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**Using Object Biography Metadata to Create  
Artefact Interactions outside Memory Institutions**

A thesis  
submitted in fulfilment  
of the requirements for the degree  
of  
**Doctor of Philosophy in Computer Science**  
at  
**The University of Waikato**  
by  
**Can Zhao**



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# Abstract

Artefacts are primarily experienced inside museums, and those with insufficient display and interpretation can be isolated and ignored. Mobile devices potentially allow the artefact interaction touchpoints to be moved into the wider environment beyond the physical boundaries of memory institutions. To achieve these interactions, one approach is to modify metadata from a typical descriptive catalogue entry to be object biography-centric. This thesis explores this opportunity and presents the creation of novel artefact-centric interactions outside museums embodied by a proof-of-concept mobile application prototype.

We performed four studies to acquire object biography metadata, design and evaluate the interactions with biography-enhanced artefacts. Study one explored the potential contributions that the biographical approach can make in documenting artefacts. Study two acquired object biography metadata in a selection of places and conceptualised the metadata fields. Study three extracted five sets of sample metadata from the collection of a local museum. The final study was the design and user evaluation of the prototype, which indicated that the implementation supported the novelty and effectiveness of object biography-centric interactions.

The current descriptive metadata of objects are not generally reusable for context-aware applications. Interactions designed on top of object biography metadata in the environment are a potential new approach for museum informatics and biographical intersections are a promising concept to focus user engagement.

Dedicated to my grandfather, who showed me why classical poetry is beautiful.

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# 1. Introduction

Artefacts are primarily experienced by visitors inside physical museums. Previous studies have shown that heritage objects with insufficient display and interpretation can be ignored during on-site visits (Monti & Keene, 2013). Although often seen as isolated in glass cases (Gosden & Marshall, 1999), the heritage objects are ‘living’ at their current dwellings—in many cases museums (Alberti, 2005; Tythacott, 2012; Friberg & Huvila, 2019)—and are on their continued journeys. Museum items have challenging metadata requirements due to their unique nature, and these requirements are ongoing.

Figure 1.1 and Figure 1.2 show an example of museum artefacts—a chain that was used by a surveyor named Richard Todd accessioned by the Auckland Museum Tāmaki Paenga Hira. The chain was displayed in a corner of a container, a small black square label with a “1”



Figure 1.1 Richard Todd the surveyor's chain (Accession Number: 1965.78.486) in the front-left corner of a display case in the Auckland Museum Tāmaki Paenga Hira. Photograph by Can Zhao on 31 October 2019

on the top was situated in the proximity of the item. The neighbouring interpretation panel delivered a narrative on the New Zealand Wars<sup>1</sup> entering a new phase by the late 1860s. The artefact was introduced under a sign that matched the small label via illustrating a 1 inside a black square followed by a subheading “Clearing the land”:

A surveyor’s chain and a cross-cut saw tell of the parcelling of the land for Pakeha settlers and the cutting down of bush for farms. In 1858 just 235,000 acres of land were cleared and fenced; by 1867 this had grown to 3,455,000 acres. (Auckland Museum Tāmaki Paenga Hira, n.d.)

No further information relating to the chain was found in the physical space. On the corresponding collection page of the museum website, *Pirongia, Waikato, New Zealand*—was listed as a place value. The other value was *New Zealand*, a considerably less fine-grained term. The chain may have been used in many places at many times and thus established relatedness to those places. Two displayed place values may help capturing certain moments during the *New Zealand Wars* in the past, but a lot more such potential connections were missing.

In a public lecture given at the University of Waikato on 19 October 2019, Dr Barbara Kirshenblatt-Gimblett—the curator of the POLIN Museum of the History of Polish Jews<sup>2</sup> shared the design and narration principles of the museum. She viewed that audiences would go to the memorial monument of the Warsaw Ghetto Uprising which was faced by the museum to remember how the victims died and go to the museum to recollect how they lived. By adopting an artefact-centric viewpoint, objects as the core display of heritage (Hoelscher, 2006) could be projected to a greater extent physically to offer another option to visitors, an option that can be mutually complementary to the in-museum experience. Enabling artefacts to have a presence in the wider environment is one way to place museums in the life of their users and this can only be achieved digitally using metadata.

