment of self-identity, maintenance of kinship, and can be a pleasurable communal experience. However, places can change and become visually different from the way we remembered over time. Moreover, the intimate places from our earlier lives may not necessarily have photographic or video records, especially for rural or suburban communities before cameras became pervasive. Without visual references of past places, it may be difficult for some people to revisit memories and share past experiences with others. Although street-level visual reference of the past may not be available for certain neighbourhoods, large area historic record such as aerial survey photographs and maps are more likely to be preserved by the public or

institutional archives, and may provide clues to these places. By using 3D computer graphic tools and production techniques, we can take these clues to reconstruct the neighbourhoods of the past. The virtually reconstructed imageries of past places may help stimulating reminiscence of past experience from the older generation and elicit personal stories to be shared with younger family members to facilitate an engaging family social experience.

In this research we developed STREMIS, a visualization process that generate artistically rendered historic sceneries designed for past residents to trigger the recall of memories about their past neighbourhoods in Taiwan. This design research explores the use of historic topographical data as the main source of reference for virtual reconstruction and stylized visualization of historic neighbourhoods to create visual stimuli that support reminiscence and storytelling. The aim is to facilitate Taiwanese, older adults, who have little access to visual record to their past neighbourhoods, to rediscover experiences and share personal accounts of the events and lives in the past as a social activity to connect with their younger family members. In a society where more family members are living apart and face-to-face interaction is becoming less frequent, STREMIS support the social activity of storytelling that may provide family members a pleasurable experience to communicate and bond during the limited opportunities of family reunion gatherings.

1.1 Memories and Stories of the Past

A simple conversation about personal experience with family members can inadvertently stimulate us in different ways. For older adults, it provides an opportunity to recall and organize memories of life journey, and to share narratives of personal experiences with family members to support the building of a sense of connectedness and self-esteem[1]. For young adults, this interaction with senior family

[1] Jeffory D., Webster & Barbara, K., Haight and. *Critical Advances in Reminiscence Work*. Springer Publishing Company. 2002.

members may be an opportunity to discover family legacies that support the building of kinship and self-identity,[2] or learn private accounts of historical events and their ancestral lands. [3] From memorable encounters to mundane daily anecdotes, intergenerational storytelling is an important family social activity that allows intimate knowledge and experience to be rediscovered and helps us construct a sense of who we are.[4]

Sharing personal stories involves reminiscence, the mental process of recalling and revisiting one's past experience, which can be beneficial for the storyteller's emotional wellbeing and maintenance of social relationship. This recounting of past can support the construction of identities and maintenance of relationships,[5] improve life satisfaction and prevent depression,[6] and can be pleasurable to both the storyteller and the listeners.[7] Reminiscence is typically a spontaneous and unstructured human experience,[8] but can also be structured processes conducted for therapeutic purposes.[9] The stories, even recollections of mundane details of the past, may also provide clues to gain insights on the cultural background and preferences of the storyteller.

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[2] Elizabeth Stone. Black Sheep and Kissing Cousins: How Our Family Stories Shape Us. New York: Times Books. 1988.

[3] Paul Thompson. "The Voice of the Past: Oral History". in *The Oral History Reader*. ed. Robert Perks and Alistair Thompson. (London: Routledge, 1998), 21.

[4] Blair Thompson et al., "Family Legacies: Constructing Individual and Family Identity through Intergenerational Storytelling." *Narrative Inquiry*, 19:1 (2009): 107-108.

[5] Jeffory D. Webster. *Critical Advances in Reminiscence Work*. Springer Publishing Company. 2002.

[6] Jeffory D. Webster, et al, "Mapping the Future of Reminiscence: A Conceptual Guide for Research and Practice". *Research on Aging*, 32(4):527–564, May 2010.

[7] Clare Gillies and Anne James, Reminiscence Work with Old People (Champan & Hall, 1994), 13.

[8] Dan Cosley, et al. "Using Technologies to Support Reminiscence." *Proceeding of BCS0CHI '09*. (2009). 480-484.

[9] L. M. Watt and P. Cappeliez. "Integrative and Instrumental Reminiscence Therapies for Depression in Older Adults: Intervention Strategies and Treatment Effectiveness." *Aging & Mental Health*, 4 (2):166–177, May 2000. doi: 10.1080/13607860050008691.

Stories told by the older generations may provide personal perspective of histories. Oral historian and sociologist Paul Thompson in his influential book *The Voice of the Past* suggested that personal accounts of historical events can bring the old and less privileged members of the society towards dignity and self-confidence, and create understandings between social classes and between generations.[10] Personal stories allow heroes to come from not just the establishment, but also from previously unknown people with personal connections. These stories can widen the scope of our understandings of the world and its past through the voices of its witnesses.

Intergenerational storytelling is an ability that most family members develop naturally through frequent practices during ordinary encounters such as daily communal meals, leisure times or special family events.[11] Families that communicate on more frequent basis are more likely to have the younger generations that participate more in storytelling activities as well as perceive more family strengths. [12] However, many families today may not have the opportunity for frequent contact due to the growing distances between members. These distances can be attributed to the shift in family structures as a result of migration and emigrations triggered by political and socioeconomic changes in societies that are becoming more industrialized and urbanized. Despite advancement in communication and travel technologies, and desires in maintaining long distance relationship, eventually distances can lessen the frequencies of interactions for many families.[13] The reduced interaction frequencies

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[10] Paul Thompson. The Voice of the Past. Oxford, Oxford University Press. 1978.

[11] Laurel J. Kiser, Barbara Baumgardner, & Joyce Dorado, "Who Are We, but for the Stories We Tell: Family Stories and Healing", *Psychol Trauma*. 2010 Sep 1; 2(3): 243–249. doi: 10.1037/a0019893

[12] Patty Ann Thompson. Joint Family Storytelling as a Mediator of Family Communication Patterns and Family Strengths. (M.Sci.diss. University of Missouri, 2013).

[13] Olena Nesteruk & Loren Marks. "Grandparents Across the Ocean: Eastern European Immigrants' Struggle to Maintain Intergenerational Relationships." *Journal of Comparative Family Studies*. Vol. 40, No. 1 (WINTER 2009). 77-95.

between family members can affect the development of storytelling tradition and skills.

This research aims to support interactions between older and younger generations in the setting of family reunion gatherings through the practice of ***family reminiscence*** (or may be simply referred to as reminiscence), which we define as when memories are shared for the social function of conversation that utilize personal narratives to support the development of empathy, passing down family legacies, and communal enjoyment.

1.2 The Distant Generations in Taiwan

In Taiwan many families are facing intergenerational distances that reduce the frequency and engagement of intergenerational storytelling. These include geographical distance, linguistic distance, and in some cases cultural distance. These distances are partly results of the political and socioeconomic changes that took place in the island's modern history.

During the twentieth century, Taiwan experienced significant historical events that brought major changes to the way of life and family structures to the island's population. These events include Imperial Japan rule, mass influx of refugees resulted from the Chinese Civil War, and a four-decade period of martial law promulgate by Kuomintang (KMT, Chinese Nationalist Party) as a single-party state of Republic of China (ROC). The socioeconomic developments triggered by these events have shifted the island's agriculture based communities into an industrialized and urbanized societies. Consequently, for native Taiwanese population, the traditional family structure where multi-generational and extended members live together in the same community, shifted toward nuclear family structure as separations and migrations took place to pursue better opportunities.[14] Moreover, the political

[14] Mei-Chen Lin & Jake Hardwood, "Accommodation Predictors of Grandparents: Grandchild Relational Solidarity in Taiwan," *Journal of Social and Personal Relationship* 20:4 (2003): 538

repressions imposed by KMT and threat of warfare with People's Republic of China (PRC) during the later period of the century also triggered emigration of many to move abroad. As a result, today many Taiwanese family members are living apart, and in some cases scattered around the world, with significant geographical distance in between.

The historical events in Taiwan not only contributed to the increased geographical distance among many family members, but also created linguistic distance for some. At the turn of twentieth century, the island's native population consisted language groups of Taiwanese Hokkien majority as well as Taiwanese Hakka and indigenous minorities. During the Japan rule period, public education system in Taiwan was required to teach the Japanese language, which produced a bilingual generation that primarily communicate using one of the native languages and was proficient in Japanese. When KMT and civil war refugees retreated to Taiwan in the late 1940's, in order to assume social control and maintain national allegiance, a near four-decade long period of martial law was imposed. During this period the use of Japanese was prohibited as part of the "de-Japanization" process, while the training and use of Mandarin Chinese as the national standard language became mandatory, and the use of native languages was discouraged by labeling them as uncivilized dialects. Many people who grew up during this era stopped teaching their mother tongues to their children in fear of discrimination or criminalization. [15] [16] These practices resulted in some of the succeeding generation unable to communicate proficiently with the primary languages of their older family members. Although language differences can sometimes be remedied by interpreters, a role that is often

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[15] Mandy Scott & Hak-Khiam Tiun. "Mandarin-only to Mandarin-plus: Taiwan," *Language Policy* 6 (2007): 57, DOI 10.1007/s10993-006-9040-5

[16] Hsi-Nan Yeh, Hui-Chen Chan & Yuh-Show Cheng., "Language Use in Taiwan: Language Proficiency and Domain Analysis," *Journal of Taiwan Normal University: Humanities & Social Sciences* 49:1 (2004): 76.

naturally assumed by other family members who are proficient in both languages,[17] the linguistic distance may still limit the engagement and frequency of interactions.

In addition to geographical and linguistic distances, growing up in different times, places, and social conditions can also create cultural distances between family members. The differences in the lived and shared experiences can create different expectorations and values that limit or prevent engaging communications. In Taiwan, older people and their wisdom are generally respected due to the filial piety value of the Confucianism influence, and intergenerational interaction can be motivated by an attitude of "learning from older people's experience", [18] opinions and suggestions that may not be applicable to younger people's situation can be perceived as unwanted advice or criticizing, and can naturally create friction and distance.[19] Although the cultural norm of respect and politeness toward the older generation is still accepted, the perceived power imbalance between the young and old can make relaxed and highly personal interaction difficult to realize.

Despite the reduced interaction frequency between generations, many young and older Taiwanese expressed interest in improving their intergenerational interaction with families. The research conducted by Taiwanese Ministry of Education revealed that over 48% of grandchildren living in nuclear family structures

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[17] Cai Shuyin 蔡書吟, "Guoxiao xuetong xuexi minnanyu zhi kunjing – yi tongzhu zhangbei jie shiyong minnanyu duitan zhi jiating wei tantao", 國小學童學習閩南語之困境-以同住長輩皆使用閩南語對談之家庭為探討 [Difficulties of Learning Southern Min for Elementary School Students – A Discussion on Families with Southern Min Speakers], guoli jiayi daxue youer jiaoyu yanjiusuo 國立嘉義大學幼兒教育研究所 [National Chiayi University Research Center of Childhood Education]. (2004) http://group.cyhvs.cy.edu.tw/mediafile/403/fdownload/1058/2090/2014-2-6-9-24-34-2090-nf1.pdf

[18] Yan Bing Zhang, Mary Lee Hummert, & Teri A. Garstka. "Stereotype Traits of Older Adults Generated by Young, Middle-aged, and Older Chinese Participants." *Hallym International Journal of Aging*, 2 (4), 2002. 119-140.

[19] Mei-Chen Lin, Yan Bing Zhang, & Jake Harwood. "Taiwanese Young Adults' Intergenerational Communication Schemas." *Journal of Cross-Cultural Gerontology*, 19, (2004).321-342

interact with their grandparents only once a month or less, and 14.6% have not interacted with grandparents in over a year. The same research also noted that 4.4% of those living with their grandparents have never had any interaction with each other, and the main reasons are "feeling distant" and "being too busy". [20] The emotional distance and sense of estrangement are also observed between separated migrant family members, as being physically apart gradually decrease the frequency of contact, and diverged lifestyle eventually reduce conversation topics.[21] However, even with the feeling of disconnectedness, the younger generation of Taiwanese usually maintain respectful attitude toward the older generation due to the cultural endorsement of filial piety and respect for experience of the old age, but dislike experienced oriented nagging and advice giving, and desires more equality during intergenerational communication. [22] Furthermore, the younger generation sees the older generation, in preferential order, as "historians", "role models", and "guardians", and both generations would like opportunities to improve their intergenerational interactions. [23]

1.3 Supporting Reminiscence and Storytelling

The prevalent cross generational importance of storytelling has inspired interest in exploring how reminiscence and intergenerational communication can be supported

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[20] Jiaoyubu 教育部 [Ministry of Education], "98 nian zusun hudong zhi xiankuang quanguo minyi diaocha baogaoshu 98," 年祖孫互動之現況全國民意調查報告書 [2010 Nation-wide Grandparents-grandchildren Interaction Survey Report], (2010) Jiaoyubu 教育部 [Ministry of Education of Taiwan]. https://moe.senioredu.moe.gov.tw/ezcatfiles/b001/img/img/28/46999823.pdf

[21] Marjorie Faulstich Orellana et al. "Transnational Childhoods: The Participation of Children in Processes of Family Migration," *Social Problems*.Vol48, No4. 572-591. 2001.

[22] Lin, Zhang, & Harwood. "Taiwanese Young Adults' Intergenerational Communication Schemas.".

[23] Jiaoyubu [Ministry of Education]. "[2010 Nation-wide Grandparents-grandchildren Interaction Survey Report]", (2010).

by digital media. In the past two decades, our societies have experienced transformation in lifestyles brought forth by the advancement of information technologies, digital contents, and the Internet. During the same period there is also growing awareness on the issue of aging population, the economical and social challenges that follow,[24] as well as new opportunities to improve quality of life for the old aged.[25] These trends have prompted growing interest in supporting seniors' social relationship, which is one of the key elements to healthy and happy lives[26]. The social natures of reminiscence and storytelling therefore have become an important inspiration for designing digital media that facilitate remembering and sharing past experiences.

The designs of digital media that support reminiscence and intergenerational storytelling have been explored by various researches and commercial works, which generally focus on the following three approaches: stimulation of reminiscence and storytelling, preservation and dissemination of personal stories, and lifelogging. Stimulation of reminiscence and storytelling aims to trigger people to recall their past experience and share their life stories. Most works in this category rely on the use of past media contents such as photographs, drawings, videos, and audios, or physical memorabilia as memory stimuli to elicit stories. One representative work of this approach is Pensieve,[27] which is designed to induce spontaneous reminiscence by using a combination of multimedia stimuli, including personal photographs and text questions asking about personal experience, as random triggers. The preservation and

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[24] Victor R. Fuchs, "Health Care for the Elderly: How Much? Who Will Pay for It?", Health Affairs 18, no.1 (1999):11-21. doi: 10.1377/hlthaff.18.1.11.

[25] J.E.M.H. van Bronswijk, H. Bouma, & J.L.Fozard, "Technology for Quality of Life: an enriched taxonomy", *Gerontechnology*, 2(2):169–172, 2002.

[26] Siân E. Lindley, Richard Harper, & Abigail Sellen, "Designing for Elders: Exploring the Complexity of Relationships in Later Life", In *Proceedings of the 22nd annual conference of the British HCI Group* (HCI 2008), Volume 1, 77-86.

[27] Sivaroop Tejaswi Peesapati, Victoria Schwanda, Johnathon Schultz, Matt Lepage, So-yae Jeong, & Dan Cosley. "Pensieve", In *Proceeding of CHI '10*, (2010) ACM Press, 20-27.

dissemination category focuses on the documentation and sharing of personal stories. Many works of this type are designed to enable the recording and archival of personal memories around specific context or theme. An example of this approach is Memoro,[28] which is a web based system for users to record personal stories in video or audio that can be categorized into different locations or events, and distributed over the Internet. The lifelogging category involves capturing user's present activities to provide an augmentation of memory for future storytelling and sharing with family. Some works of this approach involves the use of wearable recording devices, such as SenseCam[29] to capture daily activity data in photographs, or utilizes shared personal contents in social media timelines, such as Facebook, to support reminiscence in later times. Regardless of the design approach, storytellers' narratives are fundamentally based on their memories, and the recall of memories usually requires the use of certain stimuli.

Most research and design works in reminiscence and storytelling are built upon the assumption that memory-triggering materials can be readily available. Often such materials take the form of past photographs, videos, audios, publications, or personal memorabilia. The advancement in computing and communication technologies, and digitization of historical materials, enable people to access more past materials conveniently than ever. Furthermore, the recent development of social media and large area geographic visual data like Google Street View allow people to review past in detail up to the time of the inception of these services. However, these existing materials may not necessarily have the familiar or sentimental qualities to evoke reminiscence for every person.

Historic materials that are relevant to the time and place of personal experience may not necessarily be accessible or existent for everyone. The previous generations

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[28] http://www.memoro.org/

[29] Steve Hodges, Emma Berry & Ken Wood, "SenseCam: A Wearable Camera Which Stimulates and Rehabilitates Autobiographical Memory", *Memory*, 2011. http://research.microsoft.com/en-us/um/cambridge/projects/sensecam/pdf_files/Memory.pdf

maintain memorable past by keeping personal collection of tangible memorabilia such as photographs, letters, souvenirs or scrapbooks. These physical items can be lost or destroyed in events such as migration or disasters. Furthermore, collecting and maintaining mementos might not be a habit that most older adults did during their youth. Although photograph is one of the commonly used stimuli for reminiscence, in the case of Taiwan, personal cameras and photography supplies were expensive luxuries for the socioeconomic condition of many people prior 1980's. Furthermore, photography was considered to be a regulated activity due to political censorship and espionage prevention during both the Japan Rule and KMT Martial Law periods until 1970's [30]. As a result, personal photographic collection showing family members and suburban or rural residential environment from those periods are rare. Publicly available photographic records from those eras tend to focus more on landscape, urban sceneries, popular landmarks and events, but little on the life of common men and women in the middle and lower income neighbourhoods. Given this historic background on photography, many older Taiwanese adults may have little or no access to visual contents relevant to their earlier lives. This lack of reminiscence-triggering material for older Taiwanese adult who lived in suburban, middle income neighbourhoods is an underlying motivation for this research to create visual contents that support intergenerational storytelling.

1.4 Place and Memory

The memory of our past experience is said to be linked to the place where it happened. American philosopher Edward Casey in his book *Remembering: A Phenomenological Study*, describes place as "a container of experiences", and memory as "place-oriented

[30] Jiabao Wu 吳嘉寶, Jiabao Wu "Taiwan Sheying Jianshi" 台灣攝影簡史 [Brief History of Photography in Taiwan], Fotosoft Institute of Photography. Taiwan. http://www.fotosoft.com.tw/book/papers/library-1-1005.htm

or at least place-supported".[31] French philosopher Gaston Bachelard, in his book *The Poetics of Space*, also suggests that intimate places are made out of memories and experiences, and describes the recalling of our past homes as the following: "when memories of other places we have lived in come back to us, we travel to the land of Motionless Childhood, motionless the way all immemorial things are. We live fixations, fixations of happiness. We comfort ourselves by reliving memories of protection." [32] For Bachelard, it is the space, not time, which invokes memory. American historian Dolores Hayden, in her book The *Power of Place: Urban Landscapes as Public History*, suggests that the very complicated nature of the experience of place makes it an effective tool in the reproduction and stimulation of visual memories: "places trigger memories for insiders, who have shared a common past, and at the same time places often can represent shared pasts to outsiders who might be interested in knowing about them in the present."[33]

Memory of personally experienced events, or episodic memory, is also said to be physiologically linked to the acquired sensory experience of the place where the event occurred. Episodic memory may include information about the event that comprised the episode, such as the people and objects that were present, the place and context in which the episode occurred, and temporal information that provide a sense of chronology.[34] Episodic memory and learning has long been associated as the functional contribution of hippocampus region in the brain. The discovery of place cell in hippocampus by Jonathan Dostrovsky and John O'Keefe, who was awarded the 2014 Nobel Prize in Physiology or Medicine for the discovery, suggests that hippocampus is responsible for recognizing spatial geometric patterns in the

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[31] Edward S. Casey. *Remembering: A Phenomenological Study*. Indiana University Press. (1987): P186-187.

[32] Gaston Bachelard. *The Poetics of Space*. Beacon Press. 1994.

[33] Dolores Hayden. *Power of Place: Urban Landscapes as Public History*. MIT Press. 1995. P46.

[34] David M. Smith and Sheri J. Y. Mizumori. "Hippocampal Place Cells, Context, and Episodic Memory". *Hippocampus* 16: 716-729 (2006).

environment,[35] one of the contextual aspects of episodic memory. Further studies also show that place field, a specific place within an environment that activates the place cell within hippocampus, contributes importantly to episodic memory as part of the needed contextual representation that defines the situations in which learning and experience occurs. [36] [37]

The link between place and memory provides opportunities to create reminiscence-triggering materials that support storytelling for those who have no reference content of the past. Many of us may have the experience of visiting a place that brings back a sense of nostalgia and past memories. However, some places change dramatically over time and become visually unrecognizable. The suburban areas surrounding the Taiwanese city of Taipei is one such place, where farm lands with few scattered traditional housing settlements in the 1950's were transformed into one of the cities with highest population density within the course of a few decades. Using today's 3D computer graphic technologies and given sufficient reference materials, it is now possible to virtual reconstruct places of past. In this research we explore the use of imageries from virtually reconstructed past neighbourhoods in suburban Taipei as memory triggers to support family reminiscence for past residents.

1.5 The Wonder Between Similitude and Dissimilitude

Virtually reconstructing historic places and artefacts generally require high quality and accurate reference materials. Researches in this field typically emphasize the fidelity of the digital reconstruction and accurate representation of their real-world counterparts for education and research purposes. Virtual reconstruction usually begins by using topographical data such as aerial or satellite surveys or maps to layout

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[35] John O'Keefe and Jonathan Dostrovsky. 1971. "The Hippocampus as a Spatial Map: Preliminary Evidence from Unit Activity in the Freely-Moving Rat." *Brain Research* 34:171–175.

[36] Neil Burgess, Eleanor A. Maguire, and John O'Keefe. "The Human Hippocampus and Spatial and Episodic Memory". *Neuron,* Vol. 35, 625–641, August 15, 2002.

[37] Smith & Mizumori. "Hippocampal Place Cells, Context, and Episodic Memory" 2006.

the foundation for the general scale and position of the site,[38] and may adopt a variety of advanced techniques in modelling, surface scanning, physical based lighting simulations, or virtual reality to represent the historic place. This type of realistic virtual representation of places created using photographic image based rendering has been demonstrated capable of inducing reminiscence with positive result in triggering memory recall. [39] However, the requirement of high quality and accurate reference materials, as described earlier, is a challenge for the reconstruction of some suburban areas in Taiwan.

In order to create imageries of past neighbourhoods with few or no street level visual reference for the virtual reconstruction, the visualization technique needs to be reconsidered to achieve the goal of stimulating reminiscence. This research utilizes historic topographical data of aerial survey photographs and maps as the main source of reference, because these data have a large area of coverage thus are more likes to provide clues about the overall environment of the target neighbourhood. Also this type of survey data and map are more likely to be archived by public entity or institution, therefore may be more accessible. However, reconstructing past places with such limited reference is still a challenge due to the lack of street level record that provide information on elements like height of architectures, elevations, components of vertical surfaces, etc. Therefore, the visualization should be a balance between inducing a sense of familiarity and turning uncertainty into ambiguity. This technique is called “Between Similitude and Dissimilitude”.

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[38] Arnoud de Boer, Leen Breure & Hans Voorbij, “Towards a 3D Visualization Interface for Cultural Landscapes and Heritage Information”, In Proceeding *Computer Applications to Archaeology* 2009. http://archive.caaconference.org/2009/articles/de_Boer_Contribution332_c%20(1).pdf.

[39] Michel Benoit, et al., “Is It possible to Use Highly Realistic Virtual Reality in the Elderly? A Feasibility Study with Image-based Rendering.”, *Neuropsychiatric Disease and Treatment* 2015:11 557–563.

The technique "Between Similitude and Dissimilitude" [40] is an artistic expression that stimulates viewers' mind to project and complete a ambiguous visual element from personal knowledge and memory. It is a defining characteristic of the Chinese ink wash painting, or literati painting. The philosophy of this artistic tradition is to convey the essence of the subject through the artist's subjective interpretation of its forms and feels rather than the objective reproduction of its appearance. [41] Influential Chinese painter Qi Baishi has been quoted describing that the beauty of literati painting is "the wonder between similitude and dissimilitude", [42] because "similitude is unengaging"[43], and "dissimilitude is deceiving". [44] [45] Guinzbourg de Braude, in the paper, *From Ambiguity in Chinese Painting to Rorschach's Inkblots*, describes the technique as utilizations of image overlapping, vacuum dynamics, shading, light and darkness, and ambiguity to express "presence" and "absence" as perceptual stimuli to beckon the viewer to complete and project the image from archives of audiences' memories. [46] This memory inducing effect of visual familiarity and ambiguity as a psychological phenomenon has been described as Gestalt psychology.

Gestalt psychology is a theory that explain human's ability to make sense of the chaotic world and acquire meaningful perception. The central concept is that the

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[40] 似與不似之間

[41] Wen C. Fong, "Why Chinse Painting is History," The Art Bulletin 85:2 (2003): 261, http://www.jstor.org/stable/3177344.

[42] 作畫妙在似與不似之間

[43] 太似為媚俗

[44] 不似為欺世

[45] Lin Zhanghu 林章湖, "Tan Qi Baishi De Gongxie yu Xingshen", 談齊白石的工寫與形神 [Discussion on Techniques and Forms of Qi Baishi], *2011 Zhongguo Kunshan Haixia Liangan Shuhua Yishu Yantaohui Lunwenji 2011 中國昆山海峽兩岸書畫藝術研討會論文集 [Proceeding of China Kunshan Cross-Strait Painting Seminar 2011]*, (2011): 154-158.

[46] Mónica Guinzbourg de Braude, "From Ambiguity in Chinese Painting to Rorschach's Inkblots," Rorschachiana 29 (2008): 25-37, DOI: 10.1027/1192-5604.29.1.25.

mind process perception and forms a global whole from self-organization. Founding gestalt psychologist Kurt Koffka famously describes that "the whole is other than the sum of the parts", indicating that our brain can add additional layer of meaning to the sum of the perceived elements. [47] This explains why we see Chinese paintings as visual representations of the subjects rather than brush strokes and inkblots on paper. Gestalt psychology offers designers and artist practical guidelines for creating meaningful visuals with abstract design elements. [48]

Non-photorealistic rendering (NPR) is a branch of visualization techniques that take gestalt principles into consideration to generate purposeful imageries. The technique can take inspiration from a long tradition of artistic and illustrative depiction to generate images in hand-drawn or painting-like quality,[49] as well as use algorithm-defined abstract expressions designed for more effective, more expressive or more beautiful ways of conveying information.[50] NPR has been demonstrated to encourage more discussion than realistic rendering in architectural designs,[51] imply theoretical interpretation rather than historical facts in archeological reconstructions,[52] and trigger the use of a number of brain process such as feature binding, attention, and

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[47] Bang Wong, "Gestalt principles (Part 1)", *Nature Methods* Vol.7 No.11(November 2010) 863.

[48] Lisa Graham, "Gestalt Theory in Interactive Media Design", Humanities and Social Sciences, Volume 2, Issue 1, 2008. http://www.scientificjournals.org/journals2008/articles/1288.pdf.

[49] Isenberg, "Non-Photorealistic Rendering in Context: An Observational Study".

[50] Frédo Durand, "An Invitation to Discuss Computer Depiction", Proc. *2nd International Symposium on Non-Photorealistic Animation and Rendering*, 2002, 111-124. Doi:10.1145/508530.508550.

[51] Jutta Schumann, Thomas Strothotte, & Stefan Laser, "Assessing the Effect of Non-Photorealistic Rendered Images in CAD", *Proc. SIGCHI Conference on Human Factors in Computing Systems*, 1996, 35-41

[52] Maria Roussou & George Drettakis, "Photorealism and Non-Photorealism in Virtual Heritage Representation", *Proceedings of the 4th International conference on Virtual Reality, Archaeology and Intelligent Cultural Heritage* (2003) 51-60, doi:10.2312/VAST/VAST03/051-060

memory recall. [53] NPR allows designers or artists to exercise gestalt principles when designing contents and interfaces using and for digital media.

This dissertation explores the use of non-photorealistic visual imageries created from virtual reconstruction of past places to elicit past experience and personal stories. Due to the unavailability of historic visual reference materials, the virtual reconstruction utilizes historic topographical data such as aerial survey photographs and maps to provide clues of the overall environment of the past. However, this type of data only offers topographic view of the place and lacks in any information about the vertical appearance of the place. Therefore, NPR in the style of Chinese ink wash painting is utilized to visualize the virtual reconstruction to convey a sense of artistic quality and invite viewers' feedback. The key is to induce a sense of familiarity and abbreviate the lack of accurate representation by using the technique of "between similitude and dissimilitude". According to Gestalt psychology, this visual expression stimulates memory recall and mental projection to self-organize and complete the perceived ambiguous visual stimuli in viewers' minds. In order to prove this concept, we created STREMIS (Space-Time REMiniscence Impetus for Storytelling), a prototype visual content of past places generated using the proposed virtual reconstruction method to examine audiences' reminiscence and storytelling in response to the visual stimuli.

1.6 A Walk Down Memory Lane

STREMIS is a series of non-photorealistic, virtually reconstructed past sceneries of a suburban community near Taipei, Taiwan, designed to elicit memories and personal stories from past residents to facilitate an engaging family social experience. The virtual reconstruction converts topographical maps and historic aerial survey

[53] Nick Halper, et al. "Psychology and Non-Photorealistic Rendering: The Beginning of a Beautiful Relationship", *Mensch & Computer*, 2003, 277-286. http://link.springer.com/chapter/10.1007%2F978-3-322-80058-9_28.

photographs into street level sceneries in first person perspective to simulate the experience seeing the streets of the past. The sceneries are rendered in Chinese ink wash painting style to stimulate memory recall through Gestalt effect and abbreviate the lack of accuracy and details. In order to examine the visualization's effect in stimulating reminiscence and storytelling, this research selects a suburban community that is visually and spatially different in landscape today compared to its past.

This research reconstructed two neighbourhoods in the Shuanghe[54] area, a satellite suburban community adjacent to the south side of the island's capital city Taipei, to create the visualizations. Due to immigration, economic development and changes in zoning, this area has experienced dramatic changes in landscape throughout the second half of the twentieth century. Literally means the "Two He's", this generalized name is named after the two districts of "Zhonghe" and "Yonghe". This area has remained an agricultural community with few populations throughout China's Qing Dynasity and Japan rule, and until 1949 the population was no more than 30,000. When KMT retreated to Taiwan along with the mass refugee immigration from China, population of Shuanghe area began to grow rapidly due to its close proximity to the capital and relatively cheap land price. Within only 60 years the populations in the two districts have grown 21 times to over 630,000 by year 2010 as one of the highest population density municipalities in the world with over 24,000 people per square kilometer.[55] This insurgence in population has transformed the landscape and composition of the place dramatically from scattered farming villages and open spaces into high density residential and commercial districts. Today it is very difficult to find traces of the past scenery in the area.

In order to examine the effectiveness of STREMIS in supporting family reminiscence, prototype visualizations were developed. Since it is unfeasible to reconstruct the entire 26 square kilometers of Shuanghe area, this research first identified several past residents and the locations of their past homes. Based on these

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[54] 雙和地區.

[55] Yonghe today has a population density of over 40,000 per square kilometer.

locations, historic topographical data are gathered, georeferenced, cross referenced, and geometrically corrected to produce a more accurate depiction of the environment. These data also need to be analyzed to identify different types of man made and natural artefacts such as buildings, vegetation, roads, irrigation cannels, etc. Photographic records from similar period or surviving architectures still present today may be cross referenced to improve the interpretation of artefacts. A map of identified artefacts is modelled using 3D CG software to create a mock-up environment that represent an approximation of the space in the past. Virtual cameras that simulate the height and field of view of human eyes are strategically positioned in the virtual environment to capture views that are more likely to be seen in the past and visually more pleasing. These captures are then rendered in digital painting software with Chinese ink wash painting inspired visualization style, in which visual elements are deliberated expressed through ambiguous stokes, ink stains, or omissions. The rendered images are organized into a map interface on the touch panel device for easy access.

The visualizations of STREMIS provide past residents images of their neighbourhoods in the past. The images are rendered from different locations in the same area to allow the audience to see different corners of the place and rediscover forgotten memories. The images are rendered in a manner that suggests the presence of roads, buildings, and vegetation but omit detailed depiction. The visualization conveys the feel of the space in the past, creates a sense of familiarity, and invites the user to fill in the details with his or her own stories. STREMIS can be used while strolling through the old neighbourhoods as well as used in family gathering where storytelling may happen simultaneously to facilitate the recall of personal stories and pleasurable intergenerational communication experience.

This dissertation considers the methods of creating reminiscence-stimulating visual imageries that support family reminiscence. Today we live in a time when events can be captured and shared in rich media format conveniently and economically by anyone with mobile computing devices; and places are captured in high quantity and quality, and in some cases periodically, in digital map services such

as Google Street View. For younger generations there are vast amount of digital contents available as reference for reviewing past experiences. On the other hand, people in the previous generations maintained their memorable experience by retaining items such as photographs, letters, or other memorabilia. However, photography could be an expensive and exclusive luxury for some people in the past; places that were not considered to be aesthetic or important might received little or no visual record; and personal collection of physical mementos might be destroyed or lost. Thus for the older generation, personally relevant materials that support reminiscence may be difficult to obtain. Therefore, we designed a visual content that supports reminiscence for older generations, by exploring the use of archived historic aerial survey photographs and maps as the main reference, to virtually reconstruct past places and generate artistic and non-photorealistic imageries of their past neighbourhoods.

This research demonstrates the potentials in supporting family reminiscence for older adults who have no access to memory-triggering memorabilia by using virtual reconstruction and non-photorealistic rendering to create visual stimuli. Despite the lack of reference materials, by using historic topographical data and "Between Similitude and Dissimilitude" rendering technique, it is possible to create imageries that provide visual hints to audience's past neighbourhood, engage Gestalt effect, and invite communications about the place and past experiences. This visual content may contribute in supporting the maintenance of social relationship and inclusion of older adults during the time of family reunion, maintenance of emotional wellbeing, and understanding of personal and local legacies for the younger adults.

Chapter 2

Literature Review

STREMIS is a visualization of virtually reconstructed past neighbourhoods designed to stimulate reminiscence and intergenerational storytelling that facilitate an engaging family reunion experience in Taiwan. In an aging society like Taiwan where intergenerational interaction is becoming less frequent due to growing distances between family members, it is important to support older adults' social relationship in order to maintain emotional wellbeing in the old age. Reminiscence and sharing personal stories can be beneficial for older adults in strengthening social relationships because these activities can support the development of empathy and feeling of connectedness. Reminiscence is initiated by some memory triggering stimuli, which can be many things including visual or audio contents, letters or documents, or other memorabilia from the past; as well as place, smells, questions or situations that we encounter in the present. Contents and memorabilia from the past are generally used in services designed to facilitate reminiscence, however for some older adults, relevant materials that can be used to trigger memory recall may not necessarily be available. Therefore, in this research we developed the method of utilizing publicly available topographical data to create memory-triggering visual imageries of past neighbourhood and support old adults to engage reminiscence and intergenerational storytelling.

This chapter provides an overview of the underlying motivation in supporting reminiscence and intergenerational storytelling in Taiwan, along with reviews of works in a number of fields related to the use of non-photorealistic virtual reconstruction of past places to stimulate the recall of past experience. This literature review begins by looking into the generational distances in Taiwan resulted from its

historical backgrounds. The effects and benefits of reminiscence and sharing personal stories as a way to strengthen intergenerational bond will be reviewed. Subsequently the current applications of digital media in supporting reminiscence, their effects and limitations will be discussed. Finally, a number of works related to the relationship between place and memory, virtual reconstruction of place, and visualization techniques that inspired this research are reviewed. The reviews of these works will lay the conceptual foundation to the contribution of the design proposed in this dissertation.