“Metadata is a potentially informative object that describes another potentially informative object” (Pomerantz, 2015). In our context, “another potentially information object” could be the artefacts themselves. We could consider metadata “... as the sum total of what one can say at a given moment about any information object at any level of aggregation. ... [A]n information object is anything that can be addressed and manipulated as a discrete entity by a human being or an information system” (Gilliland, 2016).

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<sup>1</sup> <https://teara.govt.nz/en/new-zealand-wars>

<sup>2</sup> <https://www.polin.pl/en>

# chain, surveyor's

ON DISPLAY

OBJECT / ARTEFACT &gt; HISTORY

 Export

OTHER TITLES	Gunters chain (alternative) Richard Todd, Pirongia, King Country (associated name)
DESCRIPTION	Surveyor's chain belonging to government surveyor, Richard Todd, who was killed on Mt Pirongia as he surveyed confiscated land in the King Country on 20 November 1870 by Māori who were enforcing the aukati line, which delineated Māori from Pākeha land following the Waikato War. Steel chain, each link 170mm long, links are interspersed with brass markers with a simple loop for a handle at one end.
PLACE	<a href="#">New Zealand</a>
ACCESSION NUMBER	1965.78.486
ACCESSION DATE	29 October 1965
OTHER NUMBER	col.0254, ocm1681, 1965.78.486
COLLECTION AREA	<a href="#">History</a>
ITEM COUNT	1
DISPLAY LOCATION	a
RECORD RICHNESS	


 [Enquire](#)
 [Add to My Collection](#)

## Artefact ▾

CREDIT	Collection of Auckland Museum Tamaki Paenga Hira, 1965.78.486, col.0254, ocm1681
EVENT	New Zealand Wars; 1860-61; 1863-72
PERSON	<a href="#">Todd, Richard</a>
PLACE	<a href="#">Pirongia, Waikato, New Zealand</a>
SUBJECT CATEGORY	<a href="#">Wars/New Zealand surveying</a>
COLLECTION	<a href="#">Old Colonists' Museum</a>
PRODUCTION	unknown (maker) Circa 1865 New Zealand Wars, Wars
CONSISTS OF	chain > <a href="#">steel</a> steel, brass markers > <a href="#">brass (alloy)</a>
DIMENSIONS	0 - Whole length : 500mm (bundled) 0 - Whole diameter : 300mm
CLASSIFICATION	<a href="#">Chenhall Nomenclature (Nomenclature)</a> > <a href="#">05 Tools &amp; Equipment for Science &amp; Technology (Category)</a> > <a href="#">Surveying &amp; Navigational T&amp;E (Classification)</a> > <a href="#">Surveying Equipment (Sub-classification)</a> > <a href="#">Chain, Surveyor's (Primary Term)</a>
RECORD CREATED	19 October 2000

Figure 1.2 Part of the collections record page of Richard Todd the surveyor's chain (Accession Number: 1965.78.486), [https://www.aucklandmuseum.com/collections-research/collections/record/am\\_humanhistory-object-65641](https://www.aucklandmuseum.com/collections-research/collections/record/am_humanhistory-object-65641)

For enabling new interactions between the visitors and artefacts, standardising the heritage item metadata and making them accessible and manageable by Semantic Web tools (The World Wide Web Consortium (W3C), n.d.) could be a goal for cultural heritage stakeholders. Such interrelated datasets in the realm of cultural heritage and beyond on the Web can be called as Linked Data (The World Wide Web Consortium (W3C), n.d.). The subset of such data that is “released under an open license” is referred to as Linked Open Data (LOD) (Berners-Lee, 2006).

In practice, an ongoing curation crisis is making heritage artefacts poorly documented and orphaned (Friberg & Huvila, 2019). The metadata for most artefacts is lacking and thus insufficient to support object-centric interactions. We see object biography as one approach to inform a richer representation of, and thus interaction with, heritage artefacts. First derived from social anthropology by archaeologists (Joy, 2009), this biographical approach seeks to uncover the relationships between people and objects via life histories of an object or assemblage (Kopytoff, 1986; Gosden & Marshall, 1999; Joy, 2009). Artefacts accumulate and transform meanings and values from the moment they come into existence: the significance of an artefact is based in its connection to people and events (Gosden & Marshall, 1999). When consideration is given to these life moments of an object, their social contexts and consequences, “little is left out” (Gosden & Marshall, 1999). Object biography can be employed as a conceptual framework, the fact that it is not applied to structuring metadata opens up an opportunity for improving visitor-artefact interactions.