2.1 Intergenerational Relationship in Taiwan

2.1.1 Distance and Family Relationship

In today's Taiwan it is not uncommon to observe a sense of distance between younger and older generations. In an East Asian culture that traditionally embraces the structure and value of extended family living arrangement, this generational distance reflects the transformation this society has experience in its recent history. A 2006 report released by the Directorate-General of Budget, Accounting and Statistics of Taiwan[56] revealed a gradual decrease in the ratio of extended families (grandparents, parents, and children) from 16.7% in 1988 to 15.2% in 2004, as well as a significant decrease in nuclear family (-12.4%), and a moderate increase in couple (+6.5%) and single person (+3.9%). The report suggests that these statistics represents the societal trend of more seniors are living alone, fewer people are living with their parents, fewer grandchildren are living with their grandparents, and a low birthrate that is leading toward an aging society. This low ratio of extended family points to a trend of lowered grandparents-grandchildren interaction frequency. A 2010 research on grandparents-

[56] Xingzhengyuan zhujichu 行政院主計處 [Directorate-General of Budget, Accounting and Statistics], Jiating zucheng xingtai bianqian 家庭組成型態變遷 [Shift in Family Structure], 2006, https://www.dgbas.gov.tw/public/Data/662814133871.pdf

grandchildren interaction conducted by the Taiwanese Ministry of Education found that in families where grandparents and grandchildren are living apart, 37.1% of the grandparents meet their grandchildren once a week, 26.1% meet once a month, 22% meet less than once a month, and 14.6% had no interaction with their grandchildren in over a year.[57] The study also found that even in families where grandparents and grandchildren are living together, 4.4% responded that they have any interaction with each other. Both the older and younger generations believe that a sense of distance between the generations is the main reason for the lack of interaction.

Distance is a major factor in influencing the frequency of intergenerational contact. Andrew Cherlin and Frank Furstenberg suggest that distance creates "a geographical barrier to contact and stronger ties", and point out that families separated by great distance such as immigrants can experience emotional distance "compounded by culture and language".[58] Olena Nesteruk and Loren Marks further elaborated that *geographical* distance, *linguistic* distance, and *cultural* distance are major challenges to the maintenance of intergenerational relationship, and noted that even with modern communication devices at hand and desires to stay in contact, intimacy in long distance family relationship can be difficult to manage over time.[59] The study conducted by Hurme, Westerback and Quadrelle also found that as geographical proximity between grandparents and grandchildren increases, face-to-face contacts, phone calls and text message communications may lessen.[60] Jennifer Kam and Michael Hecht suggest that with infrequent contact between generations, the potential for identity gaps via identifying with one's own cohort increases the likelihood for

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[57] Jiaoyubu (2010).

[58] Andrew J. Cherlin, and Frank F. Furstenberg, *The new American grandparent: A Place in the Family, A Life Apart*. New York: Basic Books. (1986) P117.

[59] Olena Nesteruk & Loren Marks, (2009).

[60] Helena Hurme, Susanne Westerback & Tatiana Quadrello. (2010). "Traditional and New Communication Between Grandchildren and Grandparents." *Journal of Intergenerational Relationships*, 8, 3. 264-280.

poorer communication and lessened relationship quality. [61] Orellana et al. found that as daily lives in different places become increasingly diverged, communication can become difficult with lessened conversation topics. [62] These growing distances between family members may be a reflection of the changing social structure.

The shift of social functions, from what used to be traditionally responsibilities and obligations of family structure, to become part of public or state operated services, has been suggested as one contributing factor of the growing distance between family members. Functionalist Talcott Parsons suggests that modern industrialized society has brought publicly operated institutions such as schools, hospitals, and law enforcement, thus liberated families from traditional obligations and reliance on kinship for functions such as education, health care, protection, etc. This shift of responsibilities, which traditionally require the support of extended family members living within close proximity, from family to state operated services has encouraged younger family members to pursue better socioeconomic opportunities in different geographic locations and form less connected families. [63] Later studies point out that the shift toward living apart and nuclear family structure is one of the variables in the changing intergenerational relationship, and there are wider social aspects that affect kinship interaction. [64] [65]

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[61] Jennifer A. Kam and Michael L. Hecht, "Investigating the Role of Identity Gaps among Communicative and Relational Outcomes within the Grandparent–Grandchild Relationship: The Young-Adult Grandchildren's Perspective", *Western Journal of Communication* Volume 73, Issue 4, 2009. Pp.456-480. DOI: 10.1080/10570310903279067.

[62] Orellana et al. 2001.

[63] C H Thompson, "The isolated nuclear family – Talcott Parsons", sociologytwynham.com. June 25, 2013. https://sociologytwynham.com/2013/06/25/the-isolated-nuclear-family/.

[64] Gary R. Lee, "Kinship in the Seventies: A Decade Review of Research and Theory", *Journal of Marriage and Family*, Vol. 42, No. 4, Decade Review (Nov., 1980), pp. 923-934. DOI: 10.2307/351833

[65] Michael Murphy, "Variations in Kinship Networks Across Geographic and Social Space", *Population and Development Review* 34 (1): 19-49 (March 2008).

Social variables that affect intergenerational distance and relationship can come from different sociopolitical and demographical trends. Gerontologist and sociologist Vern Bengston suggests that macro trends such as changes in the age structures of nations; changes in family structures and relationships; and changes in governmental responsibilities can create conflict between age groups on issues such as care for the elderly, differences in gender and ethnic roles, or migration and living arrangements. [66] These conflicts in different values and norms can affect intergenerational exchange of affection and instrumental support, and is a reflection of different expectations from different age groups. Bengston also suggests that differences in expectation can come from individual, family and historical levels, which can be examined by three concepts: cohort effects, lineage effects, and period effects. *Cohort effect* refers to a common set of expectations developed in a group born during a certain time and grew up with similar sociopolitical concerns as well as life experiences. *Lineage effect* refers to the expectations of statuses manifested from the differences in family members' ranked positions within the family structure based on chronological age. *Period effect* refers to the impact of sociopolitical events, such as wars, economic shifts, and political causes, which affects the expectations of all groups within a society of a period.[67] Cohort effect, lineage effect and period effect can be influenced by events, sociopolitical and socioeconomic changes, thus creating identity gaps and generational distances between age groups, and increase the likelihood for poorer communication and lessened relationship quality. In the case of Taiwan, the generational distances resulted from period effect is particularly prominent because of the society transforming historic events that led to significant

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[66] Bengtson, V. L., Lowenstein, A., Putney, N. M., & Gans, D. (2003). "Global ageing and the challenge to families". In V. L. Bengtson & A. Lowenstein (Eds.). *Global ageing and challenges to families*. Aldine de Gruyter, Hawthorne, NY: 1-24.

[67] Vern L. Bengtson and Petrice S. Oyama, "Intergenerational Solidarity and Conflict", *Paper for UN Social Policy Division Expert Group Meeting "Intergenerational Solidarity: Strengthening Economic and Social Ties"*, Department of Economic and Social Affairs Division for Social Policy and Development. 23 – 25 October 2007, United Nations Headquarters, New York.

changes in living location and language use different generations during the twentieth century.

2.1.2 Intergenerational Distances in Taiwan

The development of geographical and linguistic distances between generations in Taiwan can be attributed to the social changes resulted from events occurred in the island's modern history. People growing up during different periods of the twentieth century in Taiwan experienced very different sociopolitical and socioeconomic conditions, which lead to migrations, emigrations, language use, and expectations. The distances and the differences in generational backgrounds, as explained by Bengston's period effect, become some of the contributing factors to the reduced intergenerational interactions.

Geographical Distance

The development of geographic distances between family members in Taiwan could be attributed to a number of socioeconomic and sociopolitical reasons that led to migrations of family members to be relocated long distance apart. In the paper *Over a Century of Population Rise and Fall in Districts of Taiwan:1897-2010,* Xu, Chen and Huang noted that the migration of population is a reflection of the political, social, economic and cultural trends and history of a state.[68] Their study found that at the beginning of the twentieth century, majority of Taiwanese population were concentrated in the south western prairie areas that were agriculture based communities, however as industrialization and urbanization began to emerge during the middle and late Japanese rule period, population began to concentrate in several

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[68] Mao-Xuan Xu, Jian-Heng Chen & Yan-Hao Huang 徐茂炫, 陳建亨 & 黃彥豪, "Yu Bainian Taiwan Xianshi Renkou Xingshuai zhi Zhuanzhe: 1897-2010 逾百年臺灣縣市人口興衰之轉折：1897-2010 [Over a Century of Population Rise and Fall in Districts of Taiwan:1897-2010]", *Renkou Xuekan 人口學刊 [Journal of Population Studies]* No.43, December 2011, pp. 109-135.

cities located along the north, mid-west, and south west sea side of the island. When the sovereignty of Taiwan was transferred to the Kuomintang (KMT) governed Republic of China (ROC) after the end of World War II, influx of Chinese immigrant began to increase and reached its peak in 1949 when over two million government and military personnel, families, businesses and refugees retreat to Taiwan as a result of KMT's defeat in the Chinese Civil War. The newly established state government and settlement of non-agricultural immigrants in Taipei in the 1950's triggered rapid urbanization and economic growth in the north, which incented the still ongoing trend of population migration and labour flow to the metropolitan areas in the north for better opportunities. Lu and Cheng, in their paper *The Inheritance and Implementation of Filial Piety: Analysis on "Adult Children's Decisions on Living with Parents"*, points out that in the modernized and urbanized societies, the practice of living together with parents has become more difficult for adult children due to different working locations, increased cost of living in cities, changing values and expectations, and intentions, despite the inheritance of the concept of filial piety as a cultural norm in Taiwan.[69] As modern societal and economic conditions make extended-family structure difficult to realize, the view of equating "not living together" and "unfilial" is becoming less common. The study suggests the shift toward nuclear family structure, increase in older couple or single parent living alone, and changing attitude toward the concept and practice of filial piety are reflections of the economic development and changing social structure.

Geographical distance between family members also extends beyond domestic boarders for some Taiwanese families. Research Fellow Tzong-Shian Yu of Academia Sinica and Professor Jin-Li Wang of China University of Technology in

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[69] Huei-chung Lu, & Roger P.C. Cheng, "Xiaodao Guannian de Chengchuan yu Luoshi – Yi 'Chengnian Erzi yu Fumu Tongzhu Juece' Wei Fenxi Duixiang 孝道觀念的傳承與落實 － 以「成年子女與父母同住決策」為分析對象 [The Inheritance and Implementation of Filial Piety: Analysis on 'Adult Children's Decisions on Living with Parents']" *Renkou Xuekan 人口學刊 [Journal of Population Studies]* No.45, 2012, pp. 111-154.

their book *Taiwan Population Shift and Economic Development* suggest that business incentive is a major reason for Taiwanese to stay abroad on long term basis.[70] The study points out that in the late 1980's when Taiwanese small and medium business owners in the manufacturing sectors encountered management difficulties due to the rising costs, they began to shift manufacturing process overseas mainly in China and south east Asian countries. As a result, many management level Taiwanese workers began to work and stay abroad long term, and visit Taiwan only occasionally during holidays. The study estimates that between 1992 and 2007, the accumulated number of Taiwanese expatriate in China alone could be over 600,000 people.[71] The pursue of better education opportunity and social stability are also reasons for some Taiwanese families to move abroad. Hsu et al. in a research, *Qualitative Research of Adaptation and Development of Taiwanese Immigrants in Los Angeles*,[72] points out that the positive perception of freedom, economic opportunities and quality of life in western nations such as the U.S. attracted Taiwanese to emigrate. The strict migration control imposed by Taiwanese government between 1960's and 1980's mainly allowed leaving boarder for educational purpose, thus international students of this period became the first wave of emigration. Many of these early emigrants chose to stay in their hosting nations after the completion of their training for reasons including career opportunities in their specialized fields, international marriage, as well as avoidance of political persecution for anti-KMT or pro-Taiwan independence

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[70] Tzong-Shian Yu & Jin-Li Wang 于宗先 & 王金利, *Taiwan Renkou Biandong yu Jingji Fazhan 臺灣人口變動與經濟發展 [Taiwan Population Shift and Economic Development]*, Taipei, Lianjing Chuban 聯經出版 [Linking Publishing], 2009.

[71] Yu & Wang, *[Taiwan Population Shift and Economic Development]*, 2009. pp50.

[72] Jung-Chung Hsu, Li-Ru Cheng, Jia-Jun Zhong, Wen-Xuan Li & Chun-Ying Chiu 徐榮崇, 陳麗如, 鐘佳君, 李妏萱 & 邱春櫻, *Meiguo Taiwan Qiaomin Shenghuo Shiying ji Fazhang zhi Yanjiu – Yi Luoshanji weili 美國臺灣僑民生活適應及發展之研究 —以洛杉磯為例 [Qualitative Research of Adaptation and Development of Taiwanese Immigrants in Los Angeles]*, Overseas Community Affairs Council, Republic of China (Taiwan) 中華民國僑務委員會, 2006.

sentiments. Between 1960 and 1979, of the 50,000 Taiwanese international students, only 6,000 returned to Taiwan. The study also notes that various sociopolitical and socioeconomic factors throughout the later half of the twentieth century, such as the withdrawal of seat membership in the United Nations and termination of diplomatic relationship with the U.S. in the 1970's; lift of martial law, economic growth and rapid rise in real estate prices in the 1980's; growing crime rate, burden of childhood education, political instability, and perceived escalading possibility of warfare with Mainland China in the 1990's; created various motivations to pursue life abroad and subsequent waves of emigration.

Linguistic Distance

The linguistic distance between Taiwanese generations were developed from the turbulent sociopolitical shifts and controls of the previous century. The native population of Taiwan in the early twentieth century consisted of Taiwanese Hokkien-speaking majority and Taiwanese Hakka minority of Han Chinese ethnic groups, as well as several indigenous language minority groups. During the Japanese Rule period between 1895 and 1945, when the island province was yielded by Qing China to the Empire of Japan under the Treaty of Shimonoseki after the First Sino Japan War, Taiwanese citizens were mandated to learn Japanese as the official language while Classical Chinese curriculum became an optional curriculum.[73] The language policy began with a bilingual approach, however with the rising worldwide trend of ethnic nationalism in 1918, Japanese colonial government began to consider cultural assimilation and Japanization of the island. By 1937 Chinese curriculums and newspaper circulations were cancelled, and the use of Japanese in public space and

[73] Taiwan Kyouikukai 台湾教育会 [Taiwan Education Committee], *Taiwan Kyouiku Enkakushi 台湾教育沿革誌 [Taiwan Education Development Report]*, 1939. http://kindai.ndl.go.jp/info:ndljp/pid/1281533

assemblies were enforced.[74] Although for half a century Taiwanese population was under foreign governance, the language policy for most of the period did not present existential threat to the Taiwanese native languages, and produced a significant number of bilingual population who were proficient in the native languages and Japanese.

The population of Taiwan experienced a violent period of political shift that created linguistic disparity between generations after the sovereignty of Taiwan was transferred to the Republic of China (ROC) ruled by Kuomintang (KMT, Chinese Nationalist Party) post World War II. Soon after the transfer, KMT introduced Chinese Mandarin as the official language and prohibited the use of Japanese and circulation of Japanese materials as a measure to erase remnant of Japanese influence in Taiwan. For the native population that had been isolated from China since the Qing Dynasty with little contact with the Chinese Mandarin language, the forced language policy and under satisfactory governance quality of KMT authorities created frustration and conflict between citizens and the new ruling regime due to communication and trust issues. The conflicts reached its peak on February 28th of 1947, when a protest demonstration in Taipei escaladed into an island-wide, 10-week long armed suppression and massacre by KMT police and military forces, and resulted in an estimated number of 2,000 to 30,000 death and missing, many of which were native Taiwanese social elites and intellectuals.[75] The incident marked the beginning of a period known as the "White Terror" with more inhabitants vanished, died or became imprisoned, and triggered the imposition of martial law in 1949. During the martial law period, the use of native Taiwanese languages became strictly censored and discouraged. The language conflict and social unity in Taiwan became further

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[74] Huang Xuanfan 黃宣範, *Yuyan shehui yu zuqun yishi : Taiwan yuyan shehuixue de yanjiu, 語言、社會與族群意識: 台灣語言社會學的研究 [Language, Society and Identity: Taiwanese Language Sociology Research]*. Taipei: Wenhe Chubanshe 台北：文鶴出版社. [Taipei: Wenhe Press]. 1999.

[75] Craig A. Smith, "Taiwan's 228 Incident and the Politics of Placing Blame", *Past Imperfect* 14 (2008). https://ejournals.library.ualberta.ca/index.php/pi/article/download/4228/3465.

complicated when two million Chinese refugees retreated to Taiwan, which at the time had six million in population, as a result of KMT's defeat in the Chinese Civil War in 1949. Strict Chinese Mandarin monolingual policy was imposed in the 1970's as an attempt to unify the island's population. Taiwanese native languages became severely restricted in mass media, school, and assemblies, and was discriminated as uncivilized dialects until the lift of martial law in 1987. This period of linguicism against Taiwanese native languages discouraged many to teach their mother tongue to their children in fear of discrimination or even criminalization. [76] [77] The Mandarin-only policy pressured the older generations to self-censor and encouraged their children to use Mandarin even at home. As a result, by the 1990's many younger generations grew up to be monolingual Mandarin speakers,[78] while many of the older generations maintained only limited Chinese Mandarin proficiency.

The reduced social interaction resulted from geographical and linguistic distances can further prevent language learning between the generations. In a research, *Linguistic Capital in Taiwan: The KMT's Mandarin Language Policy and its Perceived Impact on Language Practices of Bilingual Mandarin and Tai-gi Speakers*, University of Macau Professor Todd Sandel suggests that children's grandparents play an important role in teaching native languages and children who grew up with grandparents have better native language proficiency than those who did not[79]. Another study by Yeh, Chan and Cheng suggests that in general, the Mandarin fluency in the three age groups (grandparents, parents, and children) exhibits a continuum of decrease from young to the old group; however, in contrast their native language proficiency levels moved in the opposite direction[80]. Although many older Taiwanese

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[76] Scott & Tiun, "Mandarin-only to Mandarin-plus: Taiwan".

[77] His-Nan Yeh et al. "Language Use in Taiwan: Language Proficiency and Domain Analysis".

[78] Todd L. Sandel, "Linguistic Capital in Taiwan: The KMT's Mandarin Language Policy and its Perceived Impact on Language Practices of Bilingual Mandarin and Tai-gi Speakers," Language in Society 32 (2003): 523-551, DOI: 10.10170S0047404503324030

[79] Sandel, "Linguistic Capital,".

[80] Yeh, Chan & Cheng., "Language Use in Taiwan", 2004.

feel that communicating in native languages is more intimate, genuine, and easier to establish closer relationship, [81] the difference in language proficiency means connecting with younger age group become more difficult than with middle age group. [82]

Cultural Distance

Cultural distance may develop from the lack of shared experience and communication that create negative attitude toward interaction between generations. The rapid industrialization, urbanization and economic development of Taiwan after 1950s have changed family structure and life style to emphasize more on individualistic interests from family-based social relationships, shift to nuclear from extended living arrangement, and contraction of kin networks. [83] In addition, globalization has increased transnational study, work, emigration and marriage activities, causing family members to spread across the globe. Those who live far apart under different cultural context can develop different expectations, values and belief system, which may create conflict and negatively affect the willingness to communicate.

In a cross-cultural gerontology study, *Taiwanese Young Adult's Intergenerational Communication Schemas*, Lin, Zhang and Harwood suggest that the power imbalance and differences in lived experiences between old and young people in Taiwan can prevent a more relaxed interaction between the generations. [84] The cultural norm of filial piety in Taiwan grants older people authority and higher power over young people, thus direct confrontation or challenges are considered disrespectful. Although younger adults generally maintain politeness toward older

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[81] Todd L. Sandel et al., "Language Shift and Language Accommodation across Family Generations in Taiwan," *Journal of Multilingual and Multicultural Development* 24:2 (2006): 138.

[82] Yeh, et al., "Language Use," 100.

[83] Mei-Chen Lin and Jake Hardwood, "Accommodation Predictors of Grandparent–Grandchild Relational Solidarity in Taiwan," *Journal of Social and Personal Relationships* 20:4 (2003): 538.

[84] Lin, Zhang, & Harwood. "Taiwanese Young Adults' Intergenerational Communication Schemas."

people, the attitude may not necessarily come from a feeling of respect, but rather a sense of obligation or even intimidation. The study suggests that the source of this conflict may come from cultural acceptance toward the notion that "older people's wisdom and knowledge are to be respected" and "young people should learn from older people's experience". Although older people's criticism and advice might be important in some cases, "older adults' experience also limited or stopped young people from trying to engage in conversations for the experience that may not be applicable to their current situations."[85] The study also found that young people's feeling of intimidation may come from the way older people's advice is offered, which is characterized by the repetitious advice giving and questioning in the tone similar to "nagging" and "over parenting", and is felt by young people as being criticized and imposed upon with unwanted advice. Through the cohort effect described by Bengston,[86] the different experiences between the generations naturally create some distance between them, and the dramatic changes in Taiwanese society in its modern history may further enlarge the gap through period effect.

2.2 Remembering and Sharing Personal Stories

Remembering and sharing past personal stories are activities that can support the building of mutual understanding and strengthen bonding between generations. It is an experience that we are all familiar with; after encountering an image, a conversation, a smell, a sound, a person, a situation, or a place, a piece of our past experience may come to mind spontaneously. This memory may be a personal experience or information we learned from secondary sources; it may be a matter of fact, or an encounter with emotional attachment. When we share this recalled memory with others, we may feel a sense of recognition and improved mutual understanding.

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[85] Lin, Zhang & Harwood. Pp.335.

[86] Bengston "Intergenerational Solidarity and Conflict".

2.2.1 Reminiscence

The cognitive activity of remembering and reliving one's past experiences is referred to as reminiscence. This experience of remembering one's own past and the concept of memory have fascinated scholars since ancient times. As early as 350 B.C.E. Greek philosopher Aristotle described memory as a function of human mind's sense-perception of time, and remembering of past experience as a unique and distinctive process from re-experiencing or re-learning the same experience.[87] French novelist Marcel Proust, in his prominent work *À la recherche du temps perdu*, which is also known as *In Search of Lost Time*, describes the experience of reminiscence as an "an involuntary, sensory-induced, vivid and emotional reliving of events from the past".[88] The novel describes an episode of involuntary memory recall triggered by the taste of a tea-dipped madeleine from which a stream of childhood experiences, and the interaction with aunt in the town of Combray on Sunday mornings, was revealed. Despite being a fictional work of literary art, this episode depicts the dynamics and contextual variables of memory recall.

Reminiscence as a process of recalling personally experienced events from one's past can occur in different forms for different purposes. Gerontologist and psychiatrist Robert Butler, in his seminal work about *Life Review*, pioneered the research and practice of using reminiscence as an "inner experience or mental process of reviewing one's life", and as an analytic, structured and evaluative exploration of past experiences, integrating both positive and negative life events to support seniors coping with unresolved past conflicts and old age anxieties.[89] Marianne Lo Gerfo

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[87] Aristotle. On Memory and Reminiscence. 350 B.C.E. URL: http://classics.mit.edu/Aristotle/memory.html

[88] Marcel Proust. *Swann's way: In search of lost time, volume 1*. Yale University Press, 1922.

[89] Butler, Robert N. 1964. "The life review: An Interpretation of Reminiscence in the Aged." In *New Thoughts on Old Age*, edited by Robert Kastenbaum, 265–280. Springer-Verlag Berlin Heidelberg.

suggested three types of reminiscence: evaluative, informative and obsessive.[90] *Evaluative reminiscence* is based on Butler's life review and involves deeper remembrance and sharing stories over the range of a lifetime. *Informative reminiscence* involves recollection for the pleasure of reliving and retelling, and can be used to revive interest, self-esteem, and personal relationships. *Obsessive reminiscence* is the recollection of past negativities and can result in dwelling on guilt or failures. Other forms of reminiscence found in literatures have be summarized by Paul Wong and Lisa Watt, including: integrative, instrumental, transmissive, escapist, and narrative.[91] *Integrative reminiscence* is based on Butler's life review, but differs in the acceptance of negative life events and resolution of past conflicts. *Instrumental reminiscence* refers to the recall of past plans and attempts to overcome difficulties, for the purpose of solving present problems. *Transmissive reminiscence* refers to the recollection of past memories for passing on cultural heritage and personal legacies. *Escapist reminiscence*, also known as defensive reminiscence, refers to the use of past glories and pleasure memories to deprecate present difficulties. *Narrative reminiscence* is primarily a descriptive rather than an interpretive recollection of the past similar to informative reminiscence. Cristhian Trepowski proposed *social reminiscence*, similar to informative and transmissive reminiscences, as the act of recalling past memories and sharing them with others for the purpose of driving conversation or teaching lessons learned from past experiences.[92] These different types of reminiscence are not necessarily mutually exclusive, but the varieties reflects the wide range of contexts (clinical, personal, community, etc.) in which reminiscence have been practiced.

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[90] Marianne Lo Gerfo, "Three ways of reminiscence in theory and practice". *The International Journal of Aging and Human Development,* 12(1):39–48, 1980.

[91] Paul, T.P. Wong, & Lisa M. Watt, "What Types of Reminiscence Are Associated With Successful Aging?", *Psychology and Aging,* 6(2):272–9, June 1991.

[92] Cristhian D. P. Trepowsky, "…And Suddenly the Memory Revealed Itself" The Role of IT in Supporting Social Seminiscence" (PhD diss., University of Trento, 2014).

A theoretical model of the reminiscence practice proposed by Jeffery Webster, Ernst Bohlmeijer and Gerben Westerhof, called the *reminiscence heuristic model*, may support explaining the varieties of forms and functions of reminiscence (Figure 2-1). The model describes reminiscence as a process with several components: [93]

Trigger: Some factor that initiate the formation of narratives based on personal memory.

Modes: The narratives can be either private for intrapersonal purpose or public for interpersonal reason.

Contexts: The narratives can be surrounded by contexts including institutional, family, or intimate relationships;

Moderators: The identity (gender, age, ethnicity, personality, etc.) of the person to whom the narratives are shared with can influence the experience of the reminiscence.

Functions: Sharing narratives from reminiscence can serve a variety of functions including conversation, boredom reduction, teaching and informing, intimacy maintenance, problem solving, bitterness revival, and death preparation, etc.

Outcomes: The end result of sharing personal stories two types of impacts, the first is (a) *practical outcomes* which include positives such as improved psychosocial health or emotional regulation, as well as negatives such as increased rumination and anxiety; and (b) *research outcomes* such as the narratives adds contribution to research database, oral history, refining hypothesis, etc.

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[93] Jeffrey Dean Webster, Ernst T. Bohlmeijer, & Gerben J. Westerhof, "Mapping the Future of Reminiscence: A Conceptual Guide for Research and Practice", *Research on Aging*, 32(4):527–564, May 2010. ISSN 0164-0275. doi: 10.1177/0164027510364122.

According to this model the retrieving, articulating, and disseminating of memories and self-narratives may not only be a human capacity, but may also be a need to fulfill certain psychosocial goals such as forming social engagement, searching for coherence, sharing life lesson, etc.

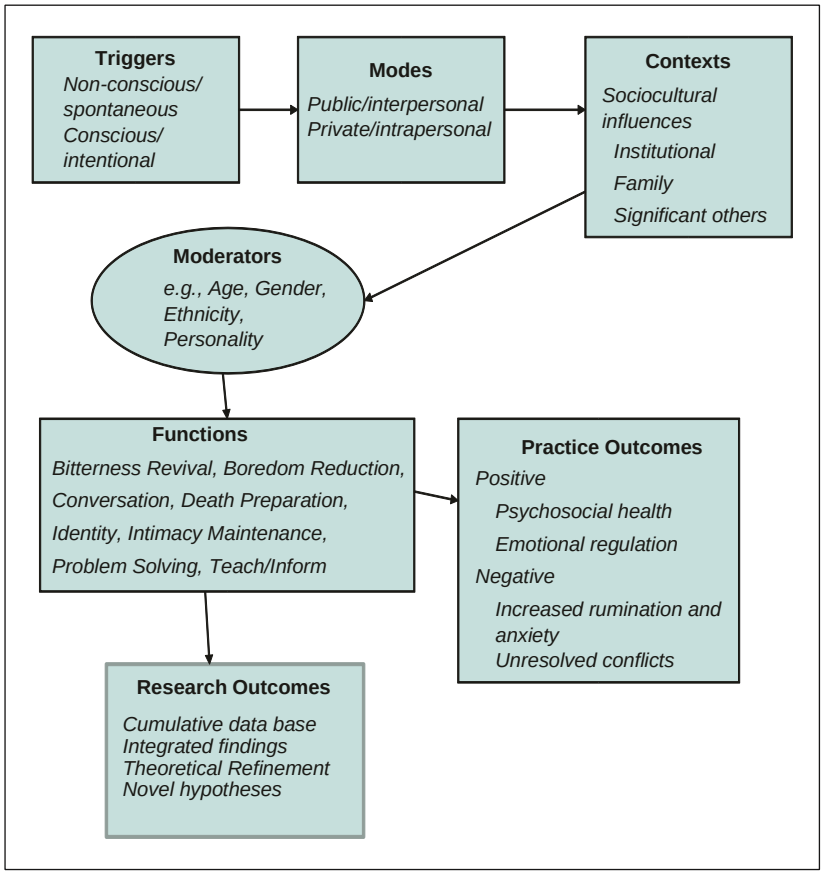

Figure 2-1: Webster's Heuristic Model of Reminiscence Components. [94]

Nurturing social bonding of existing relationship is a central social function of reminiscence and sharing autobiographical memory. In the paper *A Tale of Three Functions: The Self-Reported Uses of Autobiographical Memory*, Susan Bluck et al.

[94] Webster et al. "Mapping the Future of Reminiscence".

summarized three functions that reminiscence can serve: directive, self, and social.[95] The *directive* function refers to the use of personal past to guide present and future thoughts and behaviours. The recalled memory can serve as an aid for solving present problems or predict future outcomes. The *self* function refers to the user of autobiographical memory as a mean to create and preserve a sense in the continuity of self. The *social* function involves interacting and engaging with other people, through sharing memories, empathizing, and building relationships, to maintain and nurture social bonds. The study suggests that the social function may have two main manifestations: learning about another's life in order to form a new relationship; and maintaining warmth, empathy and social bonding in existing relationships. The study also found that more often the tendency of talking about one's past with other people is to maintain and nurture social bonding in existing relationships.

2.2.2 Personal Stories from the Past

The sharing of personal stories underlies the social function of reminiscence that develops empathy and nurtures social bonding. Clare Gillies and Anne James suggest in the book *Reminiscence Work with Old People* suggests that the act of recounting stories can be pleasurable to both the raconteurs and the listeners, and be cathartic or therapeutic for seniors.[96] The stories shared by seniors, even recollections of mundane details about everyday life style in the past, can provide clues for caregivers to gain insights on their cultural backgrounds and preferences, and improve personal bonding and seniors' well-beings in nursing environment.[97] Furthermore, reminiscence and storytelling in family context is also a socialization process and a way of passing on wisdoms between family members. Grandparents often play an important role in

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[95] Susan Bluck, Nicole Alea, Tilmann Habermas, David C. Rubin, "A Tale of Three Functions: The Self-Reported Uses of Autobiographical Memory", *Social Cognition*, Vol. 23, No. 1, 2005, pp. 91-117.

[96] Clare Gillies and Anne James, *Reminiscence Work with Old People* (Champan & Hall, 1994), 13.

[97] Gillies and James, *Reminiscence*, 30, 93.

passing on information about family legacies and historic events through storytelling. This activity facilitates identity formation and builds strong relationship between seniors and their family members.[98] [99] In urbanized societies that are increasingly aging and oriented toward households with few people, reminiscence and storytelling become increasingly valuable for maintaining family relations.

Personal stories of the past may contribute to the accumulation of oral history, and bring personal perspectives that enrich or challenge the established historical interpretations. Oral history refers to the testimonies of eye-witness participants in past events, which rely on memories of personal experiences to verify or challenge the established historical enterprise and provide new perspectives.[100] The discipline is similar to reminiscence in the emphasis on memory and personal stories, but differs in methodologies, perspectives and disciplinary origin. Essentially reminiscence concerns the emotional, cognitive, and social effects of remembering past events and sharing personal stories, while oral history concerns the social purposes of the shared narratives.[101] Both perspectives have demonstrated effects of building relationships among families and communities, and providing voices and identities for the less privileged and old aged to restore their dignity and confidence. [102] Ultimately, central to the two disciplines is the concept that storytelling of personal experiences connects generations and forms mutual understandings through the passing of knowledge and identities.

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[98] Blair Thompson et al., "Family Legacies: Constructing Individual and Family Identity through Intergenerational Storytelling," *Narrative Inquiry*, 19:1 (2009): 107-108, accessed May, 2013, doi 10.1075/ni.19.1.07tho.

[99] Barbara H. Fiese et al., "Family Stories in the Early Stages of Parenthood," *Journal of Marriage and Family*, 57:3 (Aug.1995), 768, accessed June, 29, 2013, http://www.jstor.org/stable/353930.

[100] Robert Perks & Alistair Thompson. *The Oral History Reader*. ed. Robert Perks and Alistair Thompson. (London: Routledge, 1998).

[101] Joanna Bornat. (2001). "Reminiscence and Oral History: Parallel Universes or Shared Endeavour?" *Ageing and Society* 21(2). 219–241.

[102] Paul Thompson. The Voice of the Past. Oxford, Oxford University Press. 1978.

Oral historian pioneers and sociologist Paul Thompson in his influential book *The Voice of the Past* suggested that reminiscing and telling of history can bring the old and less privileged members of the society towards dignity and self-confidence, and create understandings between social classes and between generations. [103] Such stories allow the heroes from not just the establishment, but also from previously unknown people who may be relatable to listeners. These stories can widen our scope of the world and its history through the voices of its witnesses. However, in the past some historians doubted the accuracy and significance of oral account of past events, and associated it with fiction and contrive narratives with little value in historical academia. [104] [105] Instead traditional historians favoured text-based sources and tangible evidences. However, Alejandro Yoshizawa argues that the accuracy of text-based sources of history, such as historical documents, such as journals, written testimony, second-hand accounts, statistics, etc., can be just as problematic since there is a tendency for these sources to favour the ruling elite classes and established authorities.[106] He also points out that in a multi-lingual society, minorities who are less competent with the majority language can face barrier to establish alternative perspective historical record. Thus oral history opens a channel for politically marginalized and voiceless groups to have their say of the events past beyond the traditional modes of historical inquiry.

The knowledge about our past should be more than the descriptions presented as an esoteric form of knowledge compiled by professionals or academia. Social historian Rafael Samuel argues that the concept of history should be an organic form

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[103] Paul Thompson, Voice of the Past: Oral History (Oxford University Press, 2000), 23.

[104] William W. Cutler III, "Accuracy in Oral History Interviewing", *Historical Methods Newsletter*. No.3 (1970): 1-7.

[105] Barbara Tuchman, "Distinguishing the Significant from the Insignificant", *Radcliffe Quarterly*. No.56 (1972): 9-10.

[106] Alejandro Yoshizawa,, "Listen and Learn: Oral History and the University of British Columbia", Initiative for Student Teaching and Research in Chinese Canadian Studies, University of British Columbia. 2009. http://www.instrcc.ubc.ca/Essays/ListenandLearn_AlYoshizawa.pdf.

of knowledge, be based on promiscuous sources including real-life experience, memories, feelings or even myths.[107] Trevor Lummis also argues that oral evidence is dynamic because it considers the domestic background, social attitudes, political views, leisure activities, and virtually all dimensions of the storyteller's prior experience which may have shaped their expectations.[108] Michael Frisch expands on this idea by arguing that "the process of historical memory is itself a subject for study, one capable of saying a great deal about how the past does or does not figure in our lives and what this in turn tells us about both history and ourselves".[109] When recalling a events and feeling from the past, it provides an opportunity to contrast the perception and feeling of today's. This provides a temporal dimension to the concept of history and insights about how and why attitudes have changed and events are remembered.