## 1.1 Concept Definitions

Table 1.1 Concepts and their associated concepts

Concepts	Associated Concepts
Object biography metadata	Descriptive metadata of heritage artefacts Object biography Biographical metadata Provenance
Artefact(-centric) interaction	Artefacts, objects and items Biography-enhanced artefacts
Outside memory institutions	Outside physical museums Physical and digital environments

Before moving towards specifying our research aim and questions, we elucidate the key concepts that are listed in Table 1.1 and will be used throughout this thesis:

*Object biography metadata.* The metadata that *describe* one or one set of heritage artefacts can be informed and structured by referring to their *object biographies* (Gosden & Marshall, 1999; Friberg & Huvila, 2019). By paraphrasing the explanation offered by Kopytoff (1986), Gosden and Marshall (1999) and Joy (2009), object biographies record the life stories of an object or a set of objects that highlight the person-object relationships. *Biographical metadata of artefacts* will be used interchangeably together with *object biography metadata*, though biographical metadata may also apply to other types of heritage-related entities such as persons and places. *Provenance* is traditionally defined as a chronicle of heritage object ownership (Getty Research Institute, n.d.; Milosch & Hull, 2019), which are being practically transformed to more complex records reflecting a biographical nature (Newbury & Lippincott, 2019).

*Artefact(-centric) interaction.* The information focus of such interaction is centred around the descriptive metadata of artefacts or a set of artefacts. We use these three terms—*artefacts*, *objects* and *items* interchangeably. Compared to the common use of these terms, their intended meanings in this thesis tends to be more inclusive and thus encompasses the physical things as photographs, letters, sculptures, etc. If an artefact is described by its biographical descriptive metadata, it is *biography-enhanced*.

*Outside memory institutions.* The concept can be interpreted as two approaches of artefact-centric interaction: one being accessing digital surrogates of heritage objects elsewhere, though predominantly at home (Marty, 2011; Seales, Crossan, Yoshitake, & Girgin, 2013; Petrelli, Marshall, O'Brien, McEntaggart, & Gwilt, 2017); the other being visiting physical places for a hybrid interactive experience (Jeater, 2012; Han, Shih, Rosson, & Carroll, 2014; Jones, Theodosis, & Lykourentzou, 2019). As the majority of the objects presented in this thesis is from museums, sometimes we will also use *outside physical museums*. We conceptualise any locales, both all outdoor and some indoor—particularly those situated in heritage sites and institutions as the *physical environment*, whereas access to virtual heritage offerings in the *digital environment* can potentially occur anywhere the technology permits. The combination of physical and digital also allows *hybrid* interactions where technology can enhance a physical heritage setting.

## 1.2 Research Questions

The motivation for this thesis is an interest in exploring the relationship between the artefact metadata provision and audience-artefact interaction outside physical libraries,

archives and museums (LAMs) based on two research gaps. On one hand, the descriptive metadata of objects are generally considered being of poor quality (Friberg & Huvila, 2019) and created to serve purposes other than facilitating interactions with artefacts in-situ (e.g., see two examples in Section 2.2.1). On the other, many digital heritage applications leave connections between the objects and the wider physical environments uncovered (Petrelli, Marshall, O'Brien, McEntaggart, & Gwilt, 2017; Liu & Chen, 2018). The designers of the digital heritage applications that are related to person-object interactions beyond the walls of memory institutions appear to continue employing a visit- or exhibition-centric conceptual model (Petrelli, Marshall, O'Brien, McEntaggart, & Gwilt, 2017; Law, 2018; Koo, Kim, Kim, Kim, & Cha, 2019; Yew, Deshpande, Precians, Cheng, & Do, 2020; Marto, Melo, Gonçalves, & Bessa, 2021). We aim to embed biography-enhanced artefacts into everyday lives of general audiences—where and when they are—via technologies that create an ambient appreciation of place and integration into history. Three research questions are therefore formed:

1. To what degree is existing descriptive metadata suitable for creating novel artefact-centric interactions beyond the walls of memory institutions?
2. Can we use object biography as a framework to document cultural heritage artefacts?
3. What are useful concepts to create novel artefact-centric interactions beyond the walls of memory institutions?

We adopt a practical approach to seek answers via conceptualising, acquiring object biography metadata and evaluating interactions with biography-enhanced artefacts embodied in a mobile application prototype.

### 1.3 Thesis Structure

The thesis is organised into eight chapters. Chapter 2 provides a background centring on how the design of person-object interactions can be informed by an artefact-centric perspective and object biography metadata. Chapters 3, 4 and 5 together document a continued metadata acquisition work, the issues emerged and opportunities lay ahead. To be specific, Chapter 3 explores the potential contributions that the biographical approach can make in documenting artefacts. Acquiring object biography metadata in a selection of places and conceptualising what constitute the object biography metadata is presented in Chapter 4. Chapter 5 describes extracting five sets of sample metadata from the collections database and related materials of a local museum. Chapter 6 shows the design and evaluation of a

proof-of-concept Android<sup>3</sup> prototype that uses the object biography metadata samples collected earlier. Chapter 7 addresses the research questions and discusses the lessons learned from designing and performing the research activities. Chapter 8 concludes the thesis and discusses possible future work.

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<sup>3</sup> <https://developer.android.com/>

## 2. Background

We interact with heritage artefacts in our daily lives, mainly via “perception, cognition and emotional and physical responses” (Dudley, 2015, p. 48). Such interactions can occur outside physical museums, in many places, directly and indirectly, physically and digitally. We could keep our inherited cookbooks or recipes that carry food stains in our little personal libraries and for reference when reproducing family traditions around dining tables (Hartel, 2010). We could drop by on our community post office to view the digitised old photos of our village and comment on them (Cheverst, Taylor, & Do, 2020). We could sit in a studio in a megacity, see an actor performing as the soul of a relic, meditate on the story and celebrate (Yu, et al., 2017). In this chapter, we review related literature to seek opportunities for improving such visitor-artefact interactions.

The chapter is arranged into four sections. Section 2.1 describes the potential of exporting artefact-centric interactions to the wider environment and making such interactions more sustained. Section 2.2 offers an overview of descriptive metadata of the artefacts and the current practices in memory institutions. Section 2.3 introduces the notion of object biography, the differences between object biography and provenance and the convergence of the two in practice, the qualities of object biography that are potentially useful for facilitating better visitor-artefact interactions and the use of the notion as a conceptual framework for research. Section 2.4 summarises the chapter and brings the object biographic-centric interactions into view as the foundation of our primary research work.

### 2.1 Artefact-Centric Interaction

If someone is a regular visitor to heritage institutions, a primary locale that stimulates such interactions is a museum. The artefacts in museums can commit themselves to prompting contemplation, conversation and alternative use (Simon, 2010). The in-gallery interactions with heritage objects can be likewise reflected by the alternative definition of museum selected by the Executive Board of International Council of Museums in July 2019 (International Council of Museums (ICOM), n.d.):

Museums are democratising, inclusive and polyphonic spaces for critical dialogue about the pasts and the futures. Acknowledging and addressing the conflicts and challenges of the present, they hold artefacts and specimens in trust for society, safeguard diverse memories for future generations and guarantee equal rights and equal access to heritage for all people. Museums are not for profit. They are participatory and transparent, and work in active partnership with and for diverse

communities to collect, preserve, research, interpret, exhibit, and enhance understandings of the world, aiming to contribute to human dignity and social justice, global equality and planetary wellbeing. (para. 4)

### 2.1.1 *Visit- and Artefact-Centric Perspectives*

Cultural heritage stakeholders shape, examine and design for in-museum experiences through taking different perspectives. For ensuring the interaction design between visitors and heritage items stays relevant and informed, we explore two frequently adopted and mutually complementary perspectives—those that centre around *visit* and *artefact*.

A museum visit is the focus for studies that investigate the relationship between patrons and museums (Marty, 2007) and in particular, those sustained digital tool-assisted long-lasting ones (Stock, et al., 2007; Wang, et al., 2009; Vayanou, et al., 2014; Kuflik, Wecker, Lanir, & Stock, 2015; Petrelli, Marshall, O'Brien, McEntaggart, & Gwilt, 2017; Moffat & Scott-Songin, 2020). A museum visit can be stimulated by a variety of motivations (Hornecker & Ciolfi, 2019), which can be identity-related and have an effect on visiting behaviours (Falk, 2006). We list below seven identity-related motivations of museum visitors (Falk, 2006; Bond & Falk, 2013; Falk, 2011), which suggest some of the reasons behind the in-museum information behaviours of the studied audiences:

- Explorers—seeking curiosity-satisfying content
- Facilitators—seeking experience of socialising with co-visitors
- Professional/hobbyists—seeking specific and passion-tied content
- Experience seekers—seeking experience of completing an important task
- Rechargers—seeking experience of meditation and restoration
- Respectful pilgrims—seeking experience of fulfilling memory-honouring obligation and
- Affinity seekers—seeking experience of view of heritage being recognised by content.