As seen in this section, the practice of recalling and revisiting one's past experience serves many functions and effects. Through the reviewing of one's life, one can gain a sense of continuity and identity; contrast feelings in the past with those of today's to resolve negativities and conflicts; share knowledge from the past to provide advice or solutions to today's problems; pass on cultural heritage and family legacies; or relief boredom and have fun times with peers to maintain social relationship and strengthen bonding. The social function of reminiscence is particularly prominent in nurturing the social bonding in existing relationships. Stories about the past are valuable sources to help us understand the past and how things came to be by expanding the establish histories with personal accounts, wider perspectives, and richer scopes about the past. These stories support the formation of empathy and may ultimately bridge the gap between individuals and members in a

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[107] Rafael Samuel, *Theatres of Memory: Past and Present in Contemporary Culture, Volume 1*. London: Verso, 1996.

[108] Trevor Lummis. *Listening to History: The Authenticity of Oral Evidence*. New Jersey: Barns & Novle Books, 1987. P19.

[109] Michael Frisch. *A Shared Authority: Essays on the Craft and Meaning of Oral and Public History*. New York. SUNY Press. 1990. P21.

community. These multi-dimensional benefits and playful potentials with remembering and talking about the past have motivated creative designs in assisted reminiscence.

2.3 Assisted Reminiscence and Storytelling

Assisted reminiscence and storytelling have been explored through various approaches to leverage the multi-dimensional benefits of revisiting and sharing past experiences. The different approaches focus on different components described in Webster's heuristic model of reminiscence[110] depending on the intended functions. As described by the model, the fundamental step of reminiscence is a trigger that initiate the process of recalling experience. A number of works have explored the effectiveness of different types of memory cues.

2.3.1 Triggering Reminiscence

Personal contents shared on social media, and open-ended text questions are some of the media that can be used to initiate reminiscence. *Pensieve*, developed by a team from the Information Science Department of Cornell University, is one of the notable examples of utilizing such contents to support the psychosocial goal of reminiscing. [111] The goal of the project is to bring reminiscence, traditionally a structured therapeutic or social activity conducted at a particular place or time, to be an informal and spontaneous part of everyday life. The project utilizes two types of memory cues, personalized stimuli and non-personalized stimuli, to randomly trigger recall of past memories. The personalized stimuli refer to artefacts that have personal significance or ownership drawn from personally shared contents, such as photographs or music, on social media services that include Picasa, Flickr, Blogger, Twitter, and Last.fm.

[110] Webster et al. "Mapping the Future of Reminiscence: A Conceptual Guide for Research and Practice". 2010.

[111] Peesapati et al., "Pensieve". 2010.

The non-personalized stimuli refer to text-based, random prompt that ask the users about his or her past. Examples of non-personalized text prompts include "The best concert you went to. Who did you go see and who did you go with?", and "Do you remember your father's favourite pastime?". The non-personalized prompts are designed to be broadly applicable, inoffensive, and to suggest reminiscence rather than factual recall. A combination of randomly selected personalized and non-personalized memory stimuli is delivered to its user through email on random schedule to trigger spontaneous reminiscence. The users have the option to write down the past experience and stories that they recall upon encountering the stimuli as diary entries. Pensieve demonstrated that both personalized and non-personalized stimuli are capable to triggering reminiscence. User study of the project revealed that participants would more often respond to short and non-personalized text prompts than to long ones, often with more thoughtful personal stories; users also respond more often to personalized photographs than non-personalized text prompts, however the responses were more description oriented, such as the people, event, time or place of the content, rather than autobiographical stories. The findings from this project suggest that the use of non-personalized images might be an effective medium to support reminiscence.

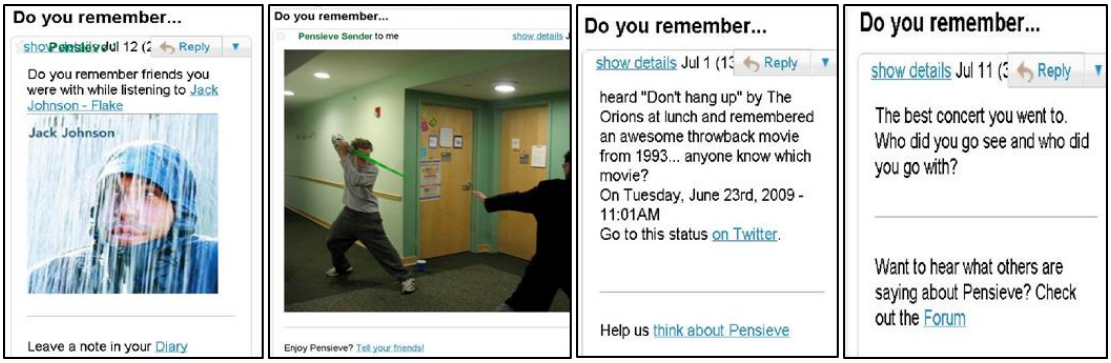

Figure 2-2: Examples of memory triggers used by Pensieve. [112]

[112] Peesapati et al., "Pensieve". 2010.

Mixed multimedia contents have also been experimented to stimulate reminiscence. *Audio-Enhanced Paper Photos*, a projected presented at of the 2013 Conference on Computer Supported Cooperative Work by Anne Marie Piper, Nadir Weibel, and James Hollan, is one example that utilizes physical personal photographs in combination with audio voice recordings to trigger reminiscence for a 105-year-old adult.[113] The project integrated personal paper photographs from the past into a physical interactive album that plays voice recording clips for each individual photograph upon demand. The recordings contain casual voice messages recorded by the user's families and kin, speaking to the user and providing identifications and descriptions about the people shown in the photographs as well as references of past events. These contents have been demonstrated to provide meaningful stimulation and engagement for recalling the past, and improve the user's social interaction with peers and caregivers after six weeks of use.

Figure 2-3: Audio-enhanced Paper Photos.

[113] Anne M. Piper, Nadir Weibel, & James Hollan. "Audio-Enhanced Paper Photos: Encouraging Social Interaction at Age 105". *Proceedings of the 2013 Conference on Computer Supported Cooperative Work*, 215-224.

Media contents from the past, such as archived photographs, video clips, and popular music can also be used to support reminiscence. CIRCA is a commercially available assisted reminiscence service in the U.K., originally developed as an academic research project by University of Dundee and University of St. Andrews, designed to support professional caregivers and relatives in conversing or providing reminiscence therapies for seniors with dementia.[114] CIRCA utilizes a broad range of old media contents as memory triggers, such as songs, TV and film videos, and historic photographs. These contents are delivered through a TV-sized touch screen that can be easily accessed by seniors with dementia as well as caregivers. User study of CIRCA found that the contents could induce laughter during reminiscence sessions indicating enjoyment, support the development of intimacy, and allow people with dementia to talk about topics that would not normally come up. The study concludes that CIRCA provides caregivers the opportunity to learn more about the person with dementia with minimal effort as they do not have to spend time finding a variety of stimuli.[115] Additionally the study found that the multimedia contents can lessen the burden and stress of maintaining conversation, and increase enjoyment in spending time with the person with dementia in general. The use of archive past media content for supporting reminiscence with CIRCA has been proven so effective, British Broadcasting Corporation (BBC) collaborated with the CIRCA project team from University of Dundee and University of St. Andrew to develop a similar service utilizing BBC's enormous archives of content, called BBC Reminiscence Archive (RemArc).[116]

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[114] CIRCA Connected. http://www.circaconnect.co.uk/

[115] Arlene J. Astell, Maggie P. Ellis, Lauren Bernardi, Normal Alm, Richard Dye, gary Gowans, Jim Campbell. "Using a Touch Screen Computer to Support Relationship Between People with Demetia and Caregivers". *Interacting with Computers* 22 (2010) 267-275.

[116] http://remarc.pilots.bbcconnectedstudio.co.uk/index.html

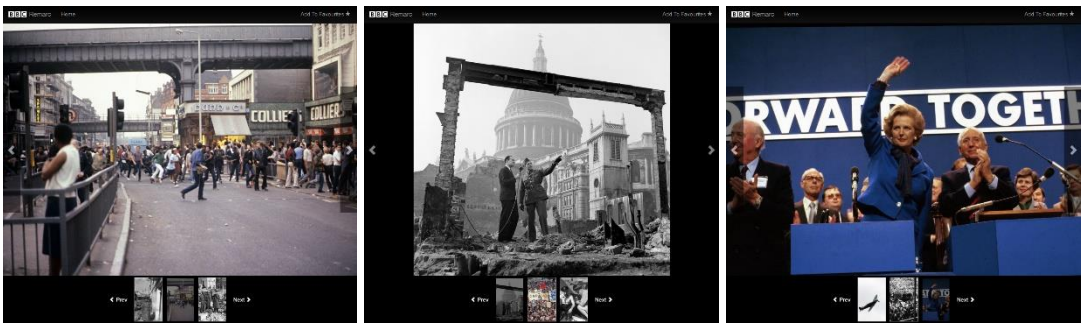

Figure 2-4: BBC Reminiscence Archive.

Modern online map contents have also been experimented as memory triggers. Mark Blythe et al. explored several ludic activities to support cross-generational engagement by encouraging curiosity and playfulness. [117] These activities utilize a number of different stimuli including Google Earth map-based biographies and archived photographs of the changing sceneries of a city over the years. The reaction from participants demonstrated that these stimuli can be engaging and elicit personal stories that was previously unknown to others. "One resident recognized a particular part of Canada from a photograph and said that she had lived there for six years. Nobody in the room appeared to have known this before and animated conversation followed."[118] The research also highlighted that working with older generation using technologies and research method should be cautions, as seniors' can become frustrated and exhausted with digital novelties and interviews.

2.3.2 The Context of Personal Stories

The preservation and sharing of the personal stories elicited through reminiscence is another interest area of a number of assisted reminiscence projects. This approach

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[117] Mark Blythe, Peter Wright, John Bowers, Andy Bouncher, Nadine Jarvis, Phil Reynolds & Bill Gaver. "Age and Experience: Ludic Engagement in a Residential Care Setting". In *Proceedings of the 8th ACM Conference on Designing Interactive Systems*, pages 161–170. ACM, 2010.

[118] Blythe et al. "Age and Experience: Ludic Engagement in a Residential Care Setting". 2010. P168.

mainly focuses on the *function* and *outcome* of reminiscence as a practice. One of the earliest example of this approach is *Palaver Tree Online*, designed by Jason Ellis and Amy Bruckman of Georgia Institute of Technology and presented at ACM Conference on Human Factors in Computing Systems (CHI) in 2001, supports intergenerational storytelling between elderlies and school children using text based communication. [119] This project allows school children to ask elders questions regarding their experiences in a varieties of historic events, such as involvement in World War II or Civil Right Movements, by sending text messages to them. The elders can share their experience and personal stories by replying the text messages at his or her own pace. This project utilizes school children's text based questions (relatively more personalized than the broadly applicable questions utilized by Pensieve, since the elders' backgrounds in historical events are the topics of the storytelling) as memory triggers to elicit elders' personal stories as a mean to fulfill the function of teaching and informing of past events. The outcomes of such type of reminiscence are accumulated oral history and school children's broadened understanding of the historical event from personal perspectives.

Personal stories from the past are generally preserved and shared based on a particular context or theme such as a place or an event. *Hiroshima Archive* is an example of preserving and sharing personal stories based on the event of the atomic bombing occurred at the Japanese city of Hiroshima in 1945. [120] This web-based service archives personal testimonies, stories, and multimedia contents in photograph audio, video and text formats about the event. These personal accounts are collected through personal interactions between bombing survivors and local high school volunteers, and are accessible through a map-based interface through a web browser. Each story is marked on the 3D map at the point that reflect the location where the story took place. This allows the story to be preserved and presented in relation to the

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[119] Jason Ellis, and Amy Bruckman. "Designing Palaver Tree Online: Supporting Social Roles in a Community of Oral History." *Proceedings of CHI 2001*. Seattle, WA, April 2001 pp. 474-481.

[120] http://hiroshima.archiving.jp/

location of ground zero of the blast. This project is designed to fulfill the function of informing the world about the terror of nuclear weapons in the hope of nuclear abolition and peaceful future. The outcome of the reminiscence is a cumulative database of oral history on the personal experience and survival stories of the atomic bombing in Hiroshima. The project also spawned other oral history archives including the *Nagasaki Archive* which documents personal stories about the Nagasaki atomic bombing;[121] *Okinawa Archive* which documents personal accounts of battle of Okinawa near the end of World War II;[122] and *The East Japan Earthquake Archive* which documents personal survival stories about the 2011 Great East Japan Earthquake.[123]

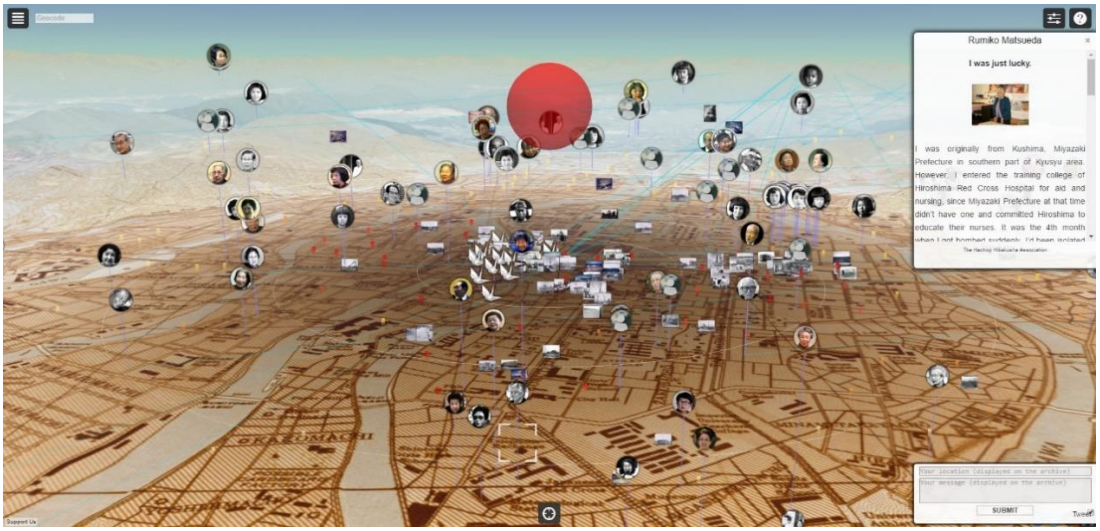

Figure 2-5: Hiroshima Archive.[124]

[121] http://nagasaki.mapping.jp/

[122] http://okinawa.mapping.jp/

[123] http://shinsai.mapping.jp/

[124] http://hiroshima.archiving.jp/

2.3.3 Location-Based Reminiscence

Place can be considered as a trigger to support reminiscence and storytelling. A notable example of location-based reminiscence and story sharing application is *GEMS*, developed by Jason Procyk and Carman Neustaedter from School of Interactive Arts and Technology of Simon Fraser University. GEMS is a game that allows its users to share place related personal stories and contents, which are geotagged and can be retrieved by family and close friends when they travel to visit the place. The game narrative and mechanics prompt its players to reflect on meaningful places from their past and to travel to those places and create geotagged digital memory records, in video, audio, photograph or text media, that capture the personal significance of the places.[125] Family members and friends can gain knowledge of the place when they visit the locations to collect and view the records left by the user. The idea behind GEMS is to encourage people to reflect on their experiences and share these experiences about places that are worth visiting. User study of GEMS found that when revisiting a familiar place, one may rediscover forgotten memories from the past, and find previously overlooked aspects about the place. For the families and friends who visit a new place to discover the story, they also seem to connect with the new place by consuming the stories shared by their family or friend. Another example of location based reminiscence and storytelling project is *TimeCapsule*, proposed by Yikun Liu and Haidan Huang of Indiana University School of Informatics. This project is designed to facilitate residents, who lived in rapidly changing urbanized environment where landscape of the past can become unfamiliar in short period, to revisit their past neighbourhoods. The project is a social networking community that preserve, organize, share and utilize personal and

[125] Jason Procyk & Carman Neustaedter, "GEMS: A Location-Based Game for Supporting Family Storytelling". *CHI EA '13 CHI '13 Extended Abstracts on Human Factors in Computing Systems* Pages 1083-1088.

collective memories by members contributing their location-related digitized materials such as old photographs.[126]

Virtually represented place may provide a novel mean for the supporting reminiscence and storytelling. A project by Chapoulie et al. developed a reminiscence-stimulating experience that allows the user to revisit a virtual past place created using imaged-based rendering (IBR) and immersive virtual reality (VR) system.[127] The project provides its user a photorealistic and immersive experience of revisiting past place through the use of a wall sized display, spatial 3D sound system, gesture based controls, and high resolution visuals of street level environment converted from multi-angle photographs. The experience is demonstrated to be able to trigger reminiscence and participants were able to comment on things that they remembered about the place. However, some participants commented that the VR representation of the place seemed "deserted", because even though users are given limited range of free view angle and movement, the environment itself is static and lacks any people or moving object as it was reconstructed using still photographs with no people. This project is another example of using representation of past place as memory stimuli, and a novel use of the VR technology in assisting reminiscence. The user feedback from this study also highlighted some of the limitations with the use of IBR derived from photographs due to the medium's temporal nature.

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[126] Yikun Liu & Haidan Huang, "TimeCapsule: Connecting Past". *Proceeding CHI EA '11 CHI '11 Extended Abstracts on Human Factors in Computing Systems*. Pages 995-1000.

[127] Emmanuelle Chapoulie, Rachid Guerchouche, Pierre-David Petit, Gaurav Chaurasia, Philippe Robert & George Drettakis. "Reminiscence Therapy using Image-Based Rendering in VR," *2014 IEEE Virtual Reality (VR)*, Minneapolis, MN, 2014, pp. 45-50.

Figure 2-6: Immersive VR reminiscence system proposed by Chapoulie et al.[128]

2.3.4 Generic and Personalized Photographic Stimuli

Photographs showing people, places, events or artefacts are perhaps the most commonly used memory trigger to assist reminiscence and storytelling. Most of the previously mentioned assisted reminiscence and storytelling projects utilize photographs, whether in digitized form or in physical paper form, as part of their memory cues. Other projects, such as *Life Frame*, proposed by Giorgi et al. utilizes digitized photographs of different types of "mementos" including objects from homes or souvenirs from holiday trips as visual stimuli. [129] A networked reminiscence system presented by Kuwahara, et al. also uses photographs as part of the memory cues for caregivers to conduct remote reminiscence therapy for dementia patients.[130]

The effectiveness of different contents in photographs as memory cues has been studied. A study conducted by Lee and Dey, from Human-Computer Interaction Institute of Carnegie Mellon University, explored different types of contents in photographs as different types of memory cues and compared differences in

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[128] http://www-sop.inria.fr/reves/Basilic/2014/CGPCRD14/

[129] Sabrina Giorgi, Alessandra Talamo, & Barbara Mellini. "The 'Life Frame': Responding to the Elderly People's Need of Remembering". *Proceeding CHI EA '11 CHI '11 Extended Abstracts on Human Factors in Computing Systems.* Pages 1381-1386

[130] Noriaki Kuwahara, Shinji Abe, Kiyoshi Yasuda, Kazuhiro Kuwabara. "Networked Reminiscence Therapy for Individuals withDementia by using Photo and Video Sharing". In Proc. *ASSETS '06*. Pages 125-132.

preference between people with episodic memory impairment (EMI) and without.[131] Their study found that effective cues are contents that can be recognized as art of the original experiences; distinctively represent the original experiences or focus on unusual or unexpected details that represent unique experiences; and hold personal meaning for the individual, such as people or places with significant personal relationship. Good cues for individuals without EMI can be subtler and less central to the original experience, where as good cues for those with EMI need to emphasize important highlights of the original experience so they can re-learn and re-construct the forgotten experience.

The findings of Lee and Dey's study contrast with the result of the study done by Astell et al. which compares the effectiveness of encouraging reminiscence and storytelling between generic photographs and personal family photographs. The study of Astell et al. finds that, for people with dementia, generic photographs, such as event photographs, elicit quite detailed and emotional personal stories of personal significance, while personal family photographs generated very few stories and produced limited information.[132] The study also finds that even for people without dementia, personal photographs are no more evocative to elicit reminiscence than generic photographs. This finding coincides with art critic John Berger's observation on the connection between photographs to memory, from which he suggests that more can be remembered with fewer stimuli, and vice versa.[133] The study of Pensieve project also found that non-personalized text-based questions elicited more thoughtful and detailed stories compared to personalized photographs. The contrasting results in these studies show that the relationship between personal ownership, connection or

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[131] Matthew L. Lee & Anind K. Dey. "Providing Good Memory Cues for People with Episodic Memory Impairment". In Proc. *ASSETS '07*. Pages 131-138.

[132] Arlene J. Astell, Maggie P. Ellis, Norman Alm, Richard Dye, & Gary Gowans. "Stimulating People with Dementia to Reminisce Using Personal and Generic Photographs". *Intl. J. Computers in Healthcare*, Vol. 1, No. 2, 2010.177-198.

[133] John Berger. *Keeping a Rendezvous*. Vintage Internationa. (1992). 192-193.

significance of the memory stimuli and effectiveness in eliciting reminiscence and storytelling is still inconclusive.

2.3.5 Reliance of Existing Materials as Reminiscence Triggers

In this section we reviewed a number of notable examples of assisted reminiscence and storytelling. In most cases reminiscence can be triggered by a variety of stimuli such as personal family photographs, non-personalized text-based questions, archive multimedia contents such as historic event photographs, and audios and visuals, physical objects and event places. With the exception of non-personalized text-based questions and places, most of the memory cues are generally contents, artefacts, or representation of artefacts that have existed since the past or from the time of the seniors' youth.

Photograph is one of the most commonly utilized memory cues perhaps due to its pervasiveness and abundance both in the public domains and private possessions for many communities. Further more the variety of subjects and personal connection with the content depicted in photographs make the medium an important asset in supporting reminiscence and storytelling. However, the availability of photographs or other historic contents from the time of seniors' youth is not a guarantee for everyone.

Private possessions of memorabilia can be damaged or lost, while publicly available materials may not necessarily have any personal relevance to one's past experience. In the case of Taiwan, photography was expensive for many people in the past, and was also a regulated activity during the early martial law period, therefore some people do not possess photographs from that period. This lack of available memory cues means supporting reminiscence and storytelling for some Taiwanese seniors may be difficult to engage. Therefore, in the research we want to create memory stimulating materials to help these seniors to recall and share their personal experience and stories with their families.

2.4 Places and Personal Stories

Place is a fundamental aspect in our sensory experience and memory of past events. In addition to being one of the many stimuli that can trigger reminiscence about ones past memories and stories, place is also the backdrop in which most of our stories took place.

The concept of place has been explored by diverse disciplines including geography, anthropology, architecture, sociology, psychology, and so forth.[134] Part of this interest in the concept of place comes from the growing awareness of the fragile person-place bonds contributed by globalization, urbanization, increased mobility, and environmental issues. Furthermore, the advancement in place-related technologies such

as telepresence and virtual reality has prompted the pursuit to understand how people relate to places. In this review we examine a number of studies that explore how places are related to our identities, memories and ultimately our stories.

2.4.1 Place Identity and Place Attachment

Place plays a significant role in the way we remember about our own past and ultimately influence the way we define ourselves. Philosopher Edward Casey, in his book *Remembering: A Phenomenological Study*, describes place as a "container of experiences" which connects spontaneously with our memories, and suggests that memory is "naturally place-oriented or at least place-supported." [135] French philosopher Gaston Bachelard suggests that intimated places are made out of memories and experiences, and the experience of recalling past homes can bring back the happiness and comfort of feeling protected. [136] In the book *The Power of Place:*

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[134] Nicole M. Ardoin, "Toward an Interdisciplinary Understanding of Place: Lessons for Environmental Education," *Canadian Journal of Environmental Education* 11(2006): 112-126.

[135] Casey. *Remembering: A Phenomenological Study*. 1987.

[136] Bachelard. *The Poetics of Space*. 1994.

Urban Landscapes as Public History, historian Dolores Hayden suggests that the complicated nature of our experience with a place makes it an effective tool in eliciting memories which can be shared with those who are interested in knowing about the past.[137] Social science professor Ken Taylor, in his paper *Landscape and Memory*[138] points out that landscape is the background setting of everything we do, it has therefore become the repository of intangible values and human meanings that nurture our very existence. Landscape and memory are inseparable because landscape is the nerve center of our personal and collective memories. Historian and geographer David Lowenthal, in his article *Past Time, Present Place: Landscape and Memory*,[139] suggests that each scene and object of a place is invested with histories of real or imagined involvements, and their perceived identities stem from our past acts and expectations. He points out that the past is not only manifested in the things we build and the landscape we create, but also embedded in the messages we hear and read.

The places where people do things in many ways define the identity of who they are. Proshansky, Fabian and Kaminoff first describe the concept "place-identity" as a "pot-pourri of memories, conception, interpretations, ideas and related feelings about specific physical settings as well as types of settings."[140] In the notable journal paper *Place and Identity Process*, Clare Twigger-Ross and David Uzzell examines the relationship between place and identity using Breakwell's four identity principles:

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[137] Hayden. *Power of Place: Urban Landscapes as Public History*. 1995.

[138] Ken Taylor. "Landscape and Memory: Cultural Landscapes, Intangible Values and Some Thoughts on Asia". In: *16th ICOMOS General Assembly and International Symposium: 'Finding the spirit of place – between the tangible and the intangible'*, 29 Sept – 4 Oct 2008, Quebec, Canada.

[139] David Lowenthal, "Past Time, Present Place: Landscape and Memory," *Geographical Review* 65:1(1975): 1-36, http://www.jstor.org/stable/213831.

[140] Harold M. Proshansky et al., "Place-identity: Physical World Socialization of the Self," *Journal of Environmental Psychology* 3:1(1983): 60.

distinctiveness, continuity, self-esteem and self-efficacy.[141] *Distinctiveness principle* is the desire to maintain personal distinctiveness or uniqueness. For examples, being a 'city' person is associated with the distinctive lifestyle of the urban environment; and being associated with a particular town enables people to differentiate them from another town. *Continuity principle* is the desire to preserve continuity over time and situation between past and present self-concepts. Two types of continuity are discussed in the literature: place-referent continuity refers to the maintenance of continuity via specific places, using physical environment as reference, that have emotional significance for a person; whereas place-congruent continuity refers to the maintenance of continuity via characteristics of places which are generic and transferable from one place to another. *Self-esteem principle* refers to the positive evaluation on oneself for being a part of favoured environment. For an example, one may feel a sense of pride as a resident of an historic town. Finally, *Self-efficacy* principle refers to an individual's belief in their capabilities to manage situational needs in an environment to accomplish their objectives.

People also develop a sense of attachment with the places where they live or spend time in. Leila Scannell and Robert Gifford proposed in their journal paper, *Defining Place Attachment: A Tripartite Organizing Framework,* a three-dimensional, *person-process-place framework* that synthesizes the various definitions of the complex relationships between person-place bonds.[142] In the *person dimension*, the sense of attachment may develop from the meaning of the place generated from personally important experiences, such as realizations (e.g., discovery of the love for a hobby), milestones (e.g., graduation), and personal growth (e.g., place of academic training); as well as symbolic meanings shared by other members of social or cultural

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[141] Clare L. Twigger-Ross and David L. Uzzell, "Place and Identity Processes," *Journal of Environmental Psychology* 16(1996): 205-220.

[142] Leila Scannell and Robert Gifford, "Defining Place Attachment: A Tripartite Organizing Framework," *Journal of Environmental Psychology* 30 (2010) 1-10, doi:10.1016/j.jenvp.2009.09.006.

groups such as being an alumni of a school, a fan a regional sports team, or a citizen of a nation. In the *psychological process dimension* place attachment is characterized by affective, cognitive, and behavioural components: the affect component is the emotional connection to a particular place, such as "feeling the pride of being a member of the community", and the desire to maintain closeness to a place in attempt to experience the positive emotions that the place may evoke; the cognitive component is the closeness to a place constructed through the memory, meaning, knowledge and beliefs that individuals associate with it; and the behavioural component concerns the action through which the bond to a place is expressed, such as the desire to visit a city, the reluctance to leave homeland, or the preference to eat regional food. Finally in the *place dimension* attachment to a place is developed through the social aspect rooted to a particular place such as familiarity and social relationship with the neighbourhood residents, or the distinctive social identity established a local community; it can also rest on the physical features, such as the dependence on the amenities or resources to support certain objectives, objects that become meaningful for individuals from the environment including buildings, streets, rivers, farms, or mountains. In sum these three dimensions summarizes the complexity of person-place bonding.

2.4.2 The Physiology of Place and Memory

The memories of personally experienced events, also known as episodic memories, have been suggested to be physiologically connected to the places where the experiences are acquired. Estonian Canadian psychologist and cognitive neuroscientist Endel Tulving was the first to make distinction between categories of memory in the paper *Episodic and Semantic Memory,* in which he defines episodic memory as memory for personally experienced events set in a spatial-temporal context, and semantic memory as memory for language, symbol, meaning, facts and

general knowledge of the world.[143] Episodic memory involves rich amount of information that makes up the episode, including the people and objects that were present at the occasion, as well as the place and context in which the episode occurs, and temporal aspect that provide a sense of chronology.[144] According to Tulving and Markowitsch, the hippocampus region of the brain is needed for episodic memory but not for semantic memory.[145] In addition to the function for episodic memory, hippocampus has also been suggested to be linked to the processing and recognition of place and spatial information.

Studies conducted by 2014 Nobel Prize for Physiology or Medicine winners John O'Keefe, May-Britt Moser, and Edvard Moser suggest that our brains have an internal positioning system. O'Keefe's studies pointed out that the hippocampus region of the brain contains a type of pyramidal neurons, referred to as "place cells", responsible for spatial processing and collectively act as a cognitive representation of a specific location in space, known as a cognitive map.[146] [147] The study led by Moser's suggests that another type of neurons, referred to as "grid cells" located in the entorhinal cortex region of our brains, are responsible for understanding our own position in a space. [148] Our episodic memory of past events is said to be linked to the spatial context in which they happened, and the place cells provide the spatial context

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[143] Endel Tulving. (1972). "Episodic and Semantic Memory". In E. Tulving and W. Donaldson (Eds.), *Organization of Memory* (pp. 381–402). New York: Academic Press.

[144] Smith & Mizumori, "Hippocampal Place Cells, Context, and Episodic Memory". 2006.

[145] Endel Tulving, Hans J. Markowitsch. 1998. "Episodic and declarative memory: Role of the hippocampus." *Hippocampus* 8:198–204.

[146] John O'Keefe & Lynn Nadel. *The Hippocampus as a Cognitive Map*. Clarendon Press. London. 1978.

[147] O'Keefe & Dostrovsky. "*The Hippocampus as a Spatial Map: Preliminary Evidence from Unit Activity in the Freely-Moving Rat.*" 1971.

[148] Torkel Hafting, Marianne Fyhn, Sturla Molden, May-Britt Moser & Edvard I. Moser. "Microstructure of a Spatial Map in the Entorhinal Cortex". *Nature.* 436, 801-806 (11 August 2005)

for a memory by recalling the neural representation of the environment in which the memory occurred.[149]

In another recent study by Travis Todd and David Bucci suggests that being able to recall the physical place is an important aspect in remembering the events happened, and suggests that the retrosplenial cortex, which is reciprocally connected with the hippocampus and various parahippocampal cortical regions, is responsible for processing physical and visual stimuli, as well as for the storage and retrieval of spatial and long-term memories. [150] These neuroscience findings provide physiological perspectives that support the explanations on why our memories and personal stories are fundamentally place-oriented as suggested by other disciplines.

The link between places and memories is a complex phenomenon both psychologically and emotionally. This link may explain why we might feel a sense of losing a piece of our belonging when seeing an intimate place from our past became altered beyond recognition. As British writer eloquently described: "The past lives on in art and memory, but it is not static: it shifts and changes as the present throws its shadow backwards. The landscape also changes, but far more slowly; it is a living link between what we were and what we have become. This is one of the reasons why we feel such a profound and apparently disproportionate anguish when a loved landscape is altered out of recognition; we lose not only a place, but ourselves, a continuity between the shifting phases of our life." [151]

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[149] David M. Smith and Sheri J.Y. Mizumori. "Hippocampal Place Cells, Context, and Episodic Memory". *Hippocampus Special Issue: Place Cells and Episodic Memory*. Volume 16, Issue 9, pages 716–729, September 2006.

[150] Travis P. Todd and David J. Bucci, "Retrosplenial Cortex and Long-Term Memory: Molecules to Behavior", *Neural Plasticity*, Volume 2015, Hindawi Publishing Corporation, Article ID 414173, http://dx.doi.org/10.1155/2015/414173

[151] Margaret Drabble. (1979). *A Writer's Britain: Landscape in Literature*. p.270; Methuen, London.

2.4.3 Place as a Reminiscence Stimulus

In this review we visited a number of studies from the perspectives of several different disciplines on the relationship between places and our memories and stories. Places contribute to the development of our identities, which can come from the distinctiveness of the place, the time that we spend at the place, the pride that we feel as a member of the place, and how we manage to live and survive at the place. We can also become attached to a place because it may serve as a reminder to personally important experiences or milestone; a symbol of personal identity or association; or a community where our social relationships exist. Our episodic memories, including details of our stories such as the people, event or time of a particular episode, are also said to be physiologically linked to the sensory experience of the place where the episode occurred.

Place may provide a source for the reproduction and stimulation to trigger reminiscence and storytelling. A number of assisted reminiscence researches have adopted the use of place to evoke the recall of past experiences.[152] [153] [154] However, in many rapidly urbanized societies, the intimate places that we are familiar with may no longer be recognizable, which can be a loss of part of our continuity, identity or sense of belonging, and an important source to help us recall our personal stories from the past. By providing sensory cues that can be recognized as representations of past intimate places, it may have the potentials to evoke memories based on the spatial context of that specific place.

2.5 Visualizing Past Places

Places may provide sensory cues that trigger the recall of past experience or personal stories. When we revisit a place, episodes that we experienced at that particular

[152] Procyk & Neustaedter, “GEMS: A Location-Based Game for Supporting Family Storytelling”.

[153] Liu & Huang, “TimeCapsule: Connecting Past”.

[154] Chapoulie et al. "Reminiscence Therapy using Image-Based Rendering in VR".

location may spontaneously comes to mind. However, place and landscape are constantly changing, some stay relatively the same for decades or centuries while others can alter within matter of weeks or days through rapid urbanization, land reform, or in some cases unfortunate events such as human conflict or natural disaster. Therefore, to some people, the places that contain their memories may have become unrecognizable today, and the clue that can support reminiscence and storytelling for them may have been lost.

2.5.1 Reconstructing Past Places

Place of past can be reconstructed given adequate amount of reference material or interpretation. Past landscapes or historic architectures having been reconstructed using physical medium or visual medium through artist's interpretation. The advancement in surveying, measurement, data acquisition and 3D computer graphic (CG) techniques of the past few decades have made virtual reconstruction possible with better accuracy and presentation. Virtual visualizations have been used to synthesize, conserve, reproduce, represent, and digitally process the digital instance of historical artefacts, architecture or archaeological landscapes. [155] Virtual visualization of past places provide reconstructed or interpreted visuals of past conditions from different perspectives, and offer platforms for examining, hypothesizing, or theorizing human development in the course of history for different purposes.