For any museum-visiting individuals, these identity-related motivations are not mutually exclusive (Bond & Falk, 2013) and their identities and motivations may change or evolve over time (Falk, 2006; Falk, 2011; Hornecker & Ciolfi, 2019). These findings prove that the crucial aspects of a visit are more frequently connected with the needs of museum-goers, not those of the institutions (Falk, 2011), which echoes the suggested shift of focus from being “the user in the life of the museum” to “the museum in the life of the user” (Chen & Marty, 2005; Marty, 2011).

Adopting a visit-centric perspective contributes to structuring the broader context of a physical museum-going itinerary as pre-, during and post-visit (Falk & Dierking, 1992). Table 2.1 shows several real-world cases with varying degrees of success to illustrate four pairs of memory institution visit and post-visit scenarios:

- Both in physical environments
- Physical visit then digital visit
- Digital visit then physical visit
- Both in digital environments.

A visit to digital then physical environments can be exemplified by the established pattern of physical visit planning, which was widely used among the visitors of National Museums Liverpool. 61% and 36% of the two groups of visitors—*general public* and *non-professional*—accessing their website were for planning purposes (Walsh, Hall, Clough, & Foster, 2020).

For the pair of physical visit and post-visit, the Brooklyn Museum in 2009 experimented with inviting the audiences to comment on *The Black List* exhibition using YouTube and received responses from 482 visitors (Devine, 2019). Physically remaining in the museum, these visitors who were among 0.4% of all audiences of the exhibition started their post-visit journey from expressing their reflection via using a less conventional platform. The content

Table 2.1 Examples of the visit and post-visit pairs

		Post-visit	
		Physical	Digital
Visit	Digital	<ul style="list-style-type: none"> <li>• Access to the National Museums Liverpool website (Walsh, Hall, Clough, &amp; Foster, 2020)</li> </ul>	<ul style="list-style-type: none"> <li>• Personal digital collections on museum websites (Marty, 2011)</li> </ul>
	Physical	<ul style="list-style-type: none"> <li>• Video comments to an exhibition at the Brooklyn Museum (Devine, 2019)</li> <li>• Tech Wall at the Cuyahoga County Public Library and Gallery One at the Cleveland Museum of Art (Alexander, 2014)</li> </ul>	<ul style="list-style-type: none"> <li>• An online extension of a physical exhibition at the Shanghai Museum (Liu &amp; Chen, 2018)</li> <li>• An online follow-up of a physical exhibition at the Museon (Petrelli, Marshall, O'Brien, McEntaggart, &amp; Gwilt, 2017; Hornecker &amp; Cioffi, 2019)</li> </ul>

of the in-museum interactive Gallery One<sup>4</sup> and the broader visit context-friendly ArtLens app<sup>5</sup>, both offered by the Cleveland Museum of Art were introduced on an interactive situated display at the partnering Cuyahoga County Public Library (Alexander, 2014). This collaborative initiative received a positive reaction from the community (Alexander, 2014). In this case, some patrons explored the digitally implemented library offerings in front of the situated display then encountered the museum collection, which was the start of a follow-up to their library content-related activities.

In the realm of digital access alone, despite progress on making artefacts digitally available for the audiences to accomplish curating collections in an indefinite period of time, a lack of need prevents them to return to and manage once favoured collections hosted by six museums (Marty, 2011).