Virtual visualization of past places can be places that still exist, and places that is no longer recognizable today. The purposes and methods of visualizing these two categories can be quite different. Places that still exist today may be digitized for preservation, virtual restoration, research and analysis, or validation and testing of

[155] Maria Roussou, "Virtual Heritage: From the Research Lab to the Broad Public" (Virtual Archaeology, proceeding of the VAST Euroconference, Arezzo, November 24-25, 2000): 93-100.

data acquisition and representation technologies. This category of visualization emphasizes the fidelity and details of the end result, and relies on the use of architectural drawings, direct measurement or surveying techniques. The visualization quality can be photorealistic thanks technologies such as image-based methods, close-range photogrammetry and terrestrial laser to scan existing sites and generate high resolution, photorealistic 3D models.[156] Furthermore, new technologies like the Microsoft Photosynth can automatically generate models of places and objects by spatial locating, analyzing and cross referencing a large number of photographs in 3-dimensional spaces.[157] [158] Place that no longer exist today may be reconstructed for validation of historic interpretation, theorizing the development of places, or communication and education about the past. Since the place and artefact of the past is no longer in existence or recognizable today, there are uncertainties regarding the actual appearance of the place, therefore this type of visualization relies on varying amount of academic researches, and interpretation or theorization of limited historic reference materials. The scope of this research aims to reconstruct past neighbourhood that is no longer recognizable today, thus this review will focus on related works on visualizations of places that no long exist.

The reconstruction of virtual environment of disappeared historical places can be problematic. In the paper *Towards a 3D Visualization Interface for Cultural Landscapes and Heritage Information*, De Boer, Voorbij and Breure explore the process of creating visualization for disappeared historic place by reconstructing Huis Honselaarsdijck, which was a fortified country house in the Netherlands built in the

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[156] Heinz Rüther, Julian Smit and Donatius Kamamba, "A Comparison of Close-Range Photogrammetry to Terrestrial Laser Scanning for Heritage Documentation," *South African Journal of Geomatics* 1:2 (2012): 149-162.

[157] Guenter Pomaska, "Utilization of Photosynth Point Cloud for 3D Object Reconstruction," (Proceeding of the XXII CIPA Symposium, Kyoto, Japan, October 11-15, 2009) , http://cipa.icomos.org/fileadmin/template/doc/KYOTO/34.pdf

[158] www.photosynth.net

1600's and demolished in 1815.[159] This visualization utilizes historic maps, drawings and paintings depicting Huis Honselaarsdijck and some supplementary existent information as reference materials. From this explorative study highlights a number of challenges for creating a disappeared historic place. First, historical reference sources are imperfect and lack important details in supporting the reconstruction of realistic visualizations. Secondly, constructing 3D models is a very laborious and skillful task which makes the construction of large 3D virtual environment unfeasible without specialized professional tools, skills and time. Finally, given that accurate reference material and 3D modelling resources are limited, several questions arise. How to convey a realistic representation of the place? How much detail is needed? How good is good enough? The solution to solve these challenges, as De Boer et al. propose, is to utilize non-photorealistic rendering (NPR) to visualized the virtual environment. NPR emphasizes simplified representation of essential characteristics of objects, thus helps reducing the effort and resource for creating highly detailed photorealistic visualizations, as well as communicate uncertainties in the final image.

Figure 2-7: Non-photorealistic rendering of Huis Honselaarsdijck by De Boer et al.

[159] Arnoud de Boer, Leen Breure & Hans Voorbij, "Towards a 3D Visualization Interface for Cultural Landscapes and Heritage Information", In Proceeding *Computer Applications to Archaeology* 2009.

Another notable visualization project of disappeared past place is *Rome Reborn*. This ambitious joint effort of several teams from American and Italian universities created a virtual reconstruction of ancient city of Rome as it appeared in 320AD. [160] [161] The primary purpose of the project was to visually present theories and hypothesis about how the urban topography of ancient Rome would look. In order to virtually reconstruct this ancient city, the project referenced a number of topographic and historic sources including ancient plans, historical texts, and archaeological studies of past scholars for documents on monumental buildings such as the Coliseum and the Roman Forum. However not many sources were available for most of the vernacular architectures (i.e. the small "filler" buildings) which formed the urban fabric in between the monuments. The project overcame this challenge first by surveying the 1:250 scale physical model of the city "Plastico di Roma Antica" created by Italian archeologist Italo Gismondi to reference his interpretation of the vernacular architectures. After analyzing the geometrical parameters of architectural components, the project generated a library of elementary buildings both manually and procedurally to compose the virtual ancient Rome. [162] Rome Reborn is another example of disappeared past place visualized using non-photorealistic rendering to accommodate the lack of accurate details and modelling large amount of 3D data.

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[160] Gabriele Guidi et al., "Rome Reborn – Virtualizing the Ancient Imperial Rome," in *3D Virtual Resconstruction and Visualization of Complex Architectures, Proceeding of the 2nd ISPRS International Workshop, 3D-ARCH 2007,* ETH Zurich, Switzerland, July 12-13 2007, ed. F. Remondino and S. El-Hakim, (International Archives of Photogrammetry, Remote Sensing and Spatial Information Science, vol. XXXVI-5/W47).

[161] Bernard Frischer, "The Rome Reborn Project. How Technology is Helping us to Study History," *OpEd* November 10 (2008), University of Virginia.

[162] Kimberly Dylla et al. "Rome Reborn 2.0: A Case Study of Virtual City Reconstruction Using Procedural Modeling Techniques," in *CAA 2009, Making History Interactive, 37th Proceedings of the CAA Conference, March 22-26, 2009,* Williamsburg, Virginia.

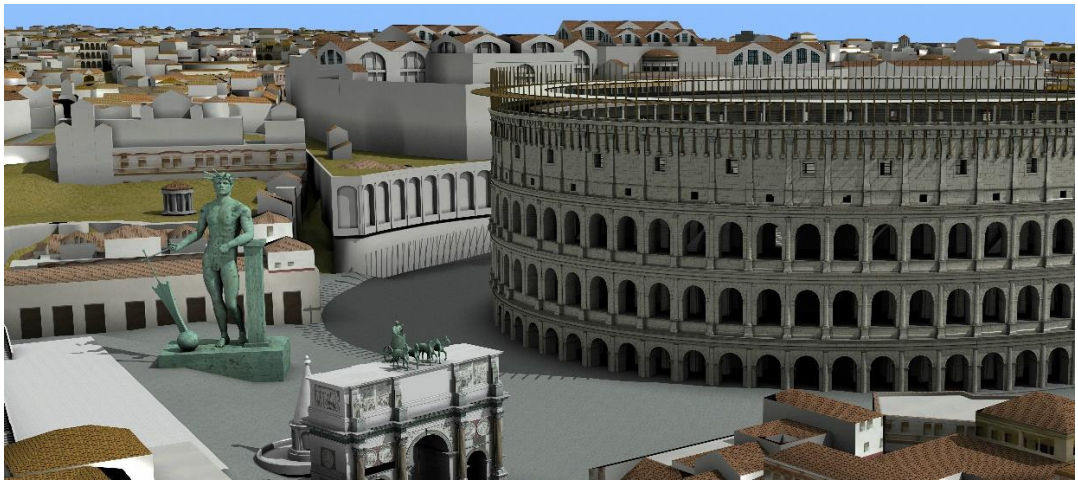

Figure 2-8: Rome Reborn Project. [163]

Although numerous virtual reconstruction of disappeared past places has been presented, there seem to be an overemphasis on the technologies and methodologies used for the reconstruction, rather than the actual use of the reconstructed past place. Beng-HiangTan and Hafizur Rahaman in their article *Virtual Heritage: Reality and Criticism* [164] document a comprehensive list of criticisms and debates in this field into six categories: (1) lack of meaningful and cultural content; (2) lack of later interpretation; (3) lack of engagement; (4) lack of sense of place; (5) technological limitations; and (6) lacking positive attitude of wide dissemination, distribution and use. They point out that the experience from heritage content depend largely on both media (technology and narrative) and viewer's background (age, cultural background, perception etc.), however majority of academic literatures focused on the former, and lack in theory and methodology of user interaction and interpretation of virtual heritage.

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[163] http://romereborn.frischerconsulting.com/

[164] Beng-Hiang Tan, Hafizur Rahaman, "Virtual Heritage: Reality and Criticism," *Joining Languages, Cultures and Visions/Joindre Langages, Cultures et Visions - CAADFutures 2009. Proceedings of the 13th International CAAD Futures Conference*, ed. Temy Tidafi and Tomás Dorta, (Les Presses de l'Université de Montréal, Montréal, 2009).

In summary, past place can be virtually reconstructed and visualized. For those places that still exist, or partially remain today, the virtual reconstruction process can be supported by a number of advanced survey and data acquisition technologies to create highly accurate and detailed result. However, for those places that have disappeared or bear little resemblance to the past, visualization can be challenging due to lack of accurate reference data, lack of resource for creating large area 3D environment and objects models in details, and the difficulty in conveying a sense of realism with the lack of details and accuracy. One solution to accommodate these limitations is to visualize the reconstructed past place using non-photorealistic rendering, which can imply an interpreted or ambiguous quality about the depiction. The research field in virtual reconstructions have received criticism including overly concentrated on the use of technologies and the process of reconstructions, and a lack of focus on the meaning of the virtual content and user's experience and emotional response to the visualizations.

2.5.2 Non-Photorealistic Visualization

Non-photorealistic rendering (NPR) is developed from the realization of limitations with photorealistic visualization. The field of virtual reconstruction of historic places and artefacts, or virtual heritage, has long focused on generating high fidelity digital counterpart of historical and cultural evidence for the purpose of conservation, reproduction, representation, or reprocessing. This quest for visual realism is rooted in the field of computer graphic which since its inception has continued advancing the acquisition and visualization techniques to synthesize imageries by simulating real world physical properties in the way humans perceive visually. However, as the field matures with more expressive exploration there is greater realization that, depending on the intended purpose and resource availability, high fidelity representation is not necessarily desirable or feasible due to computational resource requirement, complex

semantics, and viewer's psychological reaction.[165] Furthermore, audiences may not necessarily be interested in photorealistic visual representation as much in believable and convincing environments, regardless if the imagery emulates real world properties, thus high fidelity is not necessarily a requirement for an image to be perceived as a realistic representation, as long as the depiction "looks-good" enough. [166]

When we see a photograph, an oil painting, and a line drawing of the same object, we may perceive all of them as visual representations of the same thing, and yet the realistic representational elements depicted in each medium differ. Margaret Hagen, in her book *Varieties of Realism*, introduces the concept that different methods of depiction produce different varieties of realism in which certain properties of a scene are accurately represented while others are approximated, abstracted, or omitted. [167] This idea that representational images can be realistic in some aspects but not others has been further explored by James Ferwerda in his paper *Three Varieties of Realism in Computer Graphics* which identifies three varieties of realism: Physical realism, photo-realism, and functional realism. [168]

Physical realism refers to the representation that provides the same visual stimulation as the physical scene. This means that every single point of the image must emits accurate light intensity and spectral colour as the real world scene viewed

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[165] Tobias Isenberg et.al. "Non-Photorealistic Rendering in Context: An Observational Study", Proc. *NPAR '06* .115-126. Doi:10.1145/1124728.1124747.

[166] Roussou, Maria and Drettakis, George. "Photorealism and Non-Photorealism in Virtual Heritage Representation." Edited by A.Chalmers, A., Arnold, D., and Niccolucci, F. First Eurographics Workshop on Graphics and Cultural Heritage (2003), 2003, Brighton, United Kingdom. Eurographics, pp.10, 2003, *Proceedings of the International Symposium on Virtual Reality, Archeology and Cultural Heritage*. Accessed September 30, 2014. https://hal.inria.fr/inria-00606745/document

[167] Margaret Hagen. *Varieties of Realism*. Cambridge University Press. 1986.

[168] James A. Ferwerda, "Three Varieties of Realism in Computer Graphics". *Proc. SPIE 5007, Human Vision and Electronic Imaging VIII*, 290 (June 12, 2003). doi:10.1117/12.473899

from the same angle. The process of synthesizing physical realistic images would require demanding resources. First the virtual scene must contain models with accurate descriptions of the shapes, textures, and materials with proper illumination properties. This virtual scene must then be rendered with physically accurate simulation of how light energy would bounce and react to every surface and material in the space and arrive at the observer's viewpoint in order to conclude the intensity and colour information in every point of the final image. Finally, the rendered image must be presented through a display device that is capable of reproducing the light energy accurately. However, adopting physical realism as the standard for generating observable realistic images has a number of drawbacks. First, existing technologies do not have the capabilities to efficiently simulate the complete physical properties. Second, physically-based image synthesis is extremely computationally expensive, which limits its applicability in interactive graphics applications. And finally, physical realism can be overkill as physically correct details do not add meanings to the content for most communication purposes.

Photorealism refers the visual representation style and quality that attempt to synthesize images as realistically as the photograph medium. The pursuit of photorealism has been one of the most important developmental objectives for the field of computer graphics since its inception. This standard of realism requires the image to produce the same visual response as the real scene even though the physical energy coming off the image may be different. Photorealistic visualization takes advantage of the trichromatic nature of human vision to reduce the requirements for describing colors from their full spectral representations to their metameric RGB or CMYK equivalents. Photorealism visualization can be achieved with more efficient computational resources as physically correct image features beyond the sensitivity of human vision are limited during the rendering process. The relative efficiency of photorealistic rendering and the continuing advancement in rendering technologies have made possible for this type of realism to be applied in pre-rendered applications such as scientific and product visualizations, as well as visual effects for entertainment contents. However, photorealism still requires photographic quality source material

for scene construction, and acquisition of such material can be difficult to achieve. Furthermore, photorealistic image may not be necessary or desirable in certain graphical applications, as photographic details may create unnecessary noise or distractions for the intended communication purpose.

Functional realism refers to the representation that depict the required visual information to convey enough realism for the intended communication function. According to Ferwerda such information can be meaningful properties of objects in a scene, such as their shapes, sizes, positions, motions and materials that allows an observer to make reliable visual judgments and to perform useful visual tasks. This form of realism admits a wide range of rendering styles from physically-based simulation through photorealism, to more abstract approaches such as non-photorealistic rendering.

Non-photorealistic rendering (NPR) is an area of computer graphic that gained research interest from the realization that photorealistic rendering may not necessarily have direct effect on audiences' perceived realism. Nathan Perkins points out that perceived realism, although can be affected by the perception of image quality due to technical variables such as resolution and colour consistency, can also be affected by the appropriateness of the context in the content, viewpoint of the image, and viewer predispositions, expectations and receptivity. [169] For example, a high quality, photorealistic visual rendition of London's Clock Tower Big Ben placed in America's Grand Canyon may impress audiences with its technical accuracy of the visual depiction and imaginative landscape, but may fail to evoke a sense of believability due to the inappropriate context of a known symbol in an incongruous setting. Conversely landscape painters and cartographers have a long tradition of visualizing the essential urban space and landscape characteristics, through geometric abstraction by simplifying shapes and emphasizing dimensions of relationships between objects

[169] Nathan H. Perkins. "Three Questions on the Use of Photo-realistic Simulations as Real World Surrogates." *Landscape and Urban Planning*, 21. 1992. 265-267.

to convey geographic information.[170] [171] A realistic visualization of a place is a balance between adequate image qualities, expression and contextually appropriate content that determine the perceived realism for a given application. Therefore, non-photorealistic rendering used in virtual visualization of places often take inspirations from artistic expressions such as free hand drawing, painting, technical drawing or cartoons.

The artistic and ambiguity quality of non-photorealistic rendering as visual stimuli may encourage interactive and communicative behaviours as well as support object recognition and attention. Schumann, Strothotte, Laser, and Raab, in the paper *Assessing the Effect of Non-Photorealistic Rendered Images in CAD*, demonstrate that, compared to finely shaded or lined architectural renderings, sketchy representations evoke significantly more discussions between architects and clients.[172] Nick Halper et al., in the paper *Towards an Understanding of the Psychology of Non-Photorealistic Rendering*, argue that human memory seem to function independent of the realness of visual cues, and suggest that NPR can be used to effectively represent objects in non-realistic styles without influencing our brains' ability to identify objects, while maintaining the potential to vary aspects of the identified objects in manners not possible with photorealistic rendering.[173] The study also found that when asking subjects to select objects from images, subjects tend to select objects with figure-ground-segregation, that is, objects with strong cartoon style silhouette and two-tone shading that separate themselves from other objects and backgrounds depicted using oil-paint style.

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[170] De Boer, Arnoud. "Creating Realistic 3D Geo

[171] Döllner, Jürgen and Buchholz, Henrik. "Expressive Virtual 3D City Models." *University of Potsdam Hasso-Plattner-Institut*. Accessed September 30, 2014.

[172] Jutta, Schumann, Thomas Strothotte, Stafan Laser, & Andreas Raab. "Assessing the effect of non-photorealistic rendered images in CAD". *Proc. CHI '96*, ACM Press, 35-42.

[173] Nick Halper, Mara Mellin, Christoph S. Herrmann, Volker Linneweber, & Thomas Strothotte. "Towards an Understanding of the Psychology of Non-Photorealistic Rendering". *Computational Visualistics, Media Informatics and Virtual Communities*, 2003. 67-78.

The cognitive process of perceiving NPR may be explained by Gestalt psychology. Gestalt psychologist Kurt Koffka describes that humans make sense of the chaotic world and its meanings by processing the perceptions as a whole, and this whole is other than, not more than, the sum of the parts. [174] This suggests that that our brain self organizes and add additional layer of meaning to the sum of the perceived elements. Gestalt psychology describes a set of principles on how the brain interpret visual stimuli, five of the most commonly used are: (1) figure and ground, (2) proximity, (3) closure, (4) similarity, and (5) continuation [175]. The law of figure and ground refers to the contrast between the subject in the front and background, which can change visibility and focal attention. The law of proximity suggests that elements within close proximity with each other are perceived as belonging in the same group, while farther away elements are perceived as separated. The law of closure describes human brain has a natural tendency to enclose gaps in a perceived form, and ignore missing parts to complete the image as a whole. The law of similarity suggests that elements with similarities in shape, size, colour, proximity, and direction are perceived as related, even if the elements are separated at distance. The law of continuation describes the tendency that human eyes would follow a line, curve, or a sequence of shapes to seek for relationship between elements. These principles have provided designers and artists guidelines to effectively create visual communications for the development non-photorealistic rendering.

It is important to note that neither historical artefacts such as remnants of places, nor our memories should be perceived as actual past. Lowenthal cautions the historic certainties perceived by preserved historical artefacts, as they may encapsulate some images which in time may prove to be mythical or irrelevant. The preserved and restored artefacts tend to feature the more impressive, most expensive, most imposing or most symbolic of certain time period. In the same way, our memory

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[174] Bang Wong, "Gestalt principles (Part 1)", *Nature Methods* Vol.7 No.11(November 2010) 863.

[175] Lisa Graham, "Gestalt Theory in Interactive Media Design", *Humanities and Social Sciences*, Volume 2, Issue 1, 2008. http://www.scientificjournals.org/journals2008/articles/1288.pdf.

transforms the past we have known into what we think it should have been; it also simplifies and composes our perception. Consequently, he reminds the virtue of ambiguity: "Without a flexible and alterable past, future generations might doubt the reality of their present." [176]

2.6 The Conception and Contribution of this Research

In this research we propose a visual content designed to facilitate an engaging family social interaction experience by stimulating reminiscence and storytelling of past experiences. This review highlighted that the society of Taiwan is experiencing growing distances and reduced interactions between older and younger generations in families. Some of the contributing factors to the growing geographical, linguistic, and cultural distances between the generations can be traced to the socioeconomic and sociopolitical development throughout the history of later half of the twentieth century. Despite having the desire to maintain family intimacy and availability of communication tools, spending lives apart can reduce the frequency and quality of face-to-face interactions between family members. In an aging society such as Taiwan where more seniors are living alone, having healthy social relationships is an important aspect of maintaining happiness and wellbeing for the old age. Younger generation Taiwanese see the older generation as of historians and role models to learn from, but would prefer more close and personal intergenerational communication. Therefore, by facilitating an engaging intergenerational family social interaction experience through reminiscence and storytelling, we may support a more personal communication and maintenance of healthy social relationship between generations.

Reminiscence and storytelling are practices that support communication and development of empathy between generations. This review cited researches that suggest the sharing of personal experience can facilitate the maintenance of relationship, and strengthen kinship and bonding. The stories shared from seniors'

[176] Lowenthal "Past Time," P27.

memories can provide insights into their experiences and ways of thinking, personal accounts about past life styles or historical events, as well as knowledge that may support solving present or future problems. The broad effect of reminiscence has led to a variety of reminiscence activities, ranging from therapeutic practices that provide emotional and mental health care, to spontaneous exchanges of stories that provide pleasant social interaction experiences.

The process of reminiscence is generally initiated by a trigger that evoke the recall of past experience. Existing researches in assisted reminiscence have explored different types of triggers, include photographs, audio and video contents, physical memorabilia, text questions and places. Photograph is the most commonly used memory cue due to the varieties in the medium's content as well as its assumed pervasiveness. With the exception of using text questions, current researches assume the availability and existence of past materials that can be used to trigger memory recall. However, it is not always the case that people have access to such materials as historic records may not necessarily have been made or well kept. Therefore, in this research we intend to solve this problem by creating visual stimuli.

Place may provide a mean to stimulate reminiscence and facilitate an engaging social interaction between family members. A number of studies from different disciplines have suggested that our memories and personal stories are considered to be place-oriented. Neuroscience findings also suggest that place is linked to people's episodic memories because it is the fundamental context in which all of our experience is acquired. Thus a stimulus that can be recognized as a representation of personally significant place may have the potential of evoking related memories. However, place and landscape change over time, and in some cases can become unrecognizable in a short period due to rapid urbanization or disaster. This means that for some people the places that contain memories may have become lost.

In this research, we propose, STREMIS, a visualization of past neighbourhood designed to facilitate an engaging intergenerational interaction experience by stimulating reminiscence and storytelling. STREMIS provides artistically rendered images of users' past neighbourhoods, which allow users to revisit the places and

rediscover forgotten memories for sharing their personal stories. The past neighbourhood is virtually reconstructed using 3D CG by referencing topographical data of historic aerial survey photographs and maps, which may be the only historical records to some neighbourhoods that have no other visual record. The visualization of past places utilizes non-photorealistic rendering to depict past sceneries in order to tackle the issues of historical uncertainties due to lack of accurate reference materials. The use of ambiguous visualization may also stimulate mental projection of past experience to make sense of the perceived image according to Gestalt psychology, as well as encourage comments and discussions. STREMIS should provide visual stimuli that support reminiscence and storytelling and facilitate an engaging family social interaction experience for Taiwanese that have little access to relevant historic materials.

The research described in this dissertation makes contribution toward supporting an engaging family social interaction experience with assisted reminiscence. The proposed design utilizes visualization of past neighbourhoods, created using topographical data and non-photorealistic rendering, to create visual stimuli that evoke reminiscence and elicit personal stories to facilitate intergenerational storytelling. The visualization method proposed in this research also makes contribution toward solving the problem of unavailability in relevant reference materials that can be used to stimulate reminiscence for some people, as most researches in assisted reminiscence rely on the use of existing materials. This visualization of virtually reconstructed past place is the original attempt of utilizing 3D CG and non-photorealistic rendering to support reminiscence and storytelling as a mean to facilitate engaging family social interaction experience for Taiwanese families.

Chapter 3

Design

This chapter introduces STREMIS (Space-Time REMiniscence Impetus for Storytelling), a visual content designed to evoke reminiscence of past experiences and encourage sharing of personal stories to facilitate an engaging family social experience. STREMIS provides its user a collection of artistically rendered images depicting various views of the neighbourhoods where they used to live. These images allow the users to revisit their past neighbourhoods, see different angles of the past environment, and recall experiences, stories, and daily anecdotes that occurred at these places. The images are rendered using an artistic expression similar to that of Chinese ink wash painting, which visualizes the users' past neighbourhood in an ambiguous and monochromatic style that provide visual hints about the composition and space of the past. The ambiguous artistic depiction of users' past neighbourhood encourages recall of personal experience and knowledge, and invites communications about the depiction and personal stories.

STREMIS is designed for Taiwanese families of which members from different generations do not live together or see each other on daily basis. This type of living arrangement has become more common partly due to the socioeconomic development that incentivize family members to migrate separately and seek for opportunities elsewhere. The geographical distance resulted from this migration in time may reduce frequency of face-to-face interaction, conversational topics, and may eventually increase a sense of emotional distance between family members. This sense of emotional distance may also affect the engagement of conversation in the event of occasional face-to-face meeting. The design of STREMIS aims to stimulate

recalling and sharing of personal stories during the precious time of family gathering as a mean to support an engaging intergenerational storytelling experience.

This chapter begins by describing the pilot research process that led to the concept of STREMIS. This includes ethnographic researches on family intergenerational communication to discover issues involved in intergenerational interaction between family members who meet occasionally, as well as behaviours that may inspire the design that facilitate the interaction. Then the preliminary concept of STREMIS is introduced, along with the motivation of the design objectives. A series of prototype development and exploratory researches that helped refining the visualization method and user experience will also be described. These will lead to the introduction of STREMIS, its components, and the process of virtually visualizing past neighbourhoods with limited source materials.

3.1 Pilot Ethnographic Research

The motivation of this research came from a simple curiosity: “What was life like back in the past?”. The twentieth century has been a turbulent time socially, politically, technologically, and globally. Although we can learn historic events and descriptions of the past living conditions in publicized history materials, it is difficult to grasp on the personal experience of how our older family members spent their earlier lives during those times, what daily lives were like, what personal anecdotes happened, and how our families and communities came to be the ways they are today. The curiosity led to other questions, “why don’t we communicate more with the older generations?” and “how can we support the older generations to tell more stories about the past?”. In order to explore these issues, we began this research with a contextual inquiry to learn more about intergenerational communication in Taiwanese family gathering settings.

The concept of STREMIS was developed through the ethnographic research method of conceptual design process suggested by Hugh Beyer and Karen Holtzblatt

in the book *Contextual Design: Defining Customer-Centered Systems*.[177] The process involved fieldwork, thick description and model analysis to provide a background knowledge of the context in which problems and inspirations may be discovered to support the design. The fieldworks were conducted with different families to examine the intergenerational interaction behaviours between members of different generations at family gathering settings. The objective is to observe how storytelling take place in such setting and investigate the use of artefacts that support the activities. The observations were recorded into thick descriptions for flow, sequence, artefact, physical and cultural model analyses to support the ideation of design that can facilitate the storytelling activity. This analysis the supported the development of design concept of STREMIS.

Contextual inquiry often begins with fieldwork to investigate and learn about specific process on the site where the process take place. Beyer and Holtzblatt suggests that field data-gathering can support the discovery of implicit aspects of the process may be invisible or unnoticed by the participants involved in the process. [178] Fieldwork provides designers an opportunity to gather data that may be difficult to elicit from conventional interviews as the interviewees may not necessarily be aware of the detailed routine habits or behaviours in a given setting. In the case of research, fieldwork provided us the opportunity to observe how family members of different generations interact and communicate in social gathering settings. The goal was to gather real life data on intergenerational communication and storytelling and investigate how artefacts were used during such settings.

This pilot ethnographic research conducted fieldwork studies with three families. Due to the private and intimate nature of family gatherings, the families selected were close acquaintance of the researcher. This is done so to avoid creating the guest/host relationship and formalities as the presence of a stranger in a family

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[177] Hugh Beyer and Karen Holtzblatt. *Contextual Design: Defining Customer-Centered Systems*. Morgan Kaufmann Publishers. 1998.

[178] Beyer and Holtzblatt. *Contextual Design: Defining Customer-Centered Systems*. 1998.

gathering setting may alter the casual interaction and communication behaviours among the family members. The intimate relationship between the researcher and the family allowed comfortable and natural interaction between members during the gathering and, and collection of honest and open responses from the fieldwork studies. The fieldwork studies were held on weekends at occasions where family members who lived separately would get together at social gatherings. For some of the family members, the gatherings were rare opportunities to socialize with other members of the family.

3.1.1 Fieldwork at Family A

Family A is a Taiwanese family of three which consists of a father (Father A, age 84), a mother (Mother A, age 72) and a son (Son A, age 39). Father A is a retired pharmacist, who has spent his youth and attended high school in the north eastern region of Japan, and has continued mastering his Japanese language skill throughout his life. Mother A is a housewife who used to support Father A at his drug store. Son A is a pharmacist who got married a few years ago. The family emigrated from Taiwan to Canada over twenty years ago, where Father A and Mother A spent retirement life, and Son A received college education. For the past 10 years Son A has been living and working full time in Taiwan as a pharmacist and visits his parents in Canada occasionally. The field work was conducted on a Sunday evening between 8pm and 9:30pm at Father A's home in Canada during Son A's week long visit.

Thick Description of Family A

Family A is a devoted family of the Christian religion. After visiting the church in the Sunday morning, in the afternoon Father A usually would take a nap and Mother A would shop for groceries. Sunday evening after dinner is usually a time for family or social gathering either privately or with friends. Due to Father A's age, the gathering usually take place at his house. On the fieldwork day, Mother A made tea and placed fruits and biscuits on the dinning table to make ready. Father A, who sat in the dinning table, talked to Mother A, who was preparing for more food in the kitchen, about

anecdotes from the church meeting in the morning. Son A had gone to his room upstairs to use the internet to contact his wife, who stayed in Taiwan due to work. Father A seemed to become a bit bored waiting for his family to come to the table, and talked to the researcher about the fruit on the table, “These common figs are grown from our backyard. Try one, they are very delicious!” Mother A followed from the kitchen, “Even the local birds like them. Every year they make a mess of the trees. But the trees grow more than enough common figs for us and the birds, we always have leftovers for friends. I will pack you some to take home tonight.” Father A added, “Yeah those trees have been here before we bought this house over twenty years ago. I think the previous owner was Italian. They probably planted the trees.”, he continued “There are many Italians living in this neighbourhood. The next door neighbour is Italian. They share their cooking with us sometimes. Very friendly people.”

Son A came down stairs to the dinning room and joined the table after about 20 minutes. “Is everything okay?” Father A asked. “Yes, she is getting ready to go out for lunch.” Son A asked. The three talked about how things were going for Son A in Taiwan, and asked about the business at the drug store and home life with his wife. Son A did not seem to be enthusiastic talking about his situations in Taiwan, as Father A sometimes commented on Son A’s work situation in Taiwan with a critical tone. The conversation would pause every now and then. Perhaps wanting to change topic, Mother A suddenly said “Your father was watching a TV show about Yamagata Prefecture this afternoon.” “Yamagata Prefecture? On TV Japan? (Canada’s Japanese channel)” the son asked. Father A replied “Yes. It was a show talking about Oshin (A serialized Japanese TV drama released in the 1980’s), some of the stories took place in Yamagata Prefecture.” “I have not had a chance to watch it. That was where you went to high school wasn’t it?” Son A asked. Father A got up from the dining table and went to one of the kitchen counters, which had several Japanese books, dictionaries, and documents neatly organized, to take a map. Father A unfolded the map on the dining table, it was a map of the entire Japan. “I don’t have a Yamagata Prefecture map… Here is Yamagata Prefecture.” Father A circled on the map with his finger, “This map is too big….” Father A put on his glasses and started concentrating

on the map. “It was pretty cold in the winter right?” the mother asked. “Yeah, but we wore shorts in the snow. We had snow fights too.” Father A answered as he gave up looking at the map. “I had fights with the local boys too.” Father A added, “As a Taiwanese in Japan at that time, you got to fight to win respect.” Father A said with a half joking and half proud tone. Son A replied “Is that so…” with a smile. Mother A got up to prepare some cooking in the kitchen. Father A continued, “I also picked up Kendo at school over there…”, Mother A suddenly chimed in, “Speaking of Kendo, when are you going to use those Kendo armors? They’ve been sitting in the basement for years!”. Father A replied “When I have time…”. The dinning room turned into laughter. The conversation continued, as Mother A returned to the dinning table with a bowl of congee for Father A.

Summary of Family A

In this fieldwork we observed some notable phenomena. (1) Father A enjoyed talking about past experiences. Through out the fieldwork period, when Father A shared stories about the common figs, Italian neighbour, personal experience as a pharmacist, and his youth in Yamagata Prefecture, the tone in his voice seemed to be more focused and engaged. (2) Father A also seemed to assume the traditional father’s role as the central figure of the household. During the fieldwork, Father A seemed to enjoy interacting with other and drawing attention by sharing interesting stories. His critical comments about Son A’s work situation, seemed to be motivated by care and concern of his son’s wellbeing and eagerness to provide assistance as an experienced pharmacist himself. (3) From the observation of the conversation about the son’s work situation, Son A’s less enthusiastic reaction is perhaps a reflection of the cultural distance between the generations, as Father A’s comments and advices might not be applicable to Son A’s situation in today’s workplace. Instead of rebutting his father’s comments, Son A’s act of listening is perhaps a polite response out of respect of his father’s old age. (4) Mother A seemed act as a facilitator of the social interaction motivated to maintain a harmonious and enjoyable time of family gathering. She tirelessly prepared snacks and food for family members, and contributed supportive

comments during conversations. (5) The map of Japan was an artefact used by Father A to support his explanation about life at Yamagata Prefecture. The map of the entire landmass of Japan was unfortunately not ideal to support more detailed storytelling. The map, along with other Japanese materials were stored on the kitchen counter easily accessible from the dinning table, the place where socialization usually take place, might be an indication that Father A use these materials often in the dinning room. However, during the storytelling about Yamagata Prefecture, Father A did not take out any other supporting materials other than the map. This might suggest that he did not have other materials of reference, or the materials might be stored in not easily accessible manner. s

3.1.2 Fieldwork at Family B

Family B is a Taiwanese family of three generations. The members consist of a grand father (Grandfather B, age 88, retired), his son (Son B, age 56, retired), the son's wife (SonWife B, age 52, housewife), a granddaughter (Granddaughter B, age 24, student), and a grandson (Grandson B, age 20, student). Grandfather B lives alone in a large apartment complex in the outskirt of Taipei. His daily life is taken care of by a housemaid who visits daily in the morning to clean the house and prepare for meals. Son B, his wife and his two children live in a separate apartment complex about 15 minutes away by driving. Son B and SonWife B generally visit Grandfather B a few times a week, while Granddaughter B and Grandson B only visit Grandfather B a few times a month, depending on school and social life schedule. Grandfather B also has a daughter (Daughter B, age 60) who is married to (DaughterHusband B, age 64). The two have two children, one works in Taiwan while another works abroad. live about one hour away by driving, and visit Grandfather B a few times a month. The fieldwork was conducted on a Saturday afternoon at an occasion when both granddaughter and grandson, as well as Daughter B and DaughterHusband B were available for visiting Grandfather B at his place between 4pm to 6pm.

Thick Description of Family B

Grandfather B opened the door to welcome Daughter B and DaughterHusband B with a happy greeting. Due to travelling abroad, Daughter B and DaughterHusband B had not visited Grandfather B in about two months. DaughterHusband B brought some snacks bought abroad as gift for Grandfather B. The three sat on sofas in the living room, where the television had been turned on since before the arrival of the daughter and her husband. The television was showing an all news channel. After a short greeting, Grandfather B started sharing things that he had just learned from the news this afternoon with DaughterHusband B, while Daughter B went to the kitchen to check the meal that the housemaid had prepared. The entire interaction was done in Taiwanese language.

After a short while, Son B and his wife and children arrived. Everyone sat in the living room after a brief greeting. "How's school?" Grandfather B asked his grandchildren with a heavily Taiwanese-accented Mandarin. "It's alright." The grandchildren replied in Mandarin. "Granddaughter B is preparing to do a student exchange in the U.S., and is quite busy with the application these days," SonWife B added using Taiwanese. "Which U.S. school are you going to?" DaughterHusband B asked in Mandarin. "I am not sure, maybe in the East Cost." Granddaughter B replied his uncle. "Going to the U.S. is worrying. Have you seen the news? It's quite a mess over there (crime)!", Grandfather B commented in Taiwanese. "Don't worry. It'll be fine. TV news always exaggerate things." Son B replied his father in Taiwanese. After a bit of discussion about some current events in the U.S., the topic turned to Daughter B's two children. Grandfather B asked about their work situation, when they will get married, and when they would come for a visit. The conversation topic then moved on to talk about anecdotes of some of their friends. Throughout the conversations, which was conducted mostly in Taiwanese, Granddaughter B and Grandson B sat and watched quietly most of the time, and occasionally asked their parents what the conversation was about in Mandarin, ate snacks on the table, or played with their mobile phones.

As dinner time approached, the family started discussion where to go for dinner. At one point, Daughter B asked Grandfather B how the food prepared by the housemaid had been? “Not bad, but not as good as your mother’s.” Grandfather B replied. The grandmother had passed away almost 10 years ago. “She really missed your son”, he said to Daughter B, whose son was unable to see the grandmother final moment due to work. The living room went silent for a moment. Grandfather B got up and took out a photo album from a drawer under the TV. The family gathered to take a look. Most of the photographs were Granddaughter B and Grandson B’ youth taken in the late 90’s and early 2000’s. The grandmother appeared in some of the photographs. “Here I only have these photographs. Older ones were left in the south.” Grandfather B commented. Grandfather B and grandmother moved to Taipei about 15 years ago from their old home in southern Taiwan to be closer with their children. The old home was never sold and many of his belonging were still left there. “This is when we visited S. Japanese restaurant when your grandma was still here. All of you came back for this gathering.” Grandfather B said while pointing at one photograph. They looked through the photographs and commented on when and what the events were for a while. “Look how fast you two have grown!” Grandfather B said to his grandchildren in his Taiwanese-accented Mandarin with a big smile on his face. The grandchildren laughed and continued to look through the photo album.

Summary of Family B

The fieldwork at Family B made a few notable discoveries. (1) Grandfather B was enthusiastic about talking to his families. He might had felt lonely or bored from living alone, thus had the television turned on to watch 24-hour news. He was eager in sharing his findings learned from TV news, perhaps in attempt to kept himself updated and create topics for conversation. (2) Granddaughter B and Grandson B were very passive in interacting with Grandfather B. One reason might be due to the linguistic distance between the two generations, as Grandfather B’s primary language is Taiwanese and capable of limited Mandarin, while the grandchildren are monolingual in Mandarin. There were also some tendencies for the grandchildren’s parents to speak

for them, as evident when SonWife B talked about the student exchange application. Direct interaction between Grandfather B and his grandchildren were few, and most conversation were delivered through SonWife B or Son B as translators or proxy. (3) Despite the language differences and lack of direct interaction, Grandfather B showed concern and care for his grandchildren's wellbeing, even for those who were not present that day. (4) The topic of cooking reminded Grandfather B of his late wife. He actively took out an album of old photographs to share with his family, perhaps in attempt to unify everyone and remember the grandmother. The album contained photographs mostly from the time when he began to live in Taipei. He had older photographs but they were left in his old home in southern Taiwan. However, the photographs available that day did not show the earlier lives in southern Taiwan.

3.1.3 Fieldwork at Family C

Family C is also a Taiwanese family of four generations. It is a big family in which some of the members still live in an extended-family arrangement in the same housing unit. At the time of the fieldwork, the participants consisted of a grandmother (Grandmother C, age 94), her son (Son C, age 67), her daughter (Daughter C, age 58), her oldest grandson from her daughter (Grandson C1, age 38), another grandson from her son (Grandson C2, age 28), a great grandson from Grandson C1 (GreatGrandson C, age 2). Grandson C1, his wife and son live with Grandmother C in her house. Daughter C also lives with Grandmother C in her house during weekdays as a caregiver, while also taking care of GreatGrandson C because Grandson C1 and his wife are busy working on weekdays. Son C lives about 30 minutes away by driving, and visits Grandmother C once every few days. Grandson C2 lives abroad and visits Grandmother C once a year. The fieldwork was done at Grandmother C's house on a Sunday morning between 10am to 11:30am.

Thick Description of Family C

Grandmother C and Daughter C welcomed Son C and Grandson C2 in the living room as they entered the house. Grandmother C was happy to see Grandson C2 because it

had been over a year since his last visit. Grandson C2 attempted to greet using Taiwanese but the awkward pronunciation made everyone laugh. The four sat in the living room. Grandmother C asked Son C and Grandson C2 whether they had breakfast, or wanted to eat anything, and made several breakfast suggestions which she would buy from the market nearby. Son C and Grandson C2 declined, and Grandmother C went to the kitchen and returned with a basket of fruits. “Have some, these are in season, very delicious.” Grandmother C said in Taiwanese. Grandson C came out from his room with GreatGrandson C to greet Son C and Grandson C2. Daughter C took GreatGrandson C to sit on her laps as the family talked.

The conversation was conducted in mostly Mandarin to accommodate Grandson C and Grandson C2 who, although could comprehend basic Taiwanese language, were unable or nor accustomed to speak the language. The conversation began from talking about Grandson C2’s recent marriage and work life abroad, to Grandson C’s recent vacation in southern Taiwan with his wife and son. Grandmother C, who only understood some basic Mandarin vocabularies and expressions, watched her family interact with each other with a smile, and occasionally asked Son C and Daughter C what they were talked about.

The television in the living room was on, and Grandson C flipped through the channels as the other family members paused to eat fruits. Soon he stopped at a channel that was playing a tourism related show. The show talked about the riverside parks in Taipei recommended for weekend family activities. At one point, Grandmother C said in Taiwanese, “This was the place where they killed people with guns. Gun shot could be heard.” while looking at the image on television. Not fully understood, Grandson C2 asked his father what grandmother had just said. “This area outside the river levee used to be an execution field where Kuomintang shot political prisoners during the White Terror.” Son C explained in Mandarin. “It has been turned into a nice park, and a part of Taipei’s cycling scenic route.” Grandson C added. Daughter C also jokingly added, “Some said you might run into things you are not supposed to run into at night.” Grandmother C began to share the stories that she heard during the White Terror and early Martial Law period, about acquaintances who got

into trouble during those times. Although Grandson C2 could not fully understood the stories told in Taiwanese, he listened with enthusiasm as his father explained every now and then. Eventually, the stories led to other non-political related conversations about anecdotes of other acquaintances.

Summary of Family C

From this field study, several notable points were discovered. (1) Grandson C2 seemed to be the centre of attention in this social gathering. This is possibly because that he has been away from the family for a long time. (2) Despite the obvious linguistic distance between the grandmother and the two grandsons, both seemed to be enthusiastic in communicating with each other. Daughter C and Son C would naturally assume the role of translator when messages could not be understood. (3) Grandmother C seemed to be happily sat aside watching other family members socialize in Mandarin, despite of her very limited comprehension skill in the language. (4) The image of the riverside park on television evoked Grandmother C's memory about historic situation during her youth, and naturally triggered her to share the stories she experienced and heard during those period.

3.1.4 Integrated Findings from Fieldwork Researches

The contextual design process proposed by Beyer and Holtzblatt suggest the fieldwork findings to be analyzed using five models to create a complete view of the user and his or her context. [179] These models are flow model, sequence model, artefact model, physical model, and cultural model. In this research we use these models to analyze the intergenerational storytelling behaviours observed from the fieldworks in family gathering settings.

[179] Beyer and Holtzblatt. 1998.

Communication Flow

The flow model refers to the flow of communication, responsibilities and artefacts required to complete a task. In this research we examined the flow of communication observed in the fieldworks. Although communication and artefact flow in social gathering setting is less structured than in a work environment, we still observed some patterns. In both Family A and B, communication topics tend to be initiated by the central figure of the household, or older family members. Father A and Grandfather B, both in the age of 80's, seem to initiate the most topics during the fieldwork observations. In Family A, Mother A also initiated or changed topic during conversations in attempt to maintain harmony and enjoyable atmosphere. In Family B, the son, daughter and in-laws also initiate some topics or contributed comments to ongoing topics. In both Family A and B, the youngest members seemed to be at the receiving end of questions or critical comments. In Family C, however, the pattern seemed to be different, as topics could be initiated by anyone. This might be because the central figure of the household, Grandmother C, takes on a traditional female role of being a supportive figure rather than an authoritative figure. Nevertheless, just as other household central figures in Family A and B, once Grandmother C initiated a topic, other family members would follow.

Storytelling Sequence and Artefacts of Memories

The sequence model is an analysis on how sequences are triggered and for what intent, and might be obstructed in the process. The artefact model is an analysis on the use of tools, tangible objects or things with information that support one's action to achieve an intent. In the research we examined how communication would be triggered, how certain artefacts would trigger storytelling sequence, and what elements might prevent the storytelling sequence to continue or become more engaging. From the fieldworks we observed that conversations can be initiated, and topics can be changed by many different triggers, such as a simple initial greeting, asking about one's current condition, certain aspects of an ongoing conversation, etc., as one topic may lead to another. However, most conversation topics circled around

sharing knowledges of recent anecdotes rather than experience from the past. In Family A, the father's reminiscence and storytelling of his youth in Japan was triggered by the conversation about a TV show on Yamagata-Prefecture, and subsequently triggered by the map that he took out to support the storytelling process. The map however was not ideal in supporting further storytelling as its scale could not help Father A to find something he was looking for. In Family B, the grandfather's reminiscence of his wife was triggered by the conversation about the food that the housemaid made, and subsequently further triggered by the photo album that he took out. The photo album however only contained limited photographs from recent years as older photographs were left in his old home elsewhere. This somewhat limited the conversation to centre around the events occurred during the time when the photographs in the album were taken. In Family C, the grandmother's reminiscence and storytelling of political execution and acquaintances' troubles that occurred near where she lived was triggered by the present image of the execution filed appeared on the TV screen. It may be difficult to predict what would trigger reminiscence and storytelling about personal past, as everyone holds different memories and experiences. However, the fieldworks showed that place (Yamagata-Prefecture and Taipei's riverside park), or content about familiar place might be an effective trigger. The fieldworks also highlighted that reminiscence-supporting artefacts might not be available or sufficient for any families.

Physical Settings of Family Gatherings

The physical model is an analysis of the physical surroundings in which the activity takes place. In this research we examined the physical space in which the family gathering took place. The gathering took place in the dinning room for Family A, and living room for Family B and C. This difference might due to the cultural and architectural differences between homes in Canada and Taiwan. In many Canadian homes the kitchen and dinning room is generally one open space for collaborative cooking activities and is considered the social centre of a home. On the other hand, in Taiwanese homes kitchen is generally a semi-enclosed space designed to prevent high

heat and smog from Chinese style cooking to leak into the living space, thus the dinning room and living room is usually one open space for socialization. Regardless of the function of the space, the fieldworks showed that the reminiscence-supporting artefacts (map, photo album, TV) that initiated or supported the storytelling were located within close proximity to the social gathering place.

Cultural Distances between Generations

The cultural model is an analysis of the invisible influences that shape the way activities are conducted. In this research we examined the cultural background of family members that shaped the way storytelling was conducted in a social family gathering setting. In both Family B and C, we observed that language differences between grandparents and grandchildren generations can be a barrier to direct interaction. However, the middle generation, which is generally bilingual, would naturally facilitate the communication as translators. Age difference may also affect the participation of younger family member in a conversation, as observed in the passiveness of grandchildren in Family B. This may be due to the difference in interests, value and shared experience developed in different time period. In Family A we also observed that older generation's concern of the younger generation might also be a turnoff to an engaging intergenerational communication experience with unwanted attention and advices that are not applicable today. However, despite the barriers and cultural distances, in the fieldworks we observed that storytelling would connect family members.

In summary, from the fieldwork researches we found that seniors care about the wellbeing of their younger kin and are enthusiastic about interacting with them. In a family social gathering, older family members tend to initiate the conversation while the younger member tend to listen more. A conversation topic can be triggered by many things such as a news story, another conversation, or an artefact. Most conversation topics tent to circle around sharing of recent knowledge rather than past experience. Artefacts that can trigger reminiscence and storytelling may not necessarily be available or ideal in the setting of family social gatherings. However,

content about place may have potentials in evoking memory recall and personal story sharing. Despite the cultural distances and communication barriers between family members of different generations, seniors' sharing of past personal experience could facilitate

3.2 Concept

The concept of this research is to support reminiscence of past personal experience for older adults, by creating visualizations of their past neighbourhoods as visual stimuli to evoke memory recall and encourage storytelling. These visualizations depict sceneries of different corners in the neighbourhoods in a painterly style, allow older adults to revisit the places where they grew up or spent their youth, and provide clues for them to review life journey or rediscover forgotten memories. The recalled personal experiences provide older adults source of narratives to share with younger family members as a mean to engage in intergenerational interaction.

The proposed concept is designed to support Taiwanese seniors to interact with family members in a family social gathering setting. As our ethnographic research and literature review suggest, the growing geographical, linguistic and cultural distances between different generations can reduce the frequency of intergenerational interactions, and create difficulties to engage in direct communications. Although seniors are concerned about the wellbeing of their younger family members, the way they demonstrate care and intimacy by providing advices and comments on situations of others may not be well received because older knowledge and value may not necessarily be applicable today. Casual conversations that involve exchange of information on ones' recent status are also unengaging, and may be perceived as over caring. The reduced interaction frequency can make face-to-face communication difficult.

The ethnographic research and literature review revealed that by sharing autobiographical memory and stories from the past can be an effective way to connect seniors with the younger generation. During our fieldwork we observed that despite

the language gap and cultural distance, seniors' personal stories can draw the attention of family members and create conversations about past to support the development of empathy. As Elizabeth Stone suggests, family stories play important role in shaping our identity and our sense of place in the world; giving us values, inspirations, and incentives; affecting our choices in life; and connect generations as family legacies.[180] Neal Norrick also suggests that retelling of familiar stories serves purposes beyond information exchange and problem solving, but also support fostering group rapport, ratifying group membership, and conveying group values.[181] Storytelling is one of the primary ways that family members create a sense of individual and group identity, connect generations, and establish guidelines for behaviour. [182]

The recalling of past personal experience, or reminiscence, is the fundamental step in storytelling to provide source of personal narratives. Reminiscence is triggered by certain stimuli that evoke past experience. In the fieldworks we observed that sometimes certain conversation topics, photographs, or images on the television screen can spontaneously trigger reminiscence. Our literature reviews also revealed that old photographs, past audio and visual contents, and other memorabilia have been used to assist reminiscence. However, materials that are relevant to one's past experience, may not necessarily be available because record might not have been made, or materials could be damaged or lost. Place has also been suggested as an effective trigger for reminiscence. In fact, our past experience, or episodic memory, is both psychologically and physiologically connected to the place where the experience was acquired. Thus place may provide cues to trigger reminiscence and support storytelling. However, places and landscape can change over time, especially

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[180] Elizabeth Stone, (2004). *Black Sheep and Kissing Cousins: How Our Family Stories Shape Us*. New Brunswick,NJ: Transaction.

[181] Neal Norrick, "Twice-told tales: Collaborative narration of familiar stories", Language in Society 26(02):199 - 220 · June 1997. DOI: 10.1017/S004740450002090X

[182] Allison R. Thorson, Christine E. Rittenour, Jody Koenig Kellas, & April R. Trees, "Quality Interactions and Family Storytelling", *Communication Reports*, Vol. 26, No. 2, July–December 2013, pp. 88–100.

in rapidly urbanized areas where rural farm lands and suburban communities can transform into high density cities in a short period time, such as in the case of the outskirt areas surrounding Taipei. The places that contained seniors' memories of the past may have become unrecognizable or disappeared today. Therefore, in this research we propose using visualizations of virtually reconstructed past neighbourhoods as visual stimuli to support reminiscence.

The visualization and reconstruction of disappeared past places face a number of challenges. First, the lack of reference material means accurate depiction is impossible. Reconstructing a realistic large environment requires detailed data creation and resources, which can be both laboriously and computationally unfeasible with current technology. And finally, visualizing a past place with uncertainties to convey a sense of realism may be difficult to achieve. One potential solution is the use of non-photorealistic rendering (NPR). Images depicted using artistic, hand drawn and ambiguous visual qualities have been suggested to stimulate the use of mental projection of past experience to obtain meaning from the perceived stimuli, as well as to encourage comment and discussions. NPR visualization of places have been used present theoretical interpretation of historical landmarks, or support design discussion of architectural projects. However, the effect of NPR visualized modern past places in evoking reminiscence and storytelling has yet to be examined. In the next section we introduce the exploratory design process of realizing NPR visualization of past neighbourhoods that assist reminiscence for Taiwanese seniors.

3.3 Design Process

In this section we describe the design process of creating visualizations of past neighbourhoods to support reminiscence for Taiwanese seniors. There are three major challenges in reconstructing disappeared places: (1) Lack of accurate reference materials, (2) large amount of labour and computation requirement, and (3) conveying a sense of realism to evoke reminiscence with uncertainties in the depictions. The use of non-photorealistic rendering (NPR) in visualizing past place have the potential to

solve these issues. However, NPR is not any particular style of visual expression, and can take any artistic, abstract or ambiguous stylistic inspirations. Also, the effect of using NPR visualization of past place to evoke reminiscence and storytelling has not been explored. Therefore, we began the design process by conducting exploratory design studies using several prototypes.

For this exploratory design study, we adopted *design thinking* process to experiment the visualization process and examine our initial concept. Design thinking is a description of the creative process and activities that designers engage in order to solve a specific problem. There are a few variations of the description about the process by different design thinking advocates and institutions, but generally they explain the iterative cycles of three major phases of design: inspiration, ideation, and implementation.[183] The inspiration phase involves getting to know the root of a problem, and this can be achieved through observation, participation in the activity where problem exist, interview, and other ways to empathize with the people who are facing the problem. The ideation phase involves taking the inspirations to generate ideas for a solution, this can take the forms of brainstorming, body storming, Power of Ten, focus group, etc. The implementation phase involves taking the ideas to create a prototype, which can be a mock-up device or service or a fully functional one off product, and conduct experiment with the people involved in the problem to see how the ideas improve the situation and obtain feedbacks as inspirations for the next cycle of ideation and implementation process. The following introduces the design decisions and findings in each of the inspiration, ideation and implementation phases in two cycles of prototyping to develop the visualization process for STREMIS.

[183] Tim Brown, "Design Thinking", *Harvard Business Review*, June 2008

3.3.1 Prototype I

Ideation:

The primary data we gathered through the fieldwork studies, as described at the beginning of this chapter, provide us the initial inspirations for ideation of the first prototype. We noted a number of artefacts that supported memory recall (place, map, food, photo album, image on TV) were used. This phenomenon reflects the motivation of using memory-stimulating materials in assisted reminiscence projects described in the literature review of this research. We also observed that the available artefacts were limited. For example, we observed a senior man attempted to find something on a map, but due to the inadequate scale of the map he was unable to find what he was looking for, which might have been able to support the ongoing storytelling. Another example was the missing of older photographs which might have prevented an old man from telling more stories. This is an indication that relevant memory-stimulating materials might not be available or accessible for anyone. In order to support reminiscence for these individuals, alternative memory stimuli need to be used. One source that may be considered is the places where seniors have spent time in the past. Studies suggest that personal identities are developed in relation to places where they spent time in[184], and people development attachment to places.[185] Neuroscience researches also revealed that episodic memories are linked to the place where the experience and context is acquired. [186] [187] [188] Therefore, we decide to experiment with place related stimuli for this research.

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[184] Proshansky et al., "Place-identity: Physical World Socialization of the Self".

[185] Scannell and Gifford, "Defining Place Attachment: A Tripartite Organizing Framework".

[186] O'Keefe & Dostrovsky. "The Hippocampus as a Spatial Map." 1971.

[187] Smith & Mizumori. "Hippocampal Place Cells, Context, and Episodic Memory". 2006.

[188] Todd & Bucci, "Retrosplenial Cortex and Long-Term Memory: Molecules to Behavior", 2015.

Prototyping:

As an initial experiment to use place related stimuli, we decided to utilize historic photographs of heritage and landmark architectures, which are more likely to have been publicly archived. Although historic photographs of seniors' past neighbourhoods might not be available, we wanted to observe what effects historic photographs of landmarks that were located near their neighbourhoods would have on evoking memories. Being in Vancouver, Canada at the time, we chose a small public park, Victory Square, located in the downtown area as test site. Victory Square is surrounded by a mixture of modern and historic buildings, and was the commercial centre of the city in the past. We collected historic photographs of these buildings from the city archive as the test stimuli. In order to allow the viewers to understand the location of each individual buildings and ease of selecting photographs, we created an interactive map that allowed users to select different photographs by touching their corresponding locations on the map displayed using a tablet device. This prototype is referred to as TimeFrame.

Figure 3-1: Prototype I: Archived photographs of heritage buildings.

User Study:

The user study was conducted with an older couple, aged 64 and 60, who have lived in the area for more than 20 years. I decided to conduct the study using participant observations approach in two different settings. The goal was to see if there would be any differences in their reactions: Indoor in the comfort of the couple's home; and outdoor at the actual physical location. The initial study was conducted indoor at the couple's home in a casual social setting to examine what kind of reaction these historic photographs would evoke. During a casual conversation, TimeFrame was presented to them along with explanations of its photographic contents. The couple showed some curiosity and interests about the past appearances of the buildings, and expressed that they were not aware of the history of Victory Square. They did not talk about any personal stories or past experiences, whether related to the place or not. I then took the couple to the park for a relaxed stroll and observed if the reaction would differ. While walking around Victory Square and being surrounded by the buildings, the couple was interested in comparing the buildings in the present and the past by reviewing the historic photographs in TimeFrame. At north east corner of Victory Square, the man looked over toward Hasting Street, and talked about coming to this area during the Christmas holidays in 1992. Shared a story about visiting a department store called Woodward's to shop for a Christmas Tree and decorations for the family's first Christmas in Vancouver. Woodward's department store was closed in 1993, and the building was dismantled in 2006. The original location was not adjacent to Victory Square but about 100 meters away. The department building's photograph was not included in TimeFrame. At another point, the man expressed interest in seeing old photographs of the city's downtown sports stadium, which had been remodelled extensively shorty before this study. The stadium was also not visible from Victory Square, but a few hundred meters away.

Afterward the study followed up with a semi-structured interview to learn about the couple's experience. They expressed that during the past 20 years they did not visit the area around Victory Square often, and had never paid attention to the appearance of the buildings around the place. They also expressed that visiting the

park was a refreshing experience which brought back the memory of Christmas in 1992, even though the now disappeared department store building was not adjacent to the park. Finally, they commented that the entire experience was pleasant, and was fond of the Christmas memory, however the photographs themselves did not present much relevance to them.

The study revealed several notable points summarized below. At the indoor setting, the photographs did not evoke any storytelling about personal past experiences, however being physically on-site evoked the story about Christmas 1992 that took place near the site. The frequency of visits and occurrence of emotionally engaged related to a place in the past may be an important aspect in the reaction to the visual stimuli. The historic photographs, each focused on capturing the detailed appearance of one particular building, might not had effectively conveyed the sense of space around Victory Square to stimulate the reminiscence of the event that occurred near by.

3.3.2 Prototype II

Inspiration:

The study of the first prototype provided some inspirations for the next iteration of the design process. The previous prototype presented a place that was not visited often by the audience, this may be one of the reasons why the photographs did not evoke any stories. However, despite the infrequent visit, being physically at the place evoked an emotional Christmas story that happened near the place over twenty years ago. One inspiration from this observation is to use visual stimuli that convey the sense of the space more effectively. Another inspiration came from the audience's desire to see the sport stadium in its previous state. The third inspiration came from the situation where the audience may have certain emotional stories related to a particular place, however before such memory is evoked (by the place itself, representations of the place, or other stimuli), he or she may not be aware of the possession of such memory.

Ideation:

From the inspirations we developed three requirements for the next design iteration: (1) In order to provide a better sense of space, a visual representation that has wide viewing angle and captures greater aspect of the scenery is needed; (2) a visual of the place in its past state may be better suited in creating the sense of space in the past and may be more desirable for audience's curiosity; and (3) visuals that represent different angles or different locations in one area may evoke memories from forgotten places. In order to meet these requirements, I came up with the idea of reconstructing past place using 3D CG, which allows any viewing angle of any location within the reconstruction.

This iteration of design research serves two purposes. The first is to develop a process of reconstructing past place virtually with available source materials. Although the field of virtual heritage have developed numerous reconstruction projects, there are different process depending on the project's purpose and available historic reference materials. Therefore, using the development of this prototype as an opportunity we explored the types of source materials available and how to utilize them for reconstruction. The second purpose is to examine whether such virtual reconstruction can stimulate reminiscence and storytelling. Although there are numerous projects of reconstructing past place, they have been created for the purposes of education, entertainment, archaeological research and preservation, etc., but none have been attempted to support reminiscence and storytelling. Thus we will explore the potential of using virtual reconstruction of past places as a novel visual stimulus for reminiscence and storytelling.

Prototyping:

This prototype was created for the target user of this research, which is Taiwanese residents who lived in suburban areas where visual records are few or unavailable. We selected a man in his late 60's and identified the location of his residence in the early 1970's located in a suburban area south of Taipei. After extensive research we discovered an aerial survey photograph covered the area from 1974 was available

from one of Taiwan's national GIS databases provided by Center for GIS, RCHSS, Academia Sinica. When compared to today's aerial photograph of the area, it is evident that the area has been dramatically changed, not only the old residence no longer existed, but the land layout and roads have been altered. Furthermore, the previously large open fields have now been replaced by high density high rise apartment complexes and elevated highway roads. Also, we were unable to find any photographs capturing the residence or the surrounding area from 1970's. The only available source material was the 1974 aerial survey photograph.

The first step was geo-referencing the aerial survey photograph with modern map, such as Google Map. This helped us to confirm the location of the residence in relation to the landscape of today, and also set the 1974 survey photo to scale. The second step was to examine the topographic photographic and interpret the residence's shape, as well as its surroundings. Judging from the length of the shadow of the residence in comparison to the length of the shadow of a traditional Chinese house (which is usually one story, 2.5m to 3m tall), we determined that the residence was roughly 7m to 8m tall. We also determined the footprint of the residence and surrounding buildings by using the shapes of the roofs. The roadways were also identifiable to be placed on a CG plane as a texture map. Based on these interpretations we constructed a simple 3D CG environment using Autodesk Maya with polygon modelling. One major difficulty however was the lack of any reference material for how the sides of the objects, or the vertical surfaces appeared. Without these data we did not know where the windows or door were. Furthermore, the topographic photo did not have high enough clarity for the interpretation of smaller objects such as the height and types of vegetation, fences, etc. Therefore, for this iteration we decided to put in the windows based on our own judgement, and omit any vegetation to examine how the audience would react. Also, since the reconstruction is based on interpretation, we decided to adopt a non-photorealistic visualization style to avoid the implication of historical truth. In order to do this, we applied brush-like strokes to the edges of the polygon models on their UV texture map, so the image can appear to be hand drawn despite being rendered entirely in 3D.

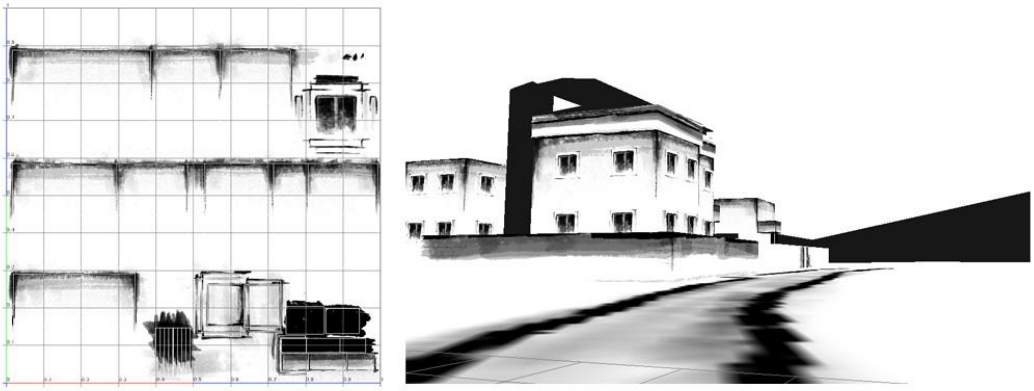

Figure 3-2: Prototype II: UV texture and polygon based virtual reconstruction.

User Study:

The user study was conducted with the man through semi-structured interview in an indoor setting. Upon seeing the rendition, he recalled the experience of driving down the road that led to the house, and described a railroad crossing located outside of the rendered image nearby. He also described how much the landscape has changed when he last visited the place in the 1990s in comparison to the rendered image. He commented that the appearance of the house was not quite how he remembered, but the overall space was somewhat reminiscent of his memory of the place. The conversation continued to talk about how his father purchased the land along with his friend who later became a neighbour living across the house. There was also mention of an old Honda Civic and Vespa owned by the family. The results of this test indicated that historic aerial survey photographs may be an adequate source material for virtual reconstruction. However, the lack of reference materials for the vertical surfaces presented difficulties for the interpretation and reconstruction of certain detail, particularly the appearance of the audience' house. The audience felt the placement of the windows were not how he remembered. He also felt the lack of vegetation was made the space somewhat odd as in reality the house was adjacent to an open field that had tall grass. Despite the inaccuracies, the image was able to evoke reminiscence and storytelling, and elicited audience's descriptions on how certain inaccurate depictions could be corrected based on his memory.

The study found several notable points summarized below. The use of virtual reconstruction using historic topographical data showed potential in supporting reminiscence and storytelling, and thus should be further explored. The lack of data for vertical surfaces presented difficulties for the interpretation and reconstruction processes, and the image created from inaccurate judgement caused audience to sense dissimilitude. However, the inaccuracy also evoked reminiscence and knowledge sharing of the correct, or remembered depiction. The use of hand drawn rendering style may have implied a sense of work-in-process quality of the depiction, thus encouraged the sharing of description to correct the inaccurate details. The use of UV map texture to create hand drawn quality in the rendered image was a very time consuming process, which involved UV projection mapping, unwrapping, scaling, texture painting, etc. for each individual polygon model. Close up object, such as the road, also required extremely large size texture to avoid showing unnatural pixel anti-aliasing artefacts.

3.4 STREMIS: Visualizing Past Neighbourhoods

STREMIS is a visual content designed to evoke reminiscence of past experiences and encourage the sharing of personal stories to facilitate an engaging family social experience. STREMIS contains a collection of images depicting various views of the user's past neighbourhood rendered in artistic style. These images provide the users a mean to revisit these places and see the past environment from different angles, and induce a sense of familiarity that support the recall their experiences associated with the neighbourhoods. The images also support the communication of personal stories as a visual medium to facilitate an engaging storytelling experience.

STREMIS is designed for seniors who do not have access to reminiscence-triggering materials. The process of reminiscence generally is initiated by a stimulus that triggers the recall of past experience. Such materials usually take the forms of old photographs, historic audio or video contents, physical memorabilia, etc. However, the availability of materials that are relevant to ones past experience cannot be

guaranteed. Thus in this research we propose to use visualizations of virtually reconstructed historic places as memory triggers to facilitate reminiscence and storytelling.

Virtual reconstruction of past places faces several challenges. First is the lack of accurate reference materials, the second is lack of production resources, and the third is difficulty in communicating realism. Through prototyping, we also discovered that historic landmarks near ones' neighbourhood may not necessarily have any significance to one's past experience, on the other hand some unexpected places may trigger forgotten memories. From the prototyping process we also discovered that topographic data such as historic aerial photographs and map provide some reference to the composition of the past environment and some hints of the artefacts that existed. Although the data lack information on the vertical aspects of the environment, rudimentary reconstruction of the basic space and layout of the past environment is a possibility. In addition, by using non-photorealistic rendering that simulates an ambiguous and artistic visual quality, the visualization of past place can evoke memory recall and invites discussion despite the presence of inaccuracy and uncertainty.

In this section, we introduce the visualization process of STREMIS, which involves three components: (1) an *topographic overview* of the place by using topographical data of the area including historical aerial survey photographs and maps, (2) *first-person views* of the historic place by interpreting and converting the topographical data into 3D environment, and (3) *non-photorealistic rendering* of the 3D environment using "between similitude and dissimilitude" technique. Each component plays an important role in supporting reminiscence and storytelling to facilitate an engaging family social experience.

3.4.1 Topographic Overview

The first component, an topographic overview of the place, serves as the foundation of STREMIS. This overview provides the visualization designer/generator a general information about the composition and layout of the entire environment for the reconstruction. This wide area information is particularly important for three reasons.

First, the availability of large area record is more likely to be available than street level record. The concept of STREMIS is to support reminiscence and storytelling with visual representations of past sceneries for people who lived in places that do not necessarily have street level photographic records, such as in the case of some suburban areas in Taiwan. However, other forms of geographic record may have higher chance of being available, particularly topographic data such as historic aerial survey photographs and maps. These data are usually kept securely by the government, and may be accessible at local or national libraries. Also, recent advancement in geographic information systems (GIS) and its public and on-line availability have given people the opportunity to access more topographic data than ever. These data can include general maps such as road maps, aerial survey photographs, and elevation maps, as well as special purpose maps showing the distribution of themes such as population density, land use, etc. Some of these data have been tracked over time, thus they provide important overview and clues for understanding past conditions of the place even if street-level photographic records are unavailable.

Secondly, an overview of the place may help the reconstruction to increase the opportunity of triggering reminiscence. When reconstructing a past place, the visualization designer or artist does not necessarily have the knowledge on which particular location would trigger reminiscence for any particular audience. Furthermore, the audience himself or herself may not necessarily remember any episodes associated with certain location until being evoked in some way. Therefore, by referencing an overall composition of the place and reconstructing a large area to generate the past sceneries, the audience is given an opportunity to navigate through

the environment, see different corners of the past place, and rediscover forgotten memories.

Thirdly, and overview allows the visualization to recreate the sense of space in the past. In many cases, places that were previously open space, agricultural farm lands, or covered by vegetation are now populated by large scale buildings and architectures, therefore the landscape, horizon, or skyline that were visible in the past have now disappeared. As a result, when one visits a place where he or she has been to in the past, in addition to the altered architectures and landscape, the sense of space may also feel completely different. Therefore, an overview of the past place may provide clues in assisting the virtual reconstruction to recreate the sense of space in the past.

Topographic images are captured through the process referred to as remote sensing, and regardless whether the images are captured by a multispectral scanner on board a satellite, a photographic system in an aircraft, or other platforms, they are all subject to some form of geometric distortion. These errors may due to various factors including the perspective of the sensor optics, the motion and stability of the scanning platform, the platform altitude and velocity, the shape of the terrain, the curvature and rotation of the Earth, etc.[189] Furthermore, when cross referencing aerial survey photographs of different time periods, we may discover that each image distorts in different manner, as they were taken at different positions and altitudes using different sensing equipment. We may also discover that each images scaled differently. In order to for the images to be interpreted correctly, they need to be geo-referenced. *Geo-referencing* is the process of aligning the topographic images to the latest and most accurate maps in order to have the elements displayed in accurate coordinates. This can be done by using software such as QGIS or ArcGIS, or even using Adobe Photoshop for more rudimentary corrections.

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[189] "Geometric Distortion in Imagery", Natural Resources Canada, Government of Canada. http://www.nrcan.gc.ca/earth-sciences/geomatics/satellite-imagery-air-photos/satellite-imagery-products/educational-resources/9401. Date Modified:2015-11-23

3.4.2 First-Person Perspective

The second component, first person perspective, refers to the process of converting topographical data into representations of the place in the way people perceived when they stood in the place. The conversion is necessary because the unnatural vertical perspective can be awkward for non-expert to process.[190] The conversion process involves three steps: *Interpreting image contents*, *3D modelling*, and *capturing sceneries that mimic views of the past*. These steps are crucial in transforming topographic data is sceneries that audiences may recognize.