For physical visit and digital follow-up, *Private Letters of Suzhou Wu School Artists in Shanghai Museum's Collection*<sup>6</sup>—an online exhibition was launched following the opening of its counterpart in the physical space of the museum from 2 August 2017 (Liu & Chen, 2018; Shanghai Museum, n.d.). The virtual exhibition provided the visitors with more opportunities to know the interpersonal relations of the literati and build relatedness between the keywords one could encounter in their modern lives and the letter content (Liu & Chen, 2018; Shanghai Museum, n.d.). From April to October 2015, an exhibition titled *The Hague and the Atlantic Wall: War in the City of Peace* was held by the Museon (Petrelli, Marshall, O'Brien, McEntaggart, & Gwilt, 2017). The audiences could use a near-field communication (NFC) tag-containing replica to interact with a reader and its associated display case to listen to and view the stories from one particular point of view in Dutch or English (Petrelli, Marshall, O'Brien, McEntaggart, & Gwilt, 2017). Before leaving, over 1,550 visitors printed their personalised postcard that was enabled by logging the use of the replica when it left the display case (Petrelli, Marshall, O'Brien, McEntaggart, & Gwilt, 2017; Hornecker & Ciolfi, 2019). The postcard could be a ticket for the audiences to view the unseen stories and other visitor-generated narratives—a follow-up exhibition online, which was attended by 39 of them (Petrelli, Marshall, O'Brien, McEntaggart, & Gwilt, 2017; Hornecker & Ciolfi, 2019).

In these visit-centric practices, artefacts are largely performing a supporting role that is loosely connected to exhibition- and collection-conveyed themes and stories, which can be

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<sup>4</sup> <https://www.clevelandart.org/artlens-gallery/first-iteration>

<sup>5</sup> <https://www.clevelandart.org/artlens-gallery/artlens-app>

<sup>6</sup> in Simplified Chinese: 遗我双鲤鱼：上海博物馆藏明代吴门书画家书札精品展，  
<https://www.shanghaimuseum.net/museum/shuangli/index.html>

set in a broader historical context and thus are considerably extensive (Dudley, 2012; Papakostopoulos, Vaptisma, & Nathanael, 2019). An object on the other hand, can be important not only because of its artistic and historical values, but also its competence in prompting conversations (Simon, 2010, p. 127). Grounded in both the materiality of artefacts and their meanings (Morgan, 2012), the artefact-centric perspective can add augmented effects to engagements with heritage and thus be complementary to the visit-focused practice (Dudley, 2015). Dudley (2012, p. 2) notes down her encounter with a “Heavenly Horse, *tian ma*” in the Compton Verney Art Gallery in 2010. She encountered a green, over one-metre-tall bronze horse stood on a plinth in the centre of a gallery room that she walked into, with no glass around and facing the entrance (Dudley, 2012).

I was utterly spellbound by its majestic form, its power, and as I began to look at it closely, its material details: its greenish colour, its textured surface, the small areas of damage. I wanted to touch it, though ... I had to intuit and imagine rather than directly experience most of the encounter (Dudley, 2012, p. 1).

No label was seen close to the horse except for a number reference that can be used for retrieving the interpretation from the gallery hand guide (Dudley, 2012). Although the visitor did not know much about the artefact at the time point, she was moved by “its three-dimensionality, tactility and sheer power” (Dudley, 2012, p. 1): “I allowed myself considerable time to reflect upon that feeling and upon the object, before I picked up the hand guide.” (Dudley, 2012, p. 1)

The hand guide describes the object as (Dudley, 2012):

Han Dynasty (206 BC – AD 220): Heavenly Horse, *tian ma*. Bronze. This large horse would have been a funerary offering for the tomb of an élite Chinese man, the intention being for the owner of the tomb to use the horse to pull his chariot in the afterlife. Such large bronze horses were very rare during the Western Han period, becoming more popular during the Eastern Han. It was extremely difficult to produce such large bronze figures in one mould, therefore this stallion is cast in nine close fitting pieces and joined together, an expensive method in terms of labour and material. (p. 2)

Dudley (2012, p. 2) recorded that she “was left breathless all over again” after reading the description. The close association between the death of a person and the horse, its ancientness and rareness, all contributed to the forming of her reaction (Dudley, 2012). The visitor searched for the joins, calculated the number of the fitting pieces and once again scrutinised the detail of the horse’s surface, only more intently (Dudley, 2012).

Dudley’s interaction with the Heavenly Horse can at least be seen as the first meeting between an artefact and a hobbyist who seeks the metadata from the available information

resources—the setting, artefact itself and hand guide in a cultural institution—a combination of typical venue and circumstances for such encounters. For the visitors, whose motivations are content-related, or to be specific, objects' descriptive metadata-related, many other places can provide opportunities to them to interact with heritage artefacts in addition to LAMs.

### 2.1.2 *Artefacts Present Somewhere Else*

Artefacts as one display of heritage are attached to place (Hoelscher, 2006). The meanings of heritage can be connected to the globe, though such heritage, sponsored and endorsed by different levels of governance is mostly communicated in localities via a network of museums, monuments and street names (Hoelscher, 2006). The intersection with times and places, may not only change the contextual information of an artefact, but also bring in alterations, sometimes substantial with respect to its intrinsic nature (Joy, 2009).