Aerial survey photographs are rich sources of spatial and temporal data of the land, therefore interpretation of this kind of photographs have emerged as a discipline and systematic image analysis methods have been developed to assist the process. Basic aerial photograph interpretation involves the analysis of following elements: [191] [192]

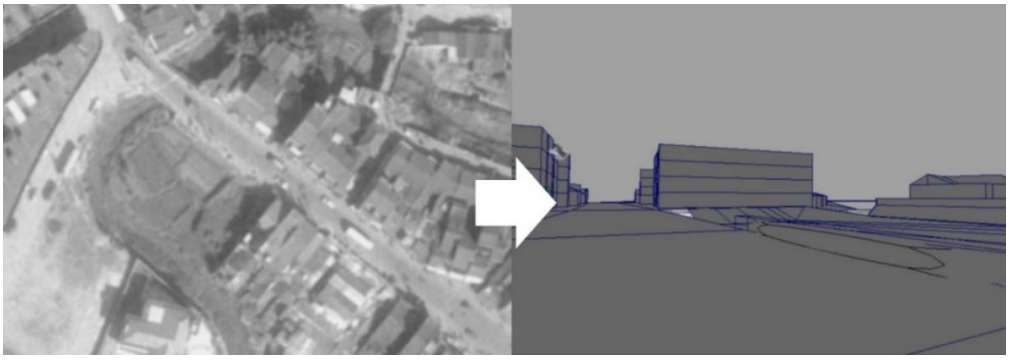

Figure 3-3: Converting aerial photo to first-person view

[190] Robert R. Hoffman, Arthur B. Markman, *Interpreting Remote Sensing Imagery: Human Factors*, 1st ed.; CRC Press: Boca Raton, FL, USA, 2001; p. 283.

[191] "Introduction to Air Photo Interpretation", Natural Resources Canada, Government of Canada. http://www.nrcan.gc.ca/earth-sciences/geomatics/satellite-imagery-air-photos/air-photos/about-aerial-photography/9689. Date Modified:2016-04-01

[192] Raechel A. Bianchetti and Alan M. MacEachren, "Cognitive Themes Emerging from Air Photo Interpretation Texts Published to 1960", *ISPRS International Journal of Geo-Information*. 2015, 4, 551-571.

Shape:

The shape of artefacts in aerial photograph helps to identify the object. Regular uniform shapes often indicate a human involvement. We can also determine the shape of the foot print of structures, or the type of architectures based on this data.

Figure 3-4: Interpreting shape.

Pattern:

Similar to shape, the arrangement of objects, such as row corps or bushes, is useful to identify an object and its usage.

Figure 3-5: Interpreting pattern.

Size/Dimension:

The size of the object's surface area, such as the length and width of a roof, may help to identify the relative dimensions of objects.

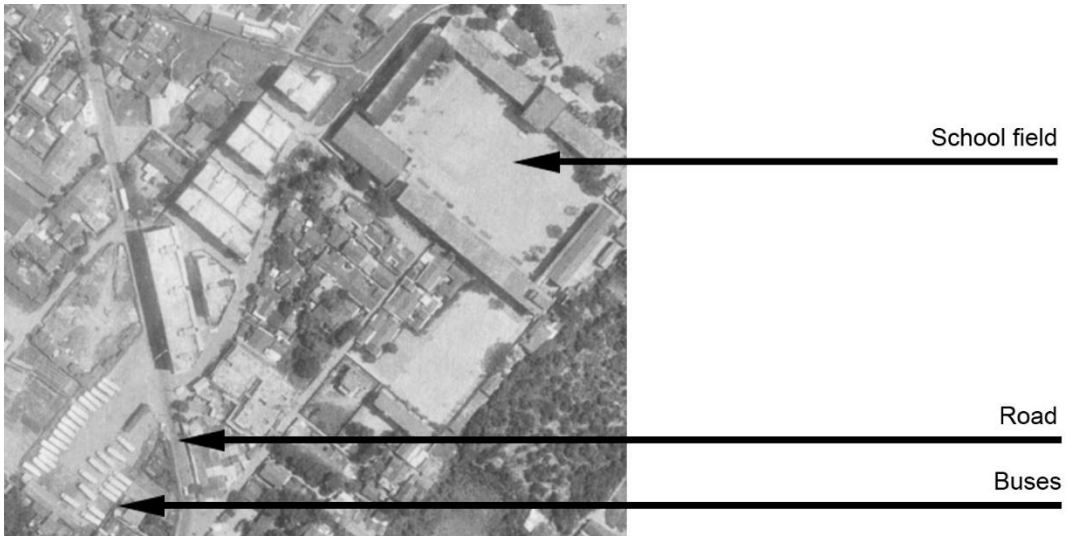

Figure 3-6: Interpreting size and dimension.

Tone/Colour:

The tone characteristics of an object relative to other objects in the photo, can be used to identify the feature. For example sand has a bright tone, while grass has a dark tone.

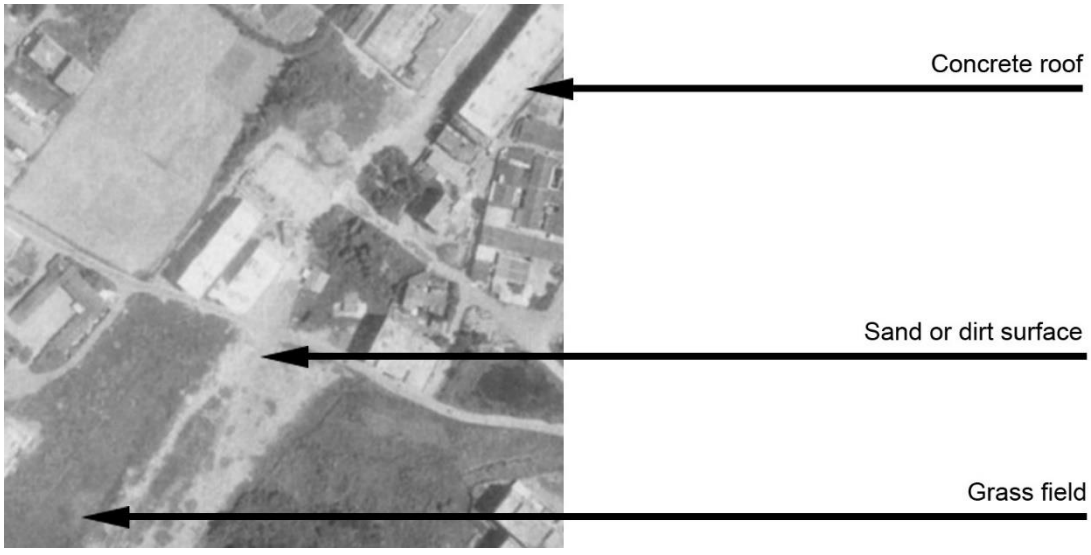

Figure 3-7: Interpreting tone and colour.

Shadow:

A shadow provides information about the object's height, shape and orientation.

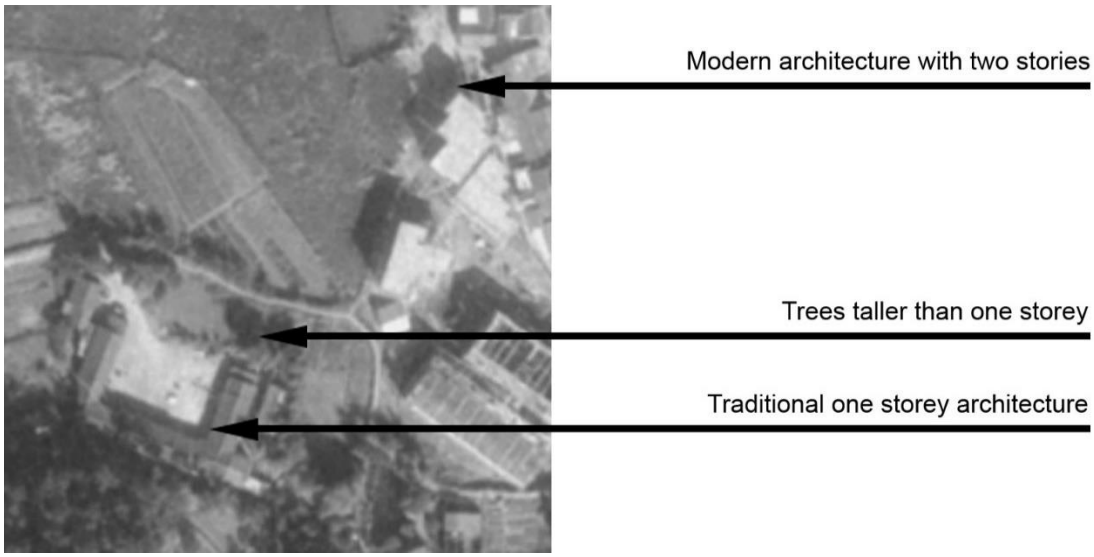

Figure 3-8: Interpreting shadows.

Texture:

The physical characteristics of an object will change the way they appear on a photo, for example calm water has a smooth texture and a forest has a rough texture.

Figure 3-9: Interpreting textures.

Association/Site:

Associating the presence of one object with another, or relating it to its environment, can help identify the object.

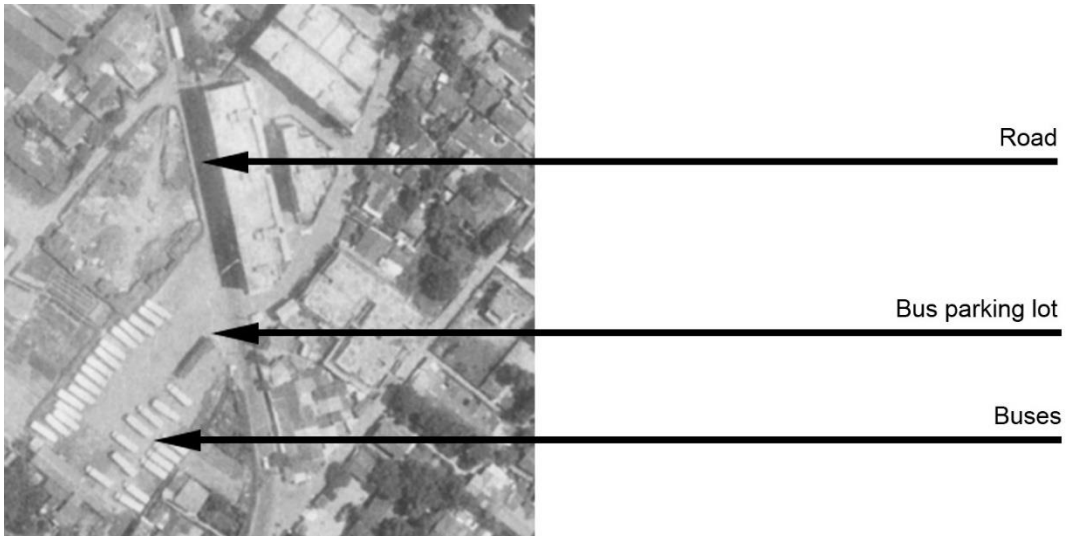

Figure 3-10: Interpreting association of artefacts.

Time:

Temporal characteristic of a series of photographs can be helpful in determining the historical change of an area. For examples, by looking at a series of photos of a city taken in different years can help determine the growth of suburban neighbourhoods.

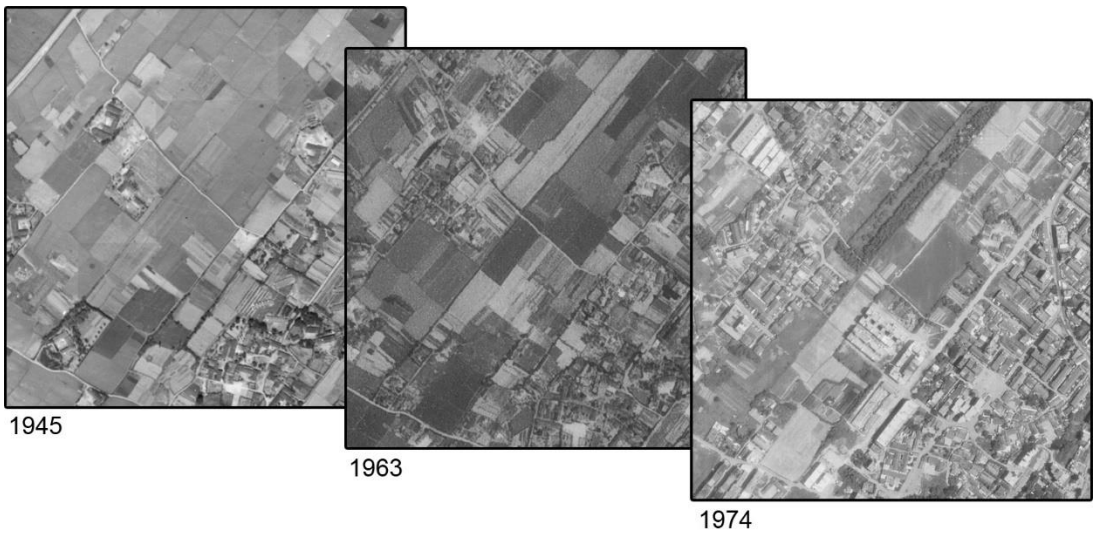

Figure 3-11: Interpreting chronological land development.

The identified objects are categorized in colour coded marker for ease of visualization on a map. The types of categories are dependent on the amount and details of identifiable objects in the aerial survey photographs and the purpose of the reconstruction. The colour coded map will be used as the foundational reference for 3D modelling of the past place reconstruction.

The 3D modelling process involves the extrusion of two-dimensional historical and geographic data into three-dimensional objects. This process utilizes two types of data, digital elevation model, and the object categorization map done mentioned in the previous section. Digital elevation model (DEM) is data that represent the 3D terrain surface of an area. This kind of data can be acquired through remote sensing techniques such as photogrammetry, lidar, interferometric synthetic aperture radar (ifSAR), land surveying, etc.[193] Currently there are various formats and levels of quality with this type of data. The format and quality can differ in grid resolution (area covered per pixel), vertical resolution (height accuracy), sampling density (elevation collection method), data algorithm, etc. DEM data can be used to create the terrain model for the reconstruction, and is particular important for areas that are composed of hills and valleys. The terrain model can also generate distant mountains that serves as background sceneries. This model will serve as the foundation which the reconstruction of the past place will be built on. One way to convert DEM data into 3-dimensional model is to first convert the data into 16-bit or 32-bit image file known as GeoTIFF. This file format is embedded with metadata that contains map projection, coordinate systems, etc. The tone of each pixel represent the elevation of the corresponding coordinate, where lower RGB value represents lower elevation and higher RGB value represents higher elevation. The 32-bit data offers greater levels of gradation than 16-bit therefore offers greater resolution in elevation accuracy. In order to generate the 3-dimensional terrain model, this GeoTIFF file can be loaded into a 3D modelling software such as Autodesk Maya or 3dsMAX to be

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[193] Zhilin Li, Qing Zhu & Christopher Gold, *Digital Terrain Modelling: Principles and Methodology*. CRC Press. 2005.

used as a displacement map. However, it should be noted that depending on the history of the place, the terrain at the time of the data acquisition may be different from that of the intended period of reconstruction, and low resolution DEM data may not have the desirable terrain quality for street level first person perspective rendering. Building on top of the terrain model are objects such as building, roads, vegetation, etc. These objects have been identified and recorded on the colour-coded and georeferenced object classification map in the previous step. The colour-coded markers on this map represent the grid position and basic topographic shape and scale of each object. In order to create the object, first the object classification map is to be projected on to the terrain model so the base of each object is set at the corresponding elevation; second base polygons are created in the shape of each individual markers; and finally, each individual base polygons are extruded to the height of their corresponding classification. This modelling process may require referencing of similar objects from other areas. For example, the height of traditional one floor residential house may be referenced by other similar architecture that still remains today in other locations or photographs. The 3D models do not require any details that are unknown from the topographic data as they may introduce inaccuracy into the scene. These models serve the purpose of representing a general composition of the space.

Finally, in order to generate first person perspective views of the place, in the 3D environment completed with terrain and object models virtual cameras are placed to capture the sceneries. These cameras are set at average height of audiences' eyes. This height is approximate since the audiences are of different age and height in the past. The angle of view of the virtual camera is set at 90 degrees, which is between the 60-degree field of vision and 120-degree peripheral vision of human vision. A narrower angle would generate an image that does not capture enough coverage of the environment to create a sense of space, and a wider angle would generate an image that distorts unnaturally near the edge of the image. The placement of the cameras is dependent on the composition of the place. More cameras and captures would produce more sceneries that provide the audience more freedom of movement in the virtual environment, however due to the lack of vertical surface data, some capturing angles

and positions may also produce incomprehensible images such as a blank wall or a vertical line from a corner edge of a building. A general strategy is to place the cameras in positions that simulate the directions of human movements, such as on the side of roads looking toward a destination, in the front yard looking toward the front door of a house, etc., as these positions and angles are more likely to be seen by the audiences in the past. These camera setups may help producing captures that better present the sense of space and have higher likelihood of triggering reminiscence.

3.4.3 Non-Photorealistic Rendering

The third component, non-photorealistic rendering, presents the reconstructed historic environment in a visual expression that simulates the quality of Chinese ink wash painting to stimulate memory recall from the audience. This artistic expression style utilizes image overlapping, vacuum dynamics, shading, light and darkness, and ambiguity to express "presence" and "absence" as perceptual stimuli to invite the audiences' minds to complete and project the image from memories and personal knowledge. [194] The psychological phenomenon of using memory and mental projection to complete an incomplete or ambiguous image has been explained by the theory of gestalt psychology, which suggests that the mind self-organizes selected visual stimuli from the chaotic world to form meanings that describe the whole world of which the sensory qualities are only a starting point and not necessarily a part of the meaning. [195] Biederman's recognition-by-components (RBC) theory suggests that the mind identifies an object through recognition of simple primitive shapes in its components.[196] Biederman in his geon theory further elaborated that the mind is able to identify objects in a novel image by processing the geons (simple 2 dimensional or 3 dimensional geometrical icons such as rectangles, cubes, circles, cylinders, wedges,

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[194] Guinzbourg de Braude, "From Ambiguity in Chinese Painting to Rorschach's Inkblots," 2008.

[195] Wong, "Gestalt principles (Part 1)", 2010.

[196] Irvine Biederman, (1987). "Recognition-by-Components: A Theory of Human Image Understanding". *Psychological Review*, 94, 115-147.

cones, etc.) as the building blocks of more complex forms, and recognizing the object through the structural description of the relationship between the geons.[197] Since topographic data are used as the sole source of reference for the reconstruction of past environment, there are many uncertainties of the place that cannot be interpreted from the source materials, especially about the appearances of vertical surfaces. The use of this "between similitude and dissimilitude" technique draw the audience's attention to identify the objects using their geons and project personal memory and knowledge to fill in the missing details. The use of non-photorealistic rendering (NPR) can also minimize the perception that the reconstruction presented is "historical truth",[198] and can encourage conversation about the rendered image as it appears "preliminary", "unfinished", and "open to change".[199] [200]

In order to create representation of past places with non-photorealistic rendering using "between similitude and dissimilitude" technique, we use the first-person perspective captures as the basic guide for the rendering. The rendering is done manually in digital painting software such as Adobe Photoshop, where the first-person perspective capture is placed as the base layer as reference. Although there has been advancement in computer graphics that enables the simulation of ink wash painting digitally, much focus has been placed on the recreation of ink diffusion quality of

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[197] Irving Biederman, Eric Cooper, John E. Hummel, József Fiser, "Geon Theory as an Account of Shape Recognition in Mind, Brain and Machine". *British Machine Vision Conference 1993*: 1-12

[198] Maria Roussou and George Drettakis, "Photorealism and Non-Photorealism in Virtual Heritage Representation", *Proceedings of the 4th International conference on Virtual Reality, Archaeology and Intelligent Cultural Heritage*. 2003. Pages 51-60

[199] Schumann et al. "Assessing the Effect of Non-Photorealistic Rendered Images in CAD",1996.

[200] Nick Halper, Mara Mellin, Christoph S. Herrmann, Volker Linneweber, Thomas Strothotte, "Towards an Understand of the Psychology of Non-Photorealistic Rendering", *Computationa Visualistics, Media Informatics, and Virtual Communities*. Volume 11 of the series Bildwissenschaft pp 67-78

brush stokes and the image conversion process to achieve ink wash quality.[201] [202] [203] The aesthetic concept of "between similitude and dissimilitude" at this point in time still requires human decision making and subjective expression. The basic aesthetic concept of ink wash painting can be summarized as following:

Simplicity:

One characteristic of ink wash painting is the focus on the essentials. This can be expressed by abandoning colours, and depicting the subjects using simple but elegant expressions. The point is to dismiss details that may not contribute to the essential representation of the subject.

Dark and Bright:

Ink wash paint utilizes black ink on white paper to produce images. The concept of this black and white expression is rooted in the ancient philosophy of Yin and Yang (Dark and Bright) that describes the nature of reality, as the contrast between black and white represents contrasts in nature: existence and non-existence, strong and weak, objective and subjective, etc. Therefore, the use of black and white, and the tonalities in between can be described as the artist's interpretation of the reality visually and semantically. [204]

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[201] Ren-jie Wang and Chung-ming Wang, "Effective Wet-in-Wet Flow Synthesis for Ink Diffusion", *Journal of Information Science and Engineering* 26, 1397-1411 (2010).

[202] Xiu-jin Wang, Jin-shan Jiao, Ji-zhou Sun, "Graphical Simulator for Chinese Ink-Wash Drawing", Transactions of Tianjin University. Vol.8 No.1 Mar. 2002.

[203] Da-jin Li, and Cheng-jie Bai, "Image-based Ink Diffusion Simulation and 3D Chinese Wash-ink Paintings Rendering", *WSEAS Transactions on Computers*, Volume 14, 2015. E-ISSN: 2224-2872

[204] Chien-fa Chen 陳建發, Chien-fa "Dangdai shuimohuaxiang chuangzuo biaoxiande heibai yuyi jiegou tansuo 當代水墨畫圖像創作表現的黑白語意結構探索 [A Discourse on the Meanings of Black and White in Contemporary Ink Wash Painting Creative Expression]." Jinian xinhai 100 zhounian liangan baijia shuimo dazhan xueshu yantaohui lunwenji 紀念辛亥 100 週年兩岸百家水

Empty and Fill Space:

The empty and fill space concept is a manifestation of the simplicity and dark and bright concepts. The white space balances and signifies the subjects depicted by the dark strokes and washes. White space also introduces an element of "unknown spirit" to the painting and invites imagination from the audience. [205]

Rendering the historic scenery in ink wash painting quality using Adobe Photoshop requires a set of virtual brushes and a hand drawing input device. The virtual brushes can simulate the random contact surfaces and frayed brush hair lines of a real dry brushes, and the uneven tonality and edge diffuse of wet brushes or washing effects in various shapes and patterns. These brushes give rendering artist the ability to utilize different brushing techniques to express different types of textures and objects. The hand drawing input device such as Wacom tablet is required to capture the natural variations in human hand movement and drawing pressure in order to create the natural imperfections in brush strokes and variations in tonalities. A general strategy for rendering the image is: broader and darker strokes for elements that are closer to the camera and thinner and lighter strokes for farther away elements; geons (identifiable primitive geometric shapes) are outlined with strokes but not fully enclosed; unknown elements are omitted; and vegetation is expressed through ambiguous strokes or washes.

3.4.4 Applying the Three Components

Component 1: Topographic Overview

The first component, topographic overview of the place, is important in providing the foundational information for the reconstruction of a virtual environment that can provide a familiar sense of space. As observed in the first prototype, the audience may

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墨大展學術研討會論文集 Proc. Xinhai Revolution 100th Anniversary Cross-Strait Ink Wash Painting Exhibition Seminar.

[205] Pengyu Li, Yifan Guo, Yi Li, Qi Zhu, "Enlightenments of "White Space" in Traditional Chinese Painting on Landscape Architecture Design", *Journal of Landscape Research* 2013, 5(1–2): 79–82.

not remember about a place or the story associated with it until being evoked by certain stimuli. Therefore, by acquiring and processing an overview data of a place as source material for the reconstruction, we may have the potential of creating visual materials to evoke memories associated with forgotten places. Furthermore, due to the lack of data on vertical surfaces, this type of virtual reconstruction need to rely more on recapturing the sense of space of the past to compensate the lack of details on individual objects. Overview data provide the information needed to create the representative environment model in 3D space and enable the production of wide angle scenery images to convey the sense of space more effectively. However due to differences in acquisition equipment and method, topographic data need to be georeferenced to match the modern, more accurate maps, and correct any geometric distortions present on individual data piece.

Geo-referencing (data patching, geo-referencing, distortion correction)

In order to obtain high resolution images for the aerial survey photographs, the images were captured while zoomed in. This however would provide small area of coverage for each individual captured images. The first step is to patch the captured images to form a large area photograph. The aerial survey photographs may also exhibit severe distortion, in different areas. Therefore, the patched image also need to be in geo-referenced with more accurate, modern day maps, and images from different time period with identifiable objects, so that artefacts in the photographs can be more accurately positioned. Furthermore, aerial survey photographs taken at different time periods with different equipment, lighting condition, and angles may have produced different types of distortions through out the area. These distortions need to be geometrically corrected in order to provide an accurate view of the overall landscape. In this project, the data patching, geo-referencing, and distortion corrections are done manually using Adobe Photoshop.

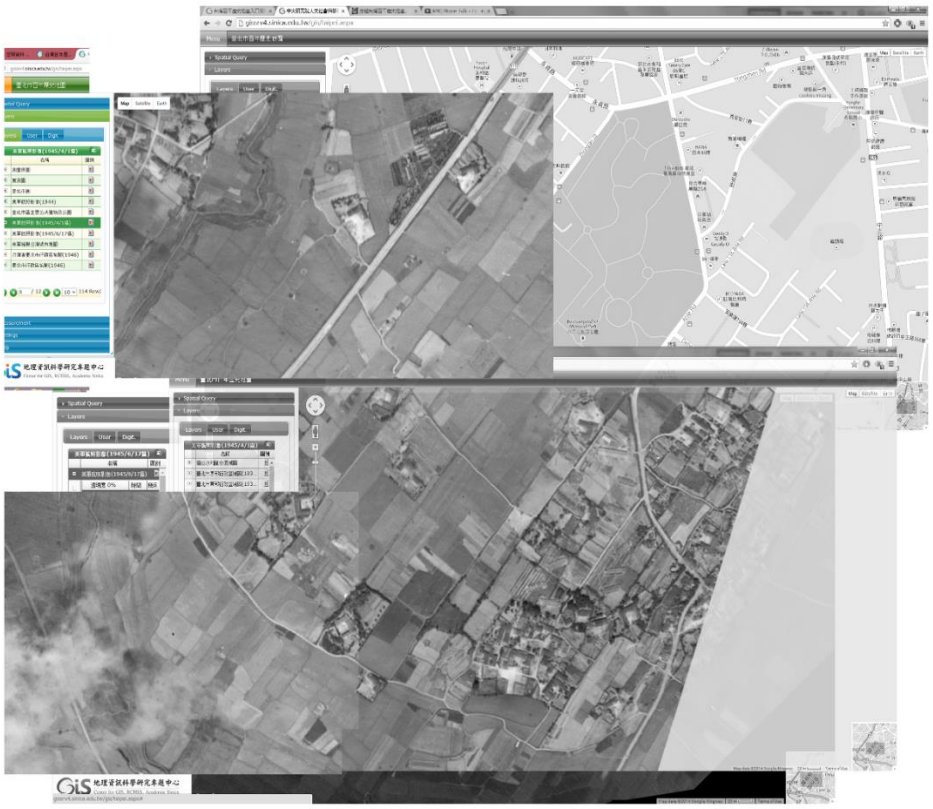

Figure 3-12: Data patching.

Figure 3-13: Data that require geo-referencing.

Figure 3-14: Data that require geometric correction.

Figure 3-12 is an example of working-in-progress data patching, geo-referencing and geometric correction for the 1949 data set. Note that modern day Google map at the base layer serves as the standard of reference. Although the survey photographs have been pre-geo-referenced from the GIS database, the precision was no ideal at. When zoomed in to street level details, the original geo-reference (as seen in Figure 3-13) and distortion (as seen in Figure 3-14) can cause position errors up to several meters. Therefore, manual fine tuning was still needed.

Component 2: First-Person Perspective

The second component, first-person-perspective view of the sceneries, is important in visualizing the reconstructed past place from a view point that imitates the way audiences saw the place in person when they were younger. Although topographical images such as aerial survey photographs give us a good overview of the place at large, for many people it is difficult to visually process this unnatural vertical view captured from high altitude. In order to translate aerial survey photographs into first-person-perspective views, the photographs; the photographs then need to be

interpreted to identify and classify different types of artefacts required for the reconstruction; and finally the objects need to be modelled based on the identified shapes and heights using basic polygon primitives using 3D CG production software. Virtual cameras that mimics audiences' eye position need to be placed in the reconstructed virtual environment to capture the basic composition of past space.

Aerial Photo Interpretation & Object Classification Map

The georeferenced and corrected photographs can be interpreted to identify different types of objects. For the purpose of reconstruction, we categorize four types of objects: houses, roads, trees, and lands that were not covered by vegetation. However due to the blurry image quality, many objects were not easy to be identified. Therefore, we also needed to cross reference objects in different photograph from different time period, as well as similar objects that still remain today.

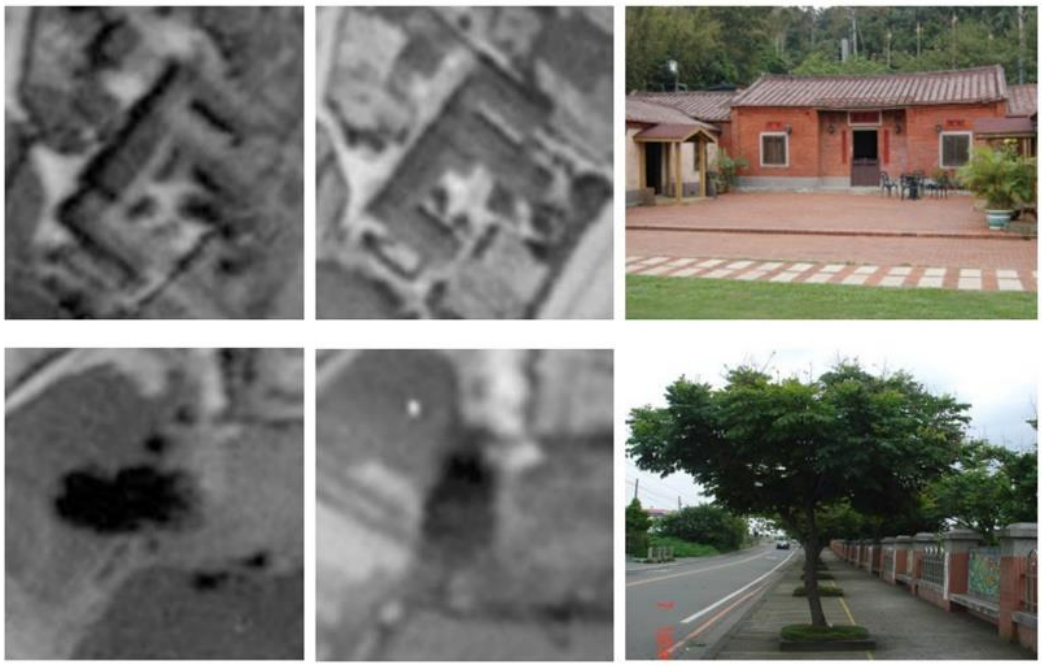

Figure 3-15: Identification through cross-referencing.

Figure 3-16: Interpreting artefacts.

This is an example of interpreted 1949 aerial survey photograph of Zhonghe district. Due to the relative homogeneous architecture type at the time, we marked all the identifiable houses in red and in the same shapes as seen topographically. Roads and possible open space that had no vegetation were marked in yellow. Tall vegetation, identified through shadow lengths and texture sizes, were marked using large green circles. Short vegetation, identified through texture, and logically interpreted growth location such as road sides and farm boarder, were marked in small green dots.

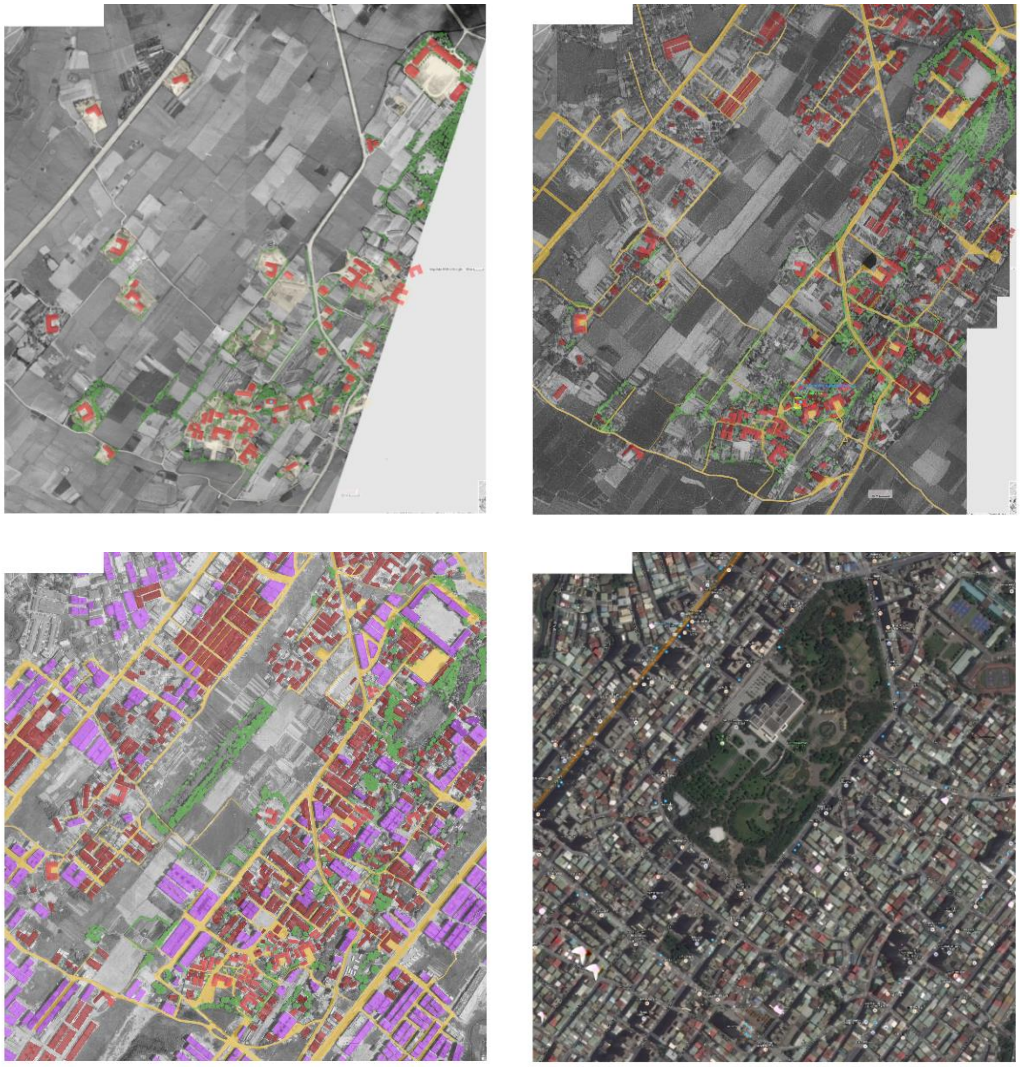

Figure 3-17: Cross referencing artefacts in different time periods.

We applied the same process for survey photos from other periods to distinguish new artefacts from old. This provides a reference to search remaining artefacts in newer data set that may provide better definition, as well as street level reference using Google Street View. From different time period we can see the dramatic development and change in landscape that took place in Zhonghe district within the past 60 years.

The identified objects are colour coded into different classifications with markers shaped in their basic outlines. These markers compose an object classification map. This map will serve as the blue print for CG modelling

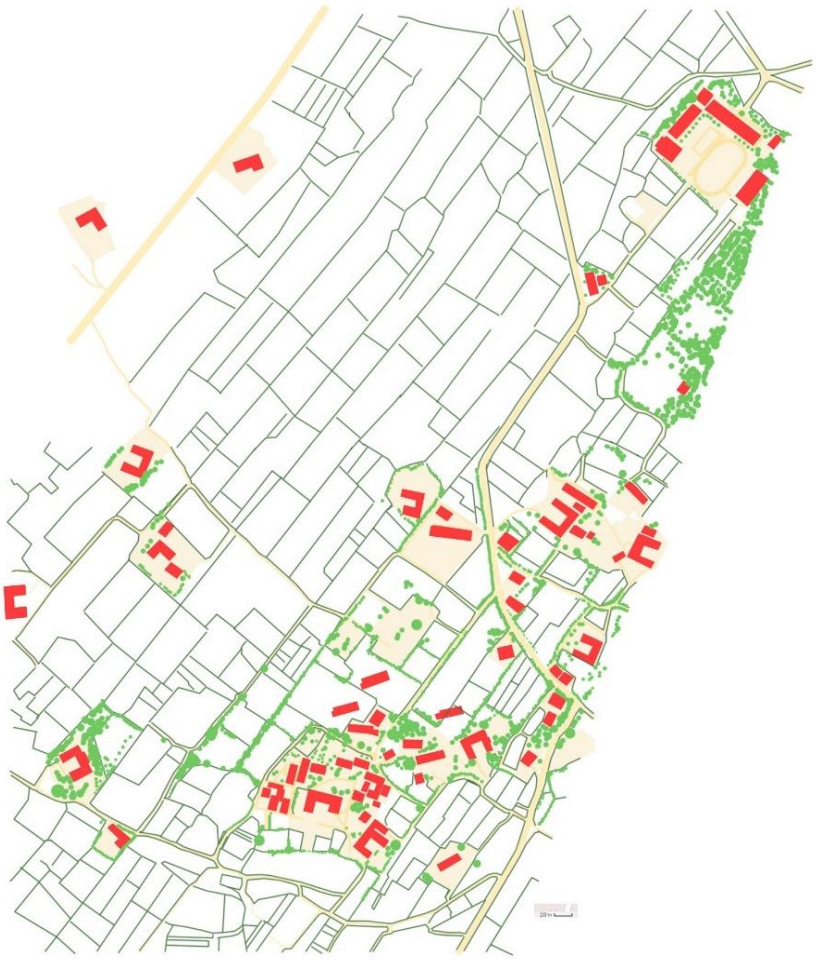

Figure 3-18: Object classification map for modelling reference.

Using Object Classification Map as Reference to Reconstruct Past Space:

Based on the object classification map, we used basic mock-up models to create house mode, vegetation, and trees. We position simple polygon models, in the shape that match the footprints of the artefacts, and in the general heights of the identified artefact categories, to reconstruct a 3D environment that approximate the sense of space in the past.

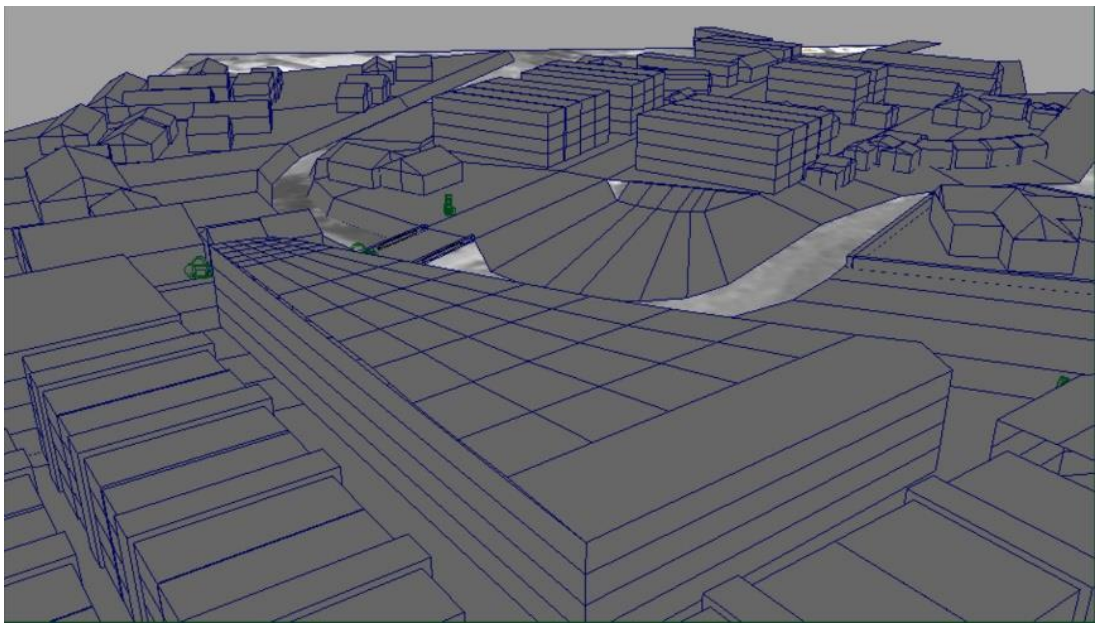

Figure 3-19: Reconstructed neighbourhood using mock-up models.

Strategic Virtual Camera Placement for First-person Perspective:

In order to create visuals that mimic the views that are familiar to past residents, virtual cameras were strategically placed in the reconstructed 3D space to capture first-person perspective sceneries. The cameras are set at a height of about 150cm above the ground to mimic the height of human eyes. The angle of view is set at about 90 degrees, which also roughly simulate human's field of view. But these camera settings vary depending on the locations to avoid depth distortion. We also positioned the cameras on the side of roads, generally aiming toward more meaningful destinations that people would be more likely to look in the past, such as someone's home, house entrance, an intersection at the end of the road, etc. This is designed to capture and mimic the views from which people in the past might have seen the place, and increase the chance of creating the sense of familiarity when looking at the visualizations. These captured images with these cameras would be used as guides for digital painting as the rendering method. This would overcome the constraints we discovered about the use of UV map texture.

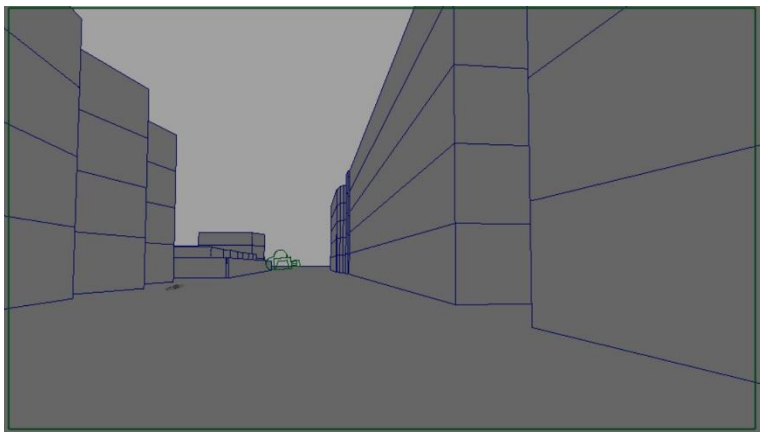

Figure 3-20: Example of first person perspective view.

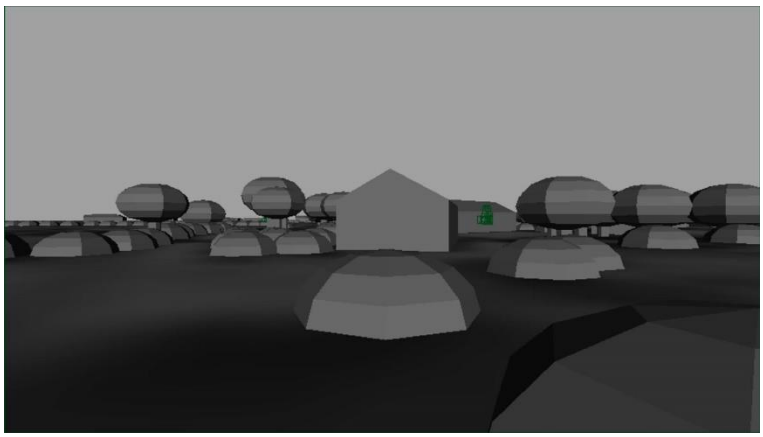

Figure 3-21: Example of first person perspective view.

Component 3: Non-Photorealistic Rendering

The third component, non-photorealistic rendering, is important for introducing a sense of ambiguity into the final representation, compensate the lack of accurate vertical details, and invite audience to contribute the discussion of the image from their memories and stories. This research proposes the use of "between similitude and dissimilitude" technique for this type of non-photorealistic rendering. The visual expression "between similitude and dissimilitude" is developed from the ancient art tradition of Chinese ink wash painting, which utilizes ink, water and brush stokes to depict the motif through representations of its essential elements using darkness and brightness, and white spaces.

The perceptual process of viewing this type of visualization has been studied and theorized by gestalt psychology and geon psychology. The first suggests that when perceiving chaotic or incomplete stimuli, the mind would self-organize the perceived information and complete the image as a whole through recalling of archived experience or knowledge stored in our memories. The latter suggests that the mind recognizes objects through identification of the simple geometric shapes that form the perceived image, therefore even in the situations where details are lacking, the mind would still be able to relate the image to prior experience and memories.

In STREMIS, this visualization is done in post processing rather than in 3D CG space due to the time consuming process of UV and texture production. As explored in previous prototype, the polygon shape and straight edges can limit the expressiveness in presenting a hand drawn quality. Therefore, in the post processing process of applying the "between similitude and dissimilitude" technique, the images captured from 3D CG software are painted over in digital painting software using simulated brush strokes.

Figure 3-22: Examples of simulated brush strokes.

The captured images are painted over using Adobe Photoshop using virtual brushes to mimic the ink brush quality. This post processing method offers more flexibility than rendering in the 3D space, and creates more natural quality than UV texture mapping. The key in the painting technique is to create ambiguity for unknown elements. For example, although from the aerial survey photographs we could see

trees and vegetation, we could not identify what types they were. When generating the image using “between similitude and dissimilitude” technique, we use the natural, chaotic and random brush strokes to depict generic tree or hint the existence of vegetation. This expression may invite the audience to contribute their personal knowledge to explain the image based on their remembered experience and stories.

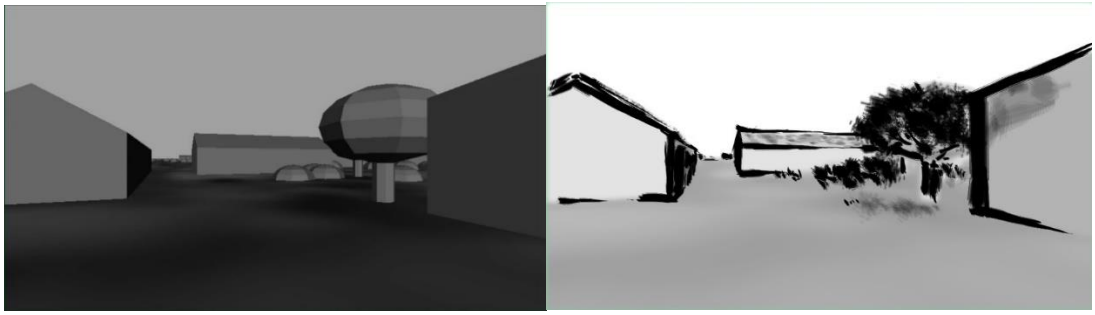

Figure 3-23: Image rendered in Chinese ink wash painting style

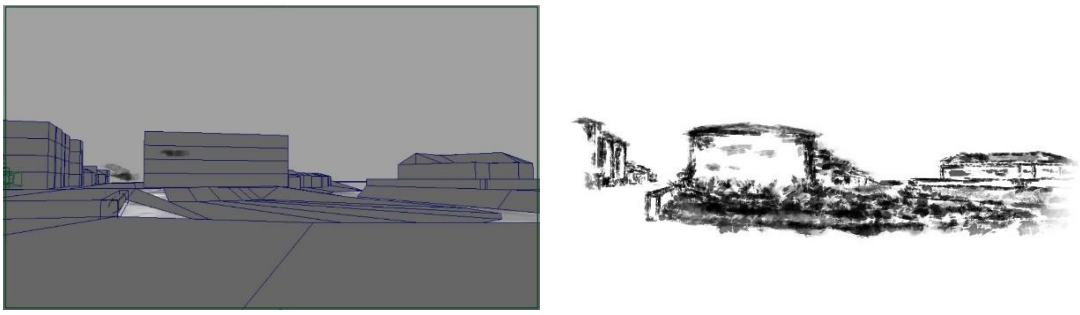

Figure 3-24: Image rendered in Chinese ink wash painting style

Similar to Prototype I, these images are organized by their camera location on an interactive map. This map is deployed using a tablet device so audiences can see different camera views by tapping on the map.

Chapter 4

Proof of Concept

This research proposes a visualization of past places, STREMIS, designed to stimulate reminiscence of past personal experience and facilitate an engaging intergenerational storytelling experience at family social gathering setting. The visualization is created by virtually reconstructing the past neighbourhoods where seniors used to live by using historical aerial survey photographs and maps as reference. The image of past neighbourhood is depicted using non-photorealistic rendering in the style of Chinese ink wash painting to present a sense of ambiguity that invites recall of personal experience, encourages comment and discussion, and draws attention away from historical uncertainties. The visualization is designed for Taiwanese seniors who may not have access to relevant materials to support reminiscence, thus these images provide them stimuli to revisit their past memories, and facilitate the sharing of past personal experience.

This chapter describes the validation process that evaluate the effectiveness of STREMIS in supporting reminiscence and facilitating an engaging storytelling experience. User studies were conducted to examine whether the images of visualized past neighbourhoods would evoke seniors to remember their past experiences, and share their stories with younger family members to create a more engaging family interaction experience. The user studies were conducted in family social gathering settings, where family members who live apart would come to visit. This research adopts the social science technique of photo-elicitation to examine the memories and stories evoked by the images of past places, and observe the interactions between family members in response to the images. The argument for using photo elicitation is that images enable people to explain their experiences more effectively, especially

for those who are "know it when they see it" type of people, because lived experience can be difficult to articulate due to it being an unconscious process.[206] [207] Photo elicitation has also developed to include the use of non-photographic stimuli such as diagrams, artworks and other visuals.[208] Interviews[209] were also conducted with the participants to gather feedback and experience of interacting with family members of different generations using STREMIS.

4.1 Research Setting

4.1.1 Selection of Research Participants

The participants have been selected prior the design process of the STREMIS in order to obtain some of their historical backgrounds, such as the location of their past neighbourhoods, time of residence, and family structure. Since reconstructing a historic place is a time consuming process, this prior selection was necessarily to ensure that the prototype can be tested by people who have prior experience of the place in the past. The participant selection criteria are described as the following:

Generational Distances:

This research selected participating families of which some members live apart and do not communicate on daily basis. The selection is based on the motivation behind

[206] Kristen Hatten, Tiago R. Forin, Robin Adams, "A Picture Elicits a Thousand Meanings: Photo Elicitation as a Method for Investigating Cross-disciplinary Identity Development", *2013 ASEE Annual Conference*.

[207] Susan Wyche, Phoebe Sengers, Rebeca E. Grinter, "Historical Analysis: Using the Past to Design the Future", *Ubicomp 2006*, LNCS 4206, pp. 35 – 51, 2006.

[208] Liz Bridger, "Seeing and Telling Households: A Case for Photo Elicitation and Graphic Elicitation in Qualitative Research", *Graduate Journal of Social Science*, May 2013 Vol 10, Issue 2.

[209] Rene Vutborg, Jasper Kjeldskov, Frank Vetere, & Sonja Pedell, "Family Storytelling for Grandparents and Grandchildren Living Apart", In Proc. *NordiCHI '10 Proceedings of the 6th Nordic Conference on Human-Computer Interaction: Extending Boundaries*. Pages 531-540.

the design of STREMIS, which is to facilitate an engaging face-to-face interaction experience for families with reduced interaction opportunities due to generational distances. As the society in Taiwan is facing a shift toward more nuclear family living arrangement and more seniors living alone, there are growing geographical distances in living locations, linguistic distances in different primary language use, and cultural distances developed through cohort, lineage and period effects between generations. Therefore, for the user studies we selected families with background that reflect this situation. In addition, when selecting participants, generations are defined as members with age difference of twenty years or more. During the selection process, we have encountered people who are genealogically uncle and niece but with an age difference of less than three years, due to large family structure that was common in the past in Taiwan. Therefore, we use contemporaneous group rather than line of decent to define a generation.

Location and Time of Past Homes - Data Availability and Quality:

Participants were selected based an assessment of the time and location of their past homes. This is done so to make sure that historic topographical data that reflect participants' historic background can be obtained through current database. Although historic topographical data provide wide coverage of time and locations, as of 2015, the accessible data available in Taiwan's national archive of *Taiwan Century Historic Map*, [210] was limited to certain years and locations. Furthermore, due to lens distortion and film quality, the historic aerial survey photographs may not provide enough interpretable data for reconstruction. Therefore, in order to be able to create virtual reconstructions and visualization of past place for proof of concept, participants were selected if their past homes are captured within the coverage of the data in adequate quality.

[210] http://gissrv4.sinica.edu.tw/gis/twhgis/

Location and Time of Past Homes - Places with Significant Changes:

The location and time of participants' past homes were also reviewed with the historic data to examine whether the place have gone through significant changes in sceneries between the time of residence and present day. The visualization of past neighbourhood is designed to evoke reminiscence of past experience, thus for seniors whose past neighbourhoods have stayed unchanged, STREMIS would make less significance. Therefore, families whose past neighbourhoods have become fully or partially unrecognizable would be selected as participant.

Acquaintanceship:

The participants were selected through acquaintance due to the intimate nature of family social gatherings. The reason is to minimize the guest/host relationship and formalities because the presence of a stranger in a family gathering setting may alter the spontaneous interaction and casual communication behaviours among the family members. The close relationship between the researcher and the participants would allow more comfortable and natural interaction during the social gathering and, and enable the researcher to collect more honest and open responses from user studies.

This research selected 8 participants coming from 2 family groups. The older participants used to live in rural and suburban areas, called Shuanghe, adjacent to the southern boarder of downtown Taipei. Shuange is a unified name referring to the two districts called Zhonghe and Yonghe of what is now called the New Taipei City special municipality. The area remained an agricultural based community with no more than 30,000 in population until 1949. However due to mass influx of Chinese immigrants, who retreated to Taiwan as a result of KMT's defeat in the Chinese civil war, Shuanghe area experienced extremely rapid growth in population. The rapid population and economic growth between 1950's to 1980's triggered land reform and urbanization in the area, which attracted more migrants to move in due to its close distance to the capital city of Taipei and relatively cheap housing prices, as the result population continued to grow. By the year 2010, population in Shuanghe area has grown 21 times to over 630,000, and has become one of the most densely populated

places in the world with over 24,000 people per square kilometer. This rapid transformation in the area means that many of the sceneries and landscapes that past residents grew up in have become unrecognizable today.

Participants from the first family are Grandma Yan (Grandmother, age 94), Mei (Daughter, age 72), Chao (First son, age 67), Sui (Second son, age 64), and Peter (Grandson, son of Chao, age 28) of the Lu Family. Grandma Yan lives in her home in Yonghe district of New Taipei City. Living in her home are one of her grandson's family of three, and one of her daughters who stays at her home during weekdays to double as a caregiver. Mei is the eldest daughter, a mother of three, and a grandmother herself, lives in a near by area from Grandma Yan's within walking distance. Mei visit Grandma Yan daily in the morning. Chao is married, a father of two, and is still working as a developer. Chao lives about 30 minutes away by driving, and visits Grandma Yan about 3 times a week. Sui is married, a father of two, and lives abroad. Sui visit Grandma Yan several times a year, and lives at her home during his visits. Peter is married and works abroad with his wife. Peter visits Taiwan about once a year. Between 1940's and 1960's, Grandma Yan, Mei, Chao and Sui used to live in a neighbourhood in the Zhonghe district near Y.A. road.

Participants from the second family are Min (Father, age 69), Yu (Mother, age 65), and Alex (Son, age 38) of the Gao Family. Min is retired and lives with Yu in their current home in the south eastern region of downtown Taipei. Alex is single and works as an engineer, and has been living independently for nearly 20 years to attend university and work. In the past year, Alex talked to or met his family about once or twice a month due to the son's busy and social life schedule. The three family members do not have difference in primary language, and no particular family estrangement. In the late 1970's and early 1980's, the three used to live together in two different neighbourhoods in the Zhonghe district. The first is on T.H. Street and the other is on N.S. Road.

4.1.2 Process of User Studies

Pilot Interview with Participants

After the selected participants have agreed to take part in the user study, interviews were conducted with each participant to gain some insights about their backgrounds and experience about interacting with family members. The interview asked questions such as the participant's age, frequency of interaction with other family members, things that they remembered about interacting with other family members, their interest in learning about family members' past experience or sharing their past experience with family members, etc. The findings of the interview would provide a better picture about the relationships between the participants and their interaction habit. This would also serve as a basis for comparison with family interaction experience with using STREMIS.

Creating STREMIS for Participant

Based on the findings of interviewing with the participants, we created visualizations of their past neighbourhoods in the Shuanghe area using virtual reconstruction and non-photorealistic rendering. In order to create the visualization, we first gathered available topographic data (historic aerial survey photographs and maps), and any supplementary materials that may support the accuracy of the reconstruction. These materials were georeferenced, geometrically corrected, and cross referenced to provide us an overview of the neighbourhood in the past. The corrected materials were analyzed and interpreted to identify artefacts such as roadways, vegetation, buildings, etc. The identified artefacts were modelled using 3D software with basic polygons to reconstruct the basic composition of the past environment. Virtual cameras were strategically placed in the virtual environment to capture first-person perspective sceneries that were more likely to have been seen by the participants, as well as angles that were visually pleasing in representing the environment. The captured images would then be manually rendered in digital painting software using the "between

similitude and dissimilitude" technique, to create non-photorealistic visualization of the participants.

The rendered images were presented using a touch panel display mobile computing device. A basic interactive map-based interface was created to allow participants select different locations of their past neighbourhood and view the corresponding visualizations. A strap was attached to the device so the participants could wear it on their necks to reduce fear of dropping or damaging the device and be more focused on the displayed content and interacting with others.

Overall three set of images were created for the participants. A set of 1940's Y.A. Road neighbourhood for the Grandma Yan, Mei, Chao, Sui and Peter. A set of mid-1970's T.H. road neighbourhood, and a set of late 1970's N.S. road neighbourhood for Min, Yu and Alex. The followings show the rendered images and their locations on the map:

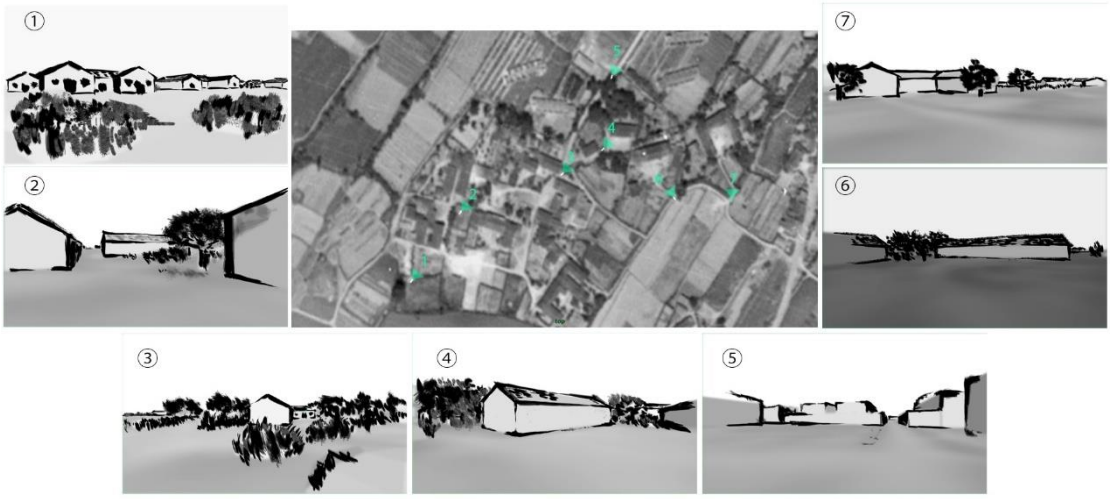

Figure 4-1: STREMIS Visualizations of 1940's Y.A. Neighbourhood

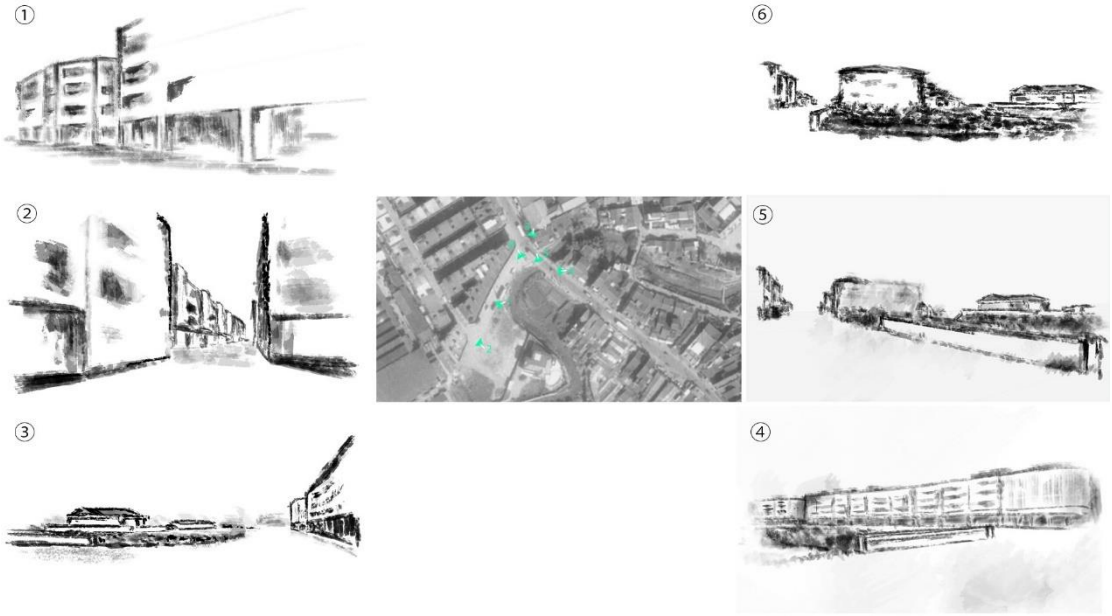

Figure 4-2: STREMIS Visualization of mid-1970's T.H. Neighbourhood

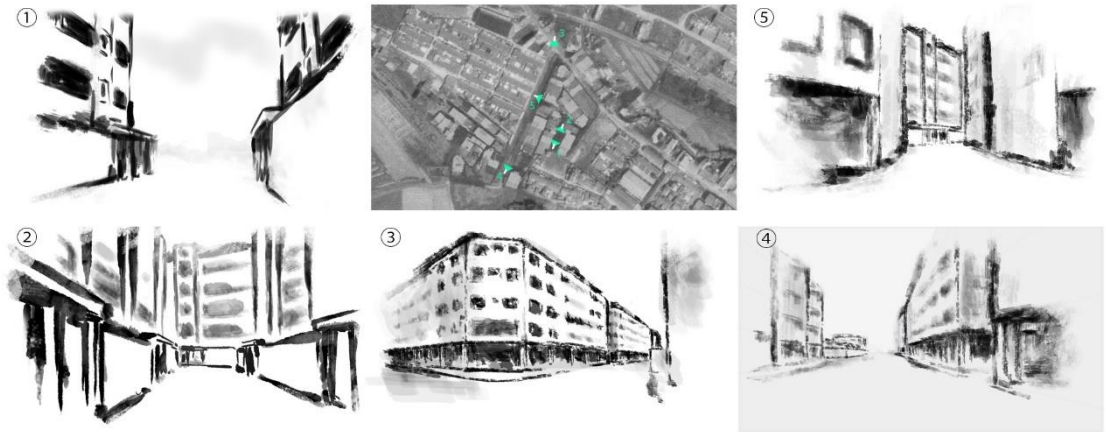

Figure 4-3: STREMIS Visualizations of late 1970's N.S. Neighbourhood

Deploying STREMIS and Observing Participants' Family Social Interaction

The user studies of STREMIS were conducted on Saturdays and Sundays in late November and early December of 2015. This was the time when selected participants could get together in casual family gatherings to conduct the studies as groups. On the scheduled dates, STREMIS designed for the participants' past neighbourhoods were delivered to their homes where the gatherings took place. Since participants were

selected from acquaintances, and prior communications had been established during the pilot interviews, the presence of an outsider as an observer was minimized.

The study begun with an observation of the interactions among family members in the social gathering setting. Since we are interested in observing the contrast of interaction behaviour and communication content with and without STREMIS, this observation may provide some basis for comparison. Prior the observation day, participants were told that the research was about family storytelling and an exploration of the local history, but were not told about the development of visualizations of their past neighbourhoods. After about half an hour of socializing, a rendered image of participants' past residence from STREMIS was presented to them to observe the initial reaction. Afterward, use of STREMIS was briefly explained to the participants, and the device was given to them to play with. The subsequent interactions among participants and conversation contents were observed for around an hour.

Afterward, the groups were invited to visit the real life location of their past neighbourhoods. Although outdoor use was not in the scope of the design research of STREMIS, because on location it would be difficult to identify whether it is the place itself or the visualization that evoke the reminiscence Still, we were curious about how groups of family members of different generations would tell stories when visiting their past neighbourhood and what kind of stories would be shared. We were also curious about how STREMIS might contribute to participants' stories when the visualizations of past sceneries were compared right against the present day scenes on site. In order to find out, we took relaxed casual strolls through their past neighbourhood, and observed the interactions among the participants without STREMIS. At the spots where corresponding visualizations were generated, we waited to observe any stories that the participants shared without STREMIS. The corresponding visualization of the past scenery at the spot was then presented to observe whether any additional stories or details about the past would be elicited. The location visit took about 15 minutes depend on the pace of participants' movement and engagement in the strolling activity.

The observations of the family social gatherings were all recorded using field notes. Although cameras were used briefly, it was soon apparent that some older participants became too aware of the camera or camera shy by putting on a hat or constantly fiddling with hair and outfit. In order to maintain the natural and spontaneous interaction in the family social gathering, the camera was put away.

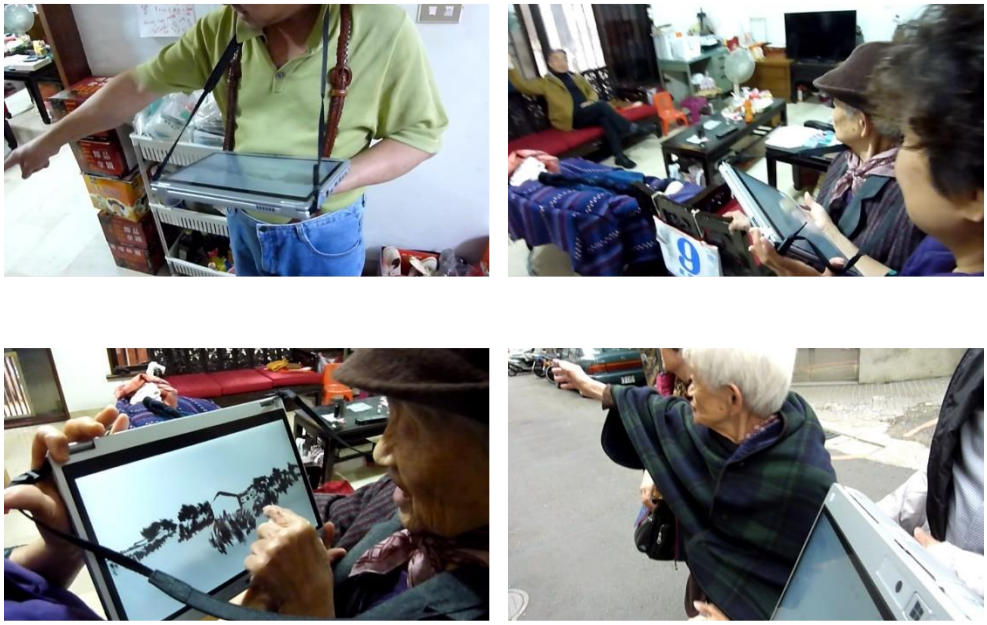

Figure 4-4: Scenes of user studies.

Follow-up Interview with Participants

After the family social gathering, participants were again interviewed individually. The interview was to learn about participants' perceived experience from the interactions between other family members with the assistance of visualizations of past neighbourhoods in STREMIS, and any notable stories or knowledge that were learned from this experience.

4.2 Findings of the Study: Lu Family

4.2.1 Pilot Interview Findings about the Participants

In this section we present findings from the pilot interviews with Grandma Yan, Mei, Chao, Sui and Pater. The findings would provide a background of the participants and some insights on the general interaction behaviours between the participants without the use of STREMIS. The findings presented here would provide a basis for comparison with the observations of using STREMIS.

The participants from Lu Family include several extended family members. Each of the participant his or her own family and homes separately. Grandma Yan, as the mother and grandmother of the participants, is the central figure of the extended family. Due to her age and health condition, her daughters and sons, including participants Mei, Chao and Sui, visit her periodically at different frequencies due to geographical distances. The grandson, Peter, who is married and lives abroad, visits Taiwan about once a year. Although Peter has been able to visit Grandma Yan, his father Chao and aunt Mei almost on his every visit, he has not met uncle Sui probably for over five years due to their different visit schedules.

When asked about what family members usually talk about with each other, all the participants said that the conversations are generally just daily anecdotes. The conversation topics between Grandma Yan and her children are generally about recent health conditions, personal encounters, and status of relatives, friends, and children. The conversation topics between Grandma Yan and Peter, due to language differences, are quite limited to greetings such as “Are you well?” and “What would you like to eat?”. The conversation between Mei and Peter are generally Mei asking Peter about his life abroad, and places that he would like to visit or food that he would like to eat during the visit. The conversation between Chao and Peter, the father and son, are generally about work situation and family lives. Neither Peter nor Sui could remember their conversation with each other aside from greetings due to the lack of interaction in over 5 years.

We also inquired about the interest in sharing personal past stories with younger family members, or interest in learning about older family members' past experiences. Grandma Yan and Mei expressed that they did not think the younger generation generations would be interested in listening to them talking about the past, and they were not sure what to talk about. Chao would be interested in sharing his past experience if the younger generations ask. He is also interested in learning what Grandma Yan has to say, but believes that he probably has heard them all. Sui is very interested in sharing his personal experiences, as well as family legacies and local histories. Sui would be interested in learning from the older generation as well. Peter had not thought about asking the older relative about their past stories, but would be interested to hear what they have to say.

4.2.2 Observation Findings (before STREMIS Deployment)

The observations findings of the interactions and communications between the Lu Family members during the family social gathering at Grandma Yan's home, before STREMIS was introduced, reflect the findings from the pilot interview. At the beginning of the gathering, Grandma Yan and Mei's attentions were on Peter because he had been away for almost a year. However due to the language difference, Grandma Yan and Peter's interactions were very limited, although both seemed to want to communicate more, but instead smiled a lot at each other. Peter and Sui greeted and asked about each other's recent status abroad. The topic of the conversation then shifted be about the recent status of one of Grandma Yan's nieces, who also lived abroad. The conversations with Grandma Yan were conducted in Taiwanese, while the conversations between Mei, Chao, and Sui were conducted in a combination of Taiwanese and Mandarin. Peter, being a Mandarin monolingual, watched the conversation and asked his father Chao for explanation once in a while.

4.2.3 Observation Findings (after STREMIS Deployment)

Initial Response and the Discovery of "Earth House":

About 30 minutes into the family gathering, the first visualization of their past neighbourhood was presented to the participants. The first image was a visualization of Lu Family's past home, rendered based on a 1949 aerial survey photograph. The participants gathered to take a look at it, and Grandma Yan laughed and said "It's our 'thóo-kak-tshù'!". [211] Peter asked what it meant, and Chao replied, "It means a house made of earth and mud." Peter was very surprised to hear that and commented "Your childhood home was made of earth!?" Chao replied "It was actually a pretty good material, cool in the summer and warm in the winter." Sui also added "But not very good with water." Sui then asked about how the image was done.

The content of STREMIS was explained to the participants briefly as "paintings of their past neighbourhoods created based on past aerial photographs". In order to maintain the spontaneous reminiscence and interactions between participants, the purpose of the research was described as "to find out how people would react to these paintings." The participants said the that paintings of their past neighbourhood was an interesting idea, and begun to browse through the images.

Conversation about the House:

The image that depicts the participants' old house elicited conversations about it appearance, structure, the environment among the participants. After learning about the earth-made house, Peter commented that he thought traditional houses in Taiwan would be made of red bricks, and asked how old the house was. "I think your grandfather grew up in this house too." Chao answered. Peter was surprised by the age of the house. Watching the conversation unfolded in Mandarin, Grandma Yan also contributed. She pointed to the vegetation on the right side of the house and

[211] "thóo-kak-tshù" 土角厝, "Earth Brick House"

described the trees were “lián-bū” [212] fruits in Taiwanese. Mei added that there were also guava trees behind the house. All four older participants described the pig pen that located on the left side of the house. Chao and Mei also described the pit latrine located on the far left side of the house, as well as how bad it used to smell and how Mei hated to use it during the night.

Figure 4-5: The “House made of Earth” and childhood playground.

The blank walls of the house depicted in the image drew some comments and discussion among the participants. Due to the lack of reference materials for street level scenes, the house was depicted in approximated dimensions with blank wall, along with slanted roof and vague interpretation of surrounding vegetation identified from the aerial survey photographs. The lack of doors and windows on the house prompted Sui to ask “How come the house does not have any doors and windows drawn?”. After learning about the reason of uncertainty, he contributed, “I can tell you that, the doors and windows are here and here.” Sui described the appearance of the

[212] “lián-bū” 蓮霧, Syzygium samarangense

house by pointing to the image. Sui pointed out that there were three doors on the front side, which prompted Peter to ask why. Sui answered that the house was shared by three households. Peter was again surprised by the reveals about the home that his seniors used to live in.

Childhood Games:

The image of the old house also elicited conversations about children's games played in the past. The image depicted the house with a large empty area in the front, which prompted Peter to ask if there was anything there. Chao commented that it was an open space where laundry and food would be put under the sun to dry. Sui mentioned that he used to play marble games in the open space. Peter got interested and asked what kind of game it was. Sui was surprised that Peter did not know about marble game, and then described how it was played and the rules. Sui also demonstrated through acting and gesture how he aimed and shot marbles with his hand. He also proudly mentioned how he used to win a lot against other kids in the neighbourhood. Chao also agreed that Sui was good at playing games when they were children. Sui then asked Chao if he remembered some of the neighbouring kids by names. Mei also told Peter that she used to play hopscotch and did cartwheels with neighbourhood girls when she was young. The conversation between Peter, Sui, Chao and Mei was enthusiastic, Grandma Yan, although did not contribute, also watched the interaction between her children and grandson closely with a delighted expression.

The Death of a Family and Superstition:

During the conversation about the past neighbourhood while browsing through the images in STREMIS, a very personal story was shared by Grandma Yan. While looking at the images, Grandma Yan sometimes commented on the relatives or friends that used to live in the different part of the neighbourhood, and shared some brief details about them or recent situation of their children. At one point, she spoke for a length to Mei and looked at Peter. Then Mei asked Peter if he understood what Grandma Yan had just said. Peter shook his head. Mei told Peter that she was talking

about the story of Chao's older brother, who passed away when he was still a young child. Peter said he had heard about this "uncle" from his father, but never heard about any detail. "Your father was too young," Mei explained.

Mei also translated the stories which Grandma Yan had just shared about Sui and another aunt when they were newborns. Grandma Yan described the story about Sui's physical impairment that was caused by an angered deity, which was offended by the breaking of window glass and hammering of iron nails in attempt to fix a broken window during a typhoon early in Sui's birth. "Hammering nails?" Peter asked. Mei continued with a story about Peter's third aunt, Chao and Sui's younger sister, who was just a few days old, also became mysteriously during another typhoon. Mei said because of the strong wind, she attempted to close the sliding door of the grocery store that the family owned, but the door fell and broke the glass windows on the door. In order to protect the shop from typhoon, their father nailed a wooden board to shut the entrance, and according to Grandma Yan, this act again offended the deity, which made the new born aunt ill. Peter listened to the story with amazement. Grandma Yan looked at Peter and smiled. "Do you believe it?" Mei asked Peter. Peter seemed still amazed by the stories, replied "So, don't use nails?". The participants laughed, and Chao went on to explain the Taiwanese superstition of the deity.

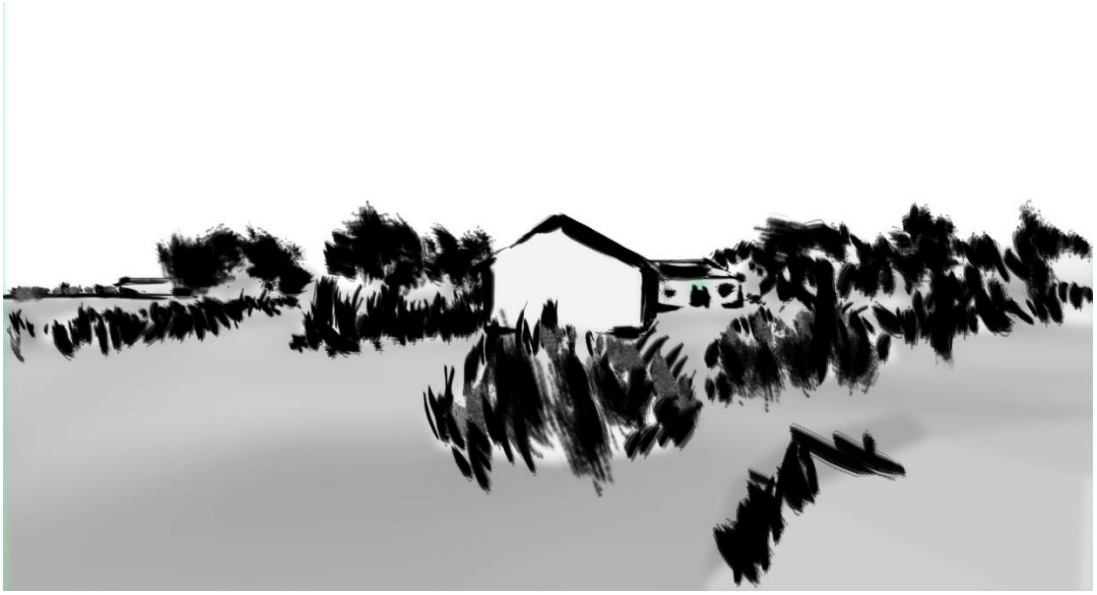

Figure 4-6: Place with emotional memories of death and illnesses.

4.2.4 Observation Findings (on Location)

The participants were invited to take a stroll through their past neighbourhood so their reaction to the physical environment and the visualizations in STREMIS can be observed. Upon arrival, Grandma Yan and Sui were eager to point out who used to live where by pointing their hand at the streets. When visualizations from STREMIS were shown to the participants on corresponding locations, the older participants' reactions were more of a confirmation on the things they had just described. However, Peter was surprised by how different the neighbourhood looked in the visualization and present because he had not visited the place in over 20 years. Peter was also observed to trying to match the view angle of the visualization to the physical location. He also suggested to have found remnant of past architectures that still exist in the neighbourhood by comparing the physical location with the visualizations.

4.2.5 Follow-up Interview Findings

The participants felt that it was a pleasant experience to talk about past stories during this family gathering. Grandma Yan was glad to see family members could interact with each other in this manner. Chao was also glad to see that his son, Peter, could interact with Grandma Yan and listen to her stories, despite the difference in languages. Grandma Yan and Mei were surprised but also delighted to see that younger generations like Peter would find their personal stories interesting. Sui felt it was fun to recall and share his childhood stories with Peter, whom he had not seen in years. Peter felt the experience with this social gathering was special and different from previous gathering, where he just went to greet older family members out of respect. He said it had not occurred to him to ask about their past experience, and even if he wanted to, he would not know how or what to ask. Peter was also surprised by the stories that the senior family members shared, because he had no idea about the type of environment they lived in, and the beliefs that older Taiwanese had. In the end Peter felt the experience made him feel closer to the extended family.

The participants felt that the visualizations of their past neighbourhood supported this social gathering experience. Chao said that without the visualizations, it would not have occurred to him to recall and share stories from such distant past about his childhood. Chao was also surprised that visualizations based on historic aerial survey photographs could captured the essence of the look of the place. Grandma Yan and Mei said they were delighted to see paintings of their past neighbourhood, and felt nostalgic. Sui felt the visualization was a good idea in supporting storytelling, because describing the past without visuals would be difficult. Sui is interested in learning and sharing about the genealogy and legacies of the Lu Family, and would like to see more visualizations of the place. Sui also requested that his descriptions about the doors and windows on their earth house to be added to the visualization, and would like to an updated rendition.

4.3 Findings of the Study: Gao Family

4.3.1 Pilot Interview Findings about the Participants

The participants Min, Yu and Alex are from the Gao Family, a nuclear family of three. The father Min and the mother Yu, live in their apartment in the south eastern side the Taipei. Their son Alex, who has been living independently since going to university at the age of 18, lives in the north eastern part of Taipei about an hour away by public transportation. In the past year, due to busy work and social schedules, Alex visits his parents on weekends about once to twice a month.

During the weekend when Alex visits his parents, the three usually would go out for lunch and then return to the parents' home to relax. Min would often sit in the living room watching television, while Yu would sit at the dinning table either reading books or watching videos on her tablet. Alex sometimes would spend time browsing the internet in a room that his parents prepared for him, or watching television with Min in the living room. Between Min and Alex, conversations can be about recent work and life situations, and comments on news or contents playing on the television. Between Yu and Alex, conversations tend to be limited to Alex's daily live habits,

and recent situations of relatives and friends. Also, Alex does not feel that he and his mother have much to talk about.

Alex would be interested in learning about his parents' personal stories from the past if they had any to share, but he is not sure what he would like to know nor what to ask his parents. Min and Yu are not sure what past stories they have to share, but if anyone asks or anything remind them of certain stories, they would share if any one is interested.

4.3.2 Observation Findings (before STREMIS Deployment)

The observed interaction between Min, Yu and Alex, before we introduced STREMIS, somewhat reflects the findings from the pilot interview. The family gathered at the dinning table and made tea. Yu talked about her recent visit with a family friend, and shared the story about the friend's son and daughter-in-law. Min commented and discussed the story with Yu. Min also talked about his friend's daughter who recently got married. Alex did not contribute much to the conversations about recent situations of his parents' friends. However, Alex participated more in the conversation when Min mentioned that a friend of his made some nice comments on Min's car, as well as when Yu mentioned that she saw a TED video on house plants that can purify air. At one point, Min had to temporarily leave the room. Alex and Yu did not have much conversation afterward except discussing what to eat for dinner.

4.3.3 Observation Findings (after STREMIS Deployment)

Initial Response and Memory on Learning to Ride a Bicycle:

The first visualization of Gao family's neighbourhood from STREMIS was introduced to Yu and Alex while Min was away. The first image was a depiction of the street where the family lived in the early 1980's. Without being explained what the image was about, Yu's first reaction was praising the aesthetic of the painting and asked researcher if he painted it. After being asked if the image looked familiar, Yu paused, looked at the image, and started questioning herself for a few seconds, then

asked the researcher “Is this the apartment of N.S. Road?”. Yu was delighted after receiving confirmation from the researcher. Alex became curious and asked “Does this painting look like the place?”. “Yes. You were probably too young at that time to remember. This would be the unit that we lived in.” Yu answered and pointed at one of the apartment windows in the image.

At this point the content of STREMIS was briefly explained to Yu and Alex as “paintings of their past neighbourhoods created based on past aerial photographs”. In order to maintain the spontaneous reminiscence and interactions between participants, the purpose of the research was described as “to find out how people would react to these paintings.” Then the participants were allowed to continue the conversation.

Afterward, Alex mentioned that he somewhat remembered the look of the place, and shared his experience about learning to ride bicycle on the street by himself. “When I was riding the kiddie bike here one day, the support wheels got bent, and I just continued riding without even noticing that I was able to balance.” The mother also recalled and replied “Hum, certainly I don’t remember dad or I ever taught you to ride.”

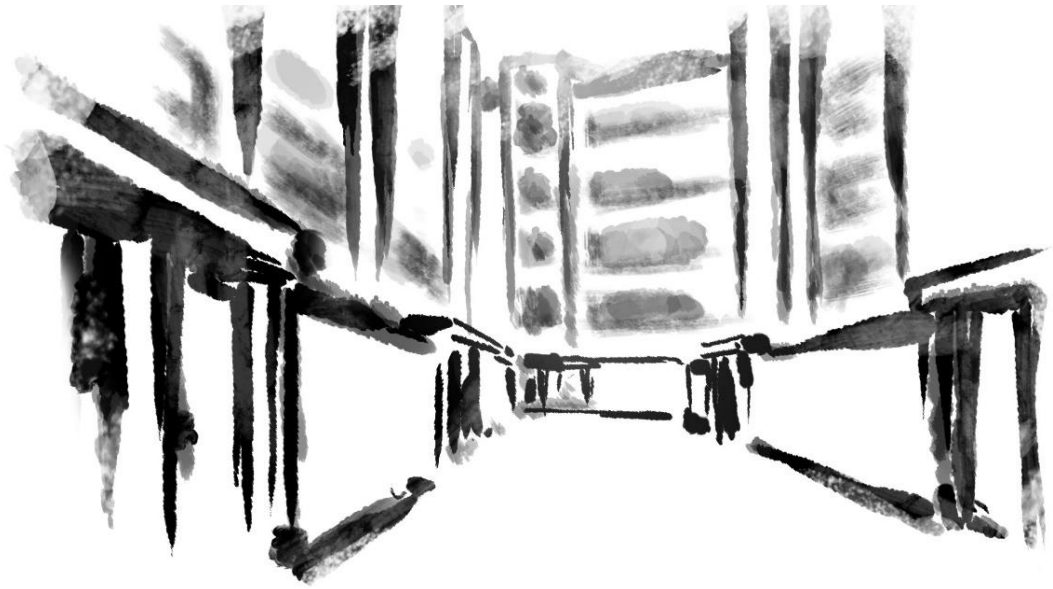

Figure 4-7: Alex’s childhood cycling ground.

The Friendly Neighbour:

When Min came back and saw the image, he recognized the depiction to be the family's home in the early 1980's. After learning about the use and purpose of STREMIS, he shared stories about a neighbour in the area. Min recalled a lady in the neighbourhood called "Ms. H", and how he and Yu often dropped Alex off at her place for lunch due to work. Yu also recalled that Ms.H liked to have Alex around, and was very kind to the family and often shard food with the family. Alex did not recall any lady named, Ms.H, but recalled memories of spending time at someone's home where there was a large fish tank, and the interior of the home was not very bright. Min confirmed with delight that Alex's description was indeed the home of Ms.H, and explained that the lightings was due to Ms.H's home being a first floor unit, and that the fish tank contained red dragons[213]. Alex continued to share his experience at Ms. H's, "I think I watched a movie about shark there. Maybe it was Jaws? I don't remember. Somehow I also remember there was an underwater base in the movie. I remember being scared for a while."

Childhood Accident:

Yu recalled an episode of being at home one day, and her son Alex, still at kindergarten age, came home all wet. Yu asked what happened back then. Alex was surprised that his mother asked and replied "You don't remember? I fell into the water storage tank in the building across the street." Yu was even more surprised to hear that and said she had never heard anything about this. Alex questioned Yu if he came home all wet, why did she not ask. Then he went on to explain what had happened, "I was playing hide-and-seek with some neighbourhood kids on the street. You know the apartment building there, behind the first floor stair case there was an underground water storage tank. I went to hide behind the stair case and sat on top of the tank cover. I remember it was quite rusty. All of a sudden I fell into the water. It was really deep

[213] 紅龍, Asian arowana

and I clung to the edge of the tank and yelled. Then someone pulled me up, maybe by one or some of the kids, I don't remember. Then I went straight home." Yu said that Alex never said anything, and Min said today was the first time he heard about the story. Min also said it was dangerous incident, but jokingly said to Alex that perhaps the young Alex was afraid of being scolded at, and did not honestly mention what had happened.

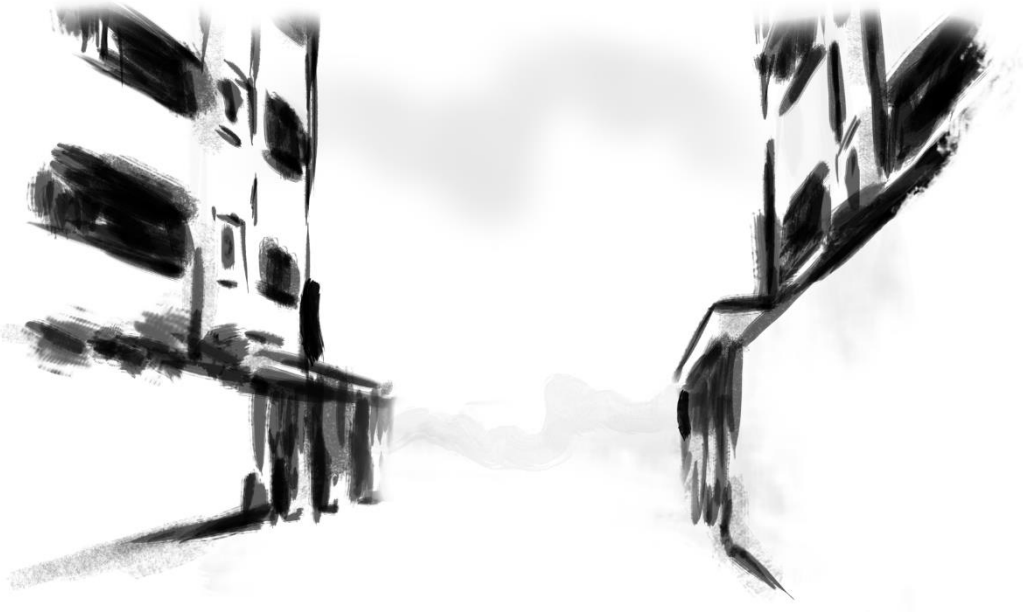

Figure 4-8: Place with memories of friendly neighbours and childhood accident.

Embarrassed Company Assistant:

Min recalled a funny episode while they browsed through images of the neighbourhood of T.H. Street. Min described that his office was located in the neighbourhood, and everyday during lunch time Alex would be dropped off by the kindergarten microbus in front of the office. Min recalled that one day, when his company assistant was buying lunch at a street food stall in front of the office while Alex was being dropped off, Alex yelled at the assistance in front of the street vendor "Teacher said street food stall is unclean, you should not eat it!" The assistant return to the office and complained to Min what a huge embarrassment it was.

Figure 4-9: Place of embarrassing story.

4.3.4 Observation Findings (on Location)

The participants were invited to take a stroll through their past neighbourhoods so their reaction to the physical environment and the visualizations of STREMIS can be observed. Min, Yu and Alex commented on how nostalgic it was to revisit the old neighbourhoods. They also commented how much T.H. street has changed with several modern tall buildings now surrounding their old building. There conversation between the participants were not particularly engaging and few additional stories were shared without or with the content from STREMIS.

4.3.5 Follow-up Interview Findings

The participants felt that the experience of talking about past stories during this family gathering was a pleasant one. Yu felt it was a nice change recall and talk about the places and events in the past with Alex, as the two often did not have much in common to interact. Min thought the experience was fun and entertaining, and felt glad that Yu and Alex had more to talk other than daily anecdotes. He also felt this experience made the family feel closer. Alex felt the experience was interesting and was surprised

by the stories revealed during the interaction. All three participants were surprised by the reveal of Alex's childhood accident story, because prior this interaction, Min and Yu had not known about their son's accident that occurred over 30 years ago, and Alex had not known that his parents had not been aware of the accident through all this time. All three participants felt the interaction at home was more engaging than their usual gathering.

The participants felt that the visualization of the past neighbourhood supported this social gathering experience. Yu was surprised by how the initial image looked familiar to the old apartment street, and said it was refreshing to see the old neighbourhood at paintings. Min said that he could probably still remember the same stories if he tried to recall the places, but the seeing and talking about the images naturally brought back the memories. Alex said that without the visualization, he might not have thought about the past neighbourhood or the accident. He also mentioned that he had forgotten about the accident prior this gathering, and could not remember when the last time he shared the story with anyone.

4.4 Discussions on the Findings

4.4.1 Stories and Descriptions of the Past

All of the participants, who have previously lived in the neighbourhoods depicted by the visualizations, have recalled stories or descriptions about the past during the user studies with STREMIS. Upon the introduction of these images, participants generally began by recalling their knowledge about the visualized places, and shared descriptions about the places. This behaviour is shown when the Lu Family discussed the appearance of their old "earth house" when it was first introduced. Yu's initial reaction was also to point out where their unit of residence was on the image. Personal stories generally follow after certain descriptive details had been recalled or shared.

In the user studies we observed some unexpected reveal of personal stories. The concept of STREMIS was originally designed to evoke reminiscence for older adults with sceneries from the past. However, in the case of Alex, we also observed

his sharing of personal experience with the neighbourhood from his memory of the kindergarten age. The story about Alex's childhood accident was an unexpected discovery not only to the researcher, but also to the Gao Family. Grandma Yan's stories about the death and illness of family members, although not uncommon in a therapeutic reminiscence practice setting, were also unexpected for a family social setting. The user studies demonstrated that stories elicited by visualizations of past neighbourhood can be both fun memories as well as difficult times that the participants have overcome.

In this research we claimed that by using the ambiguous "between similitude and dissimilitude" non-photorealistic rendering technique to visualize past neighbourhood, the images may engage suspension of disbelief despite the presence of uncertainty or inaccuracy, as well as encourage comments and discussions. This claim can be supported by the observations such as Lu Family's discussion about the placement of doors and windows on the old "earth house". Although the image triggered questions from the participants because the house was drawn with blank walls by design due to uncertainty, the image also triggered reminiscence and conversation about the visual details of the house, as well as aided the discussion by offering a pictorial reference. In this example we also observed that after describing the details of the environment, personal stories such as childhood game plays would start to emerge and led to more involved storytelling.

The visualizations of STREMIS also elicited the sharing of descriptive details about the environment, which provides reference to the lifestyle and composition of the neighbourhood in the past. Many of such descriptions were about the people who lived in the area, such as their identities, names, the location of their residences, their relationships with the participants, or their past and recent situations. The stories recalled by Min, Yu, and Alex about Ms. H. is one such example. During the study with Lu Family, Grandma Yan, Mei, Chao and Sui on several occasion mentioned about a "great grand cousin" who lived in the house next to their earth house, as well as other uncles and cousins who lived in nearby areas. Similar to Ms. H. recalled by

the Gao Family, this “great grand cousin” also seem to be an important or supportive figure to the Lu Family during their lives in the neighbourhood.

Some of the shared description were about the functional elements of the environment in the past. For examples, Grandma Yan described the location of a soy sauce maker, a water pump, etc. Mei recalled about a jasmine farm/garden in the area. Chao also talked about a truck repair shop located north of his old home, and how he used to watch the technicians repairing brakes and assembling parts while he was young. Similarly, Yu also remember the location of a toy shop where she used to buy toy cars for her son Alex. Min also recalled about a traditional market, as well as a Taoism temple in the area. Although not all shared descriptions would lead to personal stories, these little details about the past can still contribute in shaping a picture of the past environment for listeners who have no shared knowledge, and support the interaction between family members.

It should be noted that more engaging storytelling activities were observed with images that depicted participants’ homes, or sceneries located closer to participants’ homes. The more engaging stories we observed such as the discussion on house appearance, childhood plays, neighbours, accidents, death and illnesses occurred when participants were looking at images of their past residences or close by sceneries. During the interview Min also expressed that the two images depicting two different directions of the same street that he lived on, the one that showed his home was more quickly recognizable than the other. It should also be noted that some of images in the user studies did not evoked memory recall or elicited storytelling, and these images depicted sceneries that were located farther away from the participants’ past homes. These finds indicate that the image of one’s home may be more effective in evoking memories.

4.4.2 Interaction between Family Members

The user studies have shown that interaction between family members became observably different when reminiscence and storytelling begun with the deployment of STREMIS. The findings from the pilot interviews and observations conducted prior

the deployment of STREMIS provide point of reference for comparison. Generally, we found that the interaction became more engaging when participants shared their personal stories about the past.

In the pilot interviews, all six old adult participants were concerned about not knowing what to share about their past experience, despite being willing to share if one would bring up a question or a topic. In the user studies we observed that recalling and talking about the past became spontaneous when participants saw the visualized images of their past neighbourhoods. We also observed that stories or descriptions shard by one participant, may become a trigger for another participant to recall his or her experience, or ask questions that elicit more feedbacks. One example of this would be Alex and Min's discussion about their friendly neighbour Ms. H's house interior. Another is the discussion between Peter and Sui about the appearance of the "earth house" and the empty space in the front, which led to the story about Sui and Mei's childhood games. These observations from the studies have shown that STREMIS can initiate spontaneous interactions between family members.

The observations of the family social gathering prior the deployment of STREMIS showed that the oldest and youngest members can sometimes become excluded in a conversation. This can be due to the difference in language use as observed in Lu Family's situation with Peter and Grandma Yan, or the lack common knowledge in the ongoing topic as observed in Gao Family's situation with Alex. When STREMIS is presented, we observed that participants would come closer to each other to look at the image, to listen to the conversation, or to join the discussion. We also observed that the images were often spontaneously used as pictorial references by participants to explain stories or ask questions, and this would also attract participants to move closer and interact with each other. Although it is unclear whether it is the novelty of STREMIS or the conversations that gathered the participants, we observed closer interactions between the family members when STREMIS was used in the family social gatherings.

The interactions between participants were observed to be more active when conversations began to focus on the stories and descriptions of the past. For instance,

between Grandma Yan and Peter, the interaction prior the use of STREMIS were limited to simple greetings and asking about recent status due to language differences. After STREMIS initiated conversations about the past, Grandma Yan became more active and enthusiastic in talking to Peter despite knowing that he might not understand completely. Peter also became more active in asking Grandma Yan questions about the past through translations of other family members. The interactions between Peter and his uncle and aunt also became noticeably more involved, as observed by the conversation about childhood games, and enthusiasm in discussing Grandma Yan's stories on superstitions. We also observed notably more active interaction between Alex and his mother Yu after they start talking about the past. Prior the use of STREMIS, Alex did not seem to be very enthusiastic or participative in the family conversation, particularly with his mother, however after the image of Gao Family's old apartment home was presented, Alex not only interacted with Yu more, but also actively shared his own stories, including the one about his accident which neither of his parents knew previously. These observation findings support the claim that STREMIS can facilitate more engaging intergenerational family social interaction by supporting reminiscence and storytelling about the past.

4.4.3 Experience of Family Social Gatherings with STREMIS

The participants found the experience of social gathering at home with STREMIS to be pleasant. In the follow-up interviews, all the participants expressed that the experiences of talking about the past during the family gatherings were positive and surprising. Older participants like Grandma Yan and Mei were surprised that younger generation like Peter would found their knowledge of the neighbourhood or personal stories from the past interesting. Min and Yu were surprised that they would discover an important story about their son's accident that happened so close them over three decades ago, while Alex was also surprised to learn that his parents had been unaware of the incident. The three participants of Gao Family were pleased that this story surfaced with the assistance of STREMIS.

Some participants also expressed that the experience of family reminiscence and storytelling facilitated by STREMIS was important. Chao said that the stories shared by his family members included fun anecdotes as well as sad and difficult times from the past, and even though he knew about these stories, he felt the experience of recalling and talking about them with family reminded him of the journeys and accomplishments that family has achieved. Peter also felt the experience helped him knew his family better and developed further respect. “Even though I do not see the relatives in my big family often, I’ve always respected them. I knew they’ve come a long way. But this experience was still quite an eye opener. I had no idea that the older generations grew up in this kind of environment and conditions. I feel more respect and grateful that because of their efforts, I can live an enjoyable life today.”

Participants’ enthusiasm in sharing their personal experience and knowledge, as well as listening to what others have to say, was observed during the user studies at their homes. On several occasions Grandma Yan displayed delighted laughter when Peter was surprised by the stories shared by her or other participants, as well as when she watched her children and grandson engaged in conversations about the family’s past. We also observed Grandma Yan enthusiastically described in details how her newborn daughter who caught the mysterious illness was cured. Sui also became very enthusiastic about telling past stories using the visualizations of past neighbourhood, and requested to see an updated depiction of their old house based on the discussion. Sui’s enthusiasm is also shown when he actively showed off his personal collection of remnant from the old earth house, and documents that recorded the family’s history.

Figure 4-10: Historic memorabilia shared by Sui during user study.

4.4.4 Experience of Location Visits with STREMIS

The findings of user experience in the outdoor, on-location observation studies were inconclusive. Although STREMIS was designed primarily to assist reminiscence and storytelling for family social gatherings which generally take place indoors, we were curious what kind of response the participants would make when the visualizations were being compared to the physical environment on location. When participants took a walk through their past neighbourhood, some comments about how the place have changed or feeling nostalgic were made. There were also comments that confirmed some of the descriptions made earlier at participants' homes about who lived where. We also observed that Peter, who had not previously been to the past neighbourhood, was fascinated by the differences in the landscape between the images and present condition. Furthermore, at one intersection, we observed that Grandma Yan and Mei debated the physical locations of someone's residence and a shop. Although some interactions between the participants were observed, it was difficult to determine whether it was the physical environment or the images of STREMIS that supported the interaction.

It should also be noted that the experience of the location visits was influenced by a number of variables. First, for older participant like Grandma Yan, taking a walk outdoor can become physically challenging. Although Grandma Yan was energetic in pointing out the locations of people's residences while walking through the neighbourhood, it became obvious that she was exhausted after walking for a few hundred meters. Secondly, road traffics were distracting and presented safety risks during location visits. While the participants walked through the narrow streets of their past neighbourhoods, we observed that sometimes they had to avoid oncoming motorbikes and cars while talking or looking at the images on STREMIS. This not only stopped the conversation sometimes, but also kept participants' attention on the roads and oncoming traffics rather than on the interactions with family members. Thirdly, visiting the old neighbourhood could be a tedious process. For both the Lu and Gao families, we discovered that the trips to visit their past neighbourhoods in

Zhonghe districts could present some tiresome experience for older adults due to issues such as taking public transportations, driving through crowded traffics and finding a place to park vehicles. The rainy weather was also an issue with Gao Family's location visit as holding umbrella made accessing STREMIS and interacting with other difficult. Although the user studies of observing the use of STREMIS at the locations of participants' past neighbourhood did not find conclusive result, the issues that we observed highlighted the importance of supporting reminiscence and storytelling at the indoor setting of family social gathering to facilitate an engaging intergenerational interaction experience.

4.5 Effectiveness and Values of STREMIS

This study has demonstrated the effectiveness of STREMIS in stimulating reminiscence and facilitating an engaging intergenerational storytelling experience among family members in a family social gathering setting. The visualizations of participants' past neighbourhood have been shown to be able to trigger recall of past experiences. The findings support the claim that images of past neighbourhood, created using virtual reconstruction based on historic topographic data, and visualized using non-photorealistic rendering style of "between similitude and dissimilitude" expression, can support reminiscence facilitate an engaging.

The design of STREMIS has proven to be effective in supporting the recall and sharing of past experience to facilitate an engaging storytelling experience. Each of the three design components of STREMIS have contributed to the overall experience. The first component, topographical overview of the place, has proofed to be important in supporting the reconstruction of the past neighbourhood and recreation of the sense of space in the past. The second component, first-person perspective, has been demonstrated to be able to create a sense of familiarity for the visualizations to the audiences. And finally the third component, non-photorealistic rendering suing "between similitude and dissimilitude" technique, played a key role in minimizing the awareness of inaccuracy or uncertainty in the visualization. By

using this hand-drawn, artistic style to depict past scenery, the audience saw the images as subjective interpretations of the place rather than objective representations. Overall, the design was able to evoke memories about the past and assist the communication of stories, which contributed to an engaging family social gathering experience.

STREMIS is designed to support an engaging experience for family social gatherings. It achieves this by supporting reminiscence and facilitate storytelling. In modern and urbanized societies, many family members are becoming increasingly distant in geographical locations, language use, and cultural background. This caused face-to-face interaction among family members to become less frequent, which may also negatively affect family members' ability to interact with each other during limited opportunities of meeting each other. Sharing personal memories of past stories is an effective way of strengthening family bonding. For older adults, the act of reminiscence can support the maintenance of healthy social relationship and emotional wellbeing. And for younger generations, the stories provide personal perspectives of history and background for forming self-identity. Family members getting together and talking about the past can also simply be a fun communal experience.

STREMIS provides a way of creating reminiscence triggering visual stimuli. Reminiscence as a process generally require a trigger that initiate the recall of past experience. Such triggers can be many materials such as past photographs, audio and video contents, physical memorabilia, etc. Even so, for some people the materials that can trigger reminiscence may not necessarily be available. In this research we demonstrated that by using topographic map and aerial survey photographic data, 3D CG virtual reconstruction, and "between similitude and dissimilitude" style of non-photorealistic rendering, we can create visualizations of past places that can be used as reminiscence triggers. This will support many seniors and families to be able to engage in reminiscence for therapeutic purposes, oral history contributions, or as social activities that strengthen bonding and relationships.

Chapter 5

Conclusion

This dissertation documented a journey to learn about people's lives in the past. Through this learning process we have participated in intergenerational social gatherings to observe and empathize, reviewed literatures on several disciplines in the realm of history, memory, place, visualizing the past, and the concept of realism, and we conducted hands-on design process of designing novel stimuli to facilitate reminiscence and storytelling. These multidisciplinary inspirations have supported the design process and the development of a visual content for the intended objective.

This research explores the concept of incorporating non-photorealistic rendering with virtual reconstruction of past places in suburban Taiwan to generate artistic representation of audience's past neighbourhood as visual stimuli for reminiscence to support storytelling. The virtual reconstruction method proposed in this research is developed with the consideration of the unavailability of street-level reference materials, and utilizes historic topographical data such as aerial survey photographs and maps as main source. To create the visual representations, three components are required: overview of the place, first-person-perspective of the place, and non-photorealistic rendering. This non-photorealistic rendering adopts the "between similitude and dissimilitude" technique, mimicking the visual quality of Chinese ink wash painting, to leverage the perceptual process described by Gestalt and Geon psychology theories.

The user study findings demonstrated the potential effectiveness of the renderings for the places that they represented. Subjects have recalled personal stories on a variety of topics, including descriptions of people and places in the neighbourhoods, unsolved mysteries, physical accidents, death of family members, as

well as various past anecdotes. The studies also noticed that shared stories can trigger more reminiscence and storytelling.

It is worthwhile to explore further whether this type of rendering technique can be applied to broader regions with different architectures and landscapes, and whether other seniors would still find the representation stimulating in bringing back their memories. In the future phase of this research we plan to develop a broader virtual environment representing historic greater Taipei area to enable users exploring more space of the past and rediscover their forgotten stories in the history of the city.

The works described in this dissertation have been presented at the International Conference of Digital Archives and Digital Humanities, and Asian Network GIS-based Historical Studies International Conference. The proposed design as a support for memory and oral account elicitation was critically received. This virtually reconstructed visual stimuli may support broader range of studies in oral history collection, genealogy, and as observed in the user studies, also support continuous reconstruction the historic place with growing details based on audience's feedbacks. The proposed method of virtual reconstruction using historic topographical data also provided an alternative use of GIS as the source for creating derivative contents that support the communication of geography and history, as well as support the primary research process on the people who live in the lands.

The proposed method of converting topographical data into artistic, first-person perspective visualization currently requires time and labour intensive process in aerial photo interpretation, modelling, and hand drawn rendering. However, with the future advancement in image analysis and non-photorealistic rendering computations, the visualization process may soon become automated. When there is enough accumulated data to cover large area, real-time navigation in artistic virtual historic place may be realized and provide more applications such as location-based infotainment services in autonomous transports.

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