Some artefacts are grounded in the place where a museum is subsequently established, such as a boundary stone (see Figure 2.1) on display in the Museum of Zhang Zhidong and Hanyang Ironworks<sup>7</sup> in Wuhan<sup>8</sup>. Formerly located at the East Wharf of the ironworks, the boundary stone was moved and reused in the wharf area as a door saddle by a local resident in circa 1950s until its return to the museum by his son in 2006 (Zhou, 2006).

More generally, heritage artefacts regardless of whether they are collected by memory institutions, have a travel history. Their journeys, or at least part of the journeys, are noted in academic discourses (Dunn, Earl, Foka, & Wootton, 2019; Barthel, et al., 2013), as well as catalogued in their metadata and linked open data (Rijksmuseum, n.d.; Auckland Museum Tāmaki Paenga Hira, 2018). Nonetheless, museumising artefacts entails a well-known problem—a broken link with locales (Dudley, 2015; Hoelscher, 2006). Such artefacts ranging from those who stayed as local to those who experienced extremes such as a sudden shift of circumstances (Gosden & Marshall, 1999) or illegitimate acquisition (McDonald, 1996; Cheng & Shi, 2012; Hugo, 1861; Sarr & Savoy, 2018), continue obtaining new meanings in the institutions—their current (Hoelscher, 2006; Tythacott, 2012) or former whereabouts (Colwell, 2017). Like museums, the disconnected places in the wider environment with their intersection with artefacts difficult to trace are usually visited alone (Law, 2018) or even ignored (McGookin, Vazquez-Alvarez, Brewster, & Bergstrom-Lehtovirta, 2012).

The lily pendant (Museum of Fine Arts, Boston, n.d.) or gilded lotus earring (Habicht, et al., 2016) of the Egyptian Queen Nefertari (see Figure 2.2) collected by the Museum of Fine

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<sup>7</sup> in Simplified Chinese: 张之洞与汉阳铁厂博物馆

<sup>8</sup> in Simplified Chinese: 武汉



Figure 2.1 Boundary stone of Hanyang Ironworks engraved with “鐵廠界 (Boundary of Ironworks)” in regular script (in Simplified Chinese: 楷书). Photograph by Can Zhao on 26 December 2016

Arts, Boston is not on display (Museum of Fine Arts, Boston, n.d.). The damage on the piece of jewellery can be seen from Figure 2.2, the condition was described as “[d]iscolored and worn” and the medium and technique was “[c]opper overlaid with gold foil” (Museum of Fine Arts, Boston, n.d.).

The piece was acquired by Mohammed Mohassib, an antiquities dealer in Luxor and sold to Albert M. Lythgoe, the then curator of Department of Egyptian Art of the museum in 1904 (Museum of Fine Arts, Boston, n.d.; British Museum, n.d.; Museum of Fine Arts, Boston, 1904; McDonald, 1996). The origin was unknown, yet a findspot of the lavishly decorated tomb of Queen Nefertari—QV66 in the Valley of the Queens was both claimed and inferred (McDonald, 1996; Museum of Fine Arts, Boston, n.d.). The queen was deified ante-mortem (Fisher, 2013), deceased in circa 1255 BCE and QV66 was ransacked since circa 1109 BCE (McDonald, 1996).

Ernesto Schiaparelli, an Italian Egyptologist and the then Director of the Museo Egizio in Turin rediscovered the tomb in 1904 (McDonald, 1996; Parlamento, 2000, as cited in



Figure 2.2 Lily pendant or gilded lotus earring of Queen Nefertari (Accession Number: 04.1956). Photograph courtesy of the Museum of Fine Arts, Boston

Comune di Occhieppo Inferiore & Università Popolare Biellese per l'educazione continua, 2008). All the artefacts and the human remains excavated following the rediscovery are part of the collection of the Museo Egizio in Turin (Schiaparelli, 1904, Vassilika, 2012, Grilletto, 1991, as cited in Habicht, et al., 2016). Since 1979, QV66 is part of the UNESCO<sup>9</sup> World Heritage Site—the ancient Thebes with its necropolis (World Heritage Committee, 1979).

Both the boundary stone and the pendant or earring has a rich history with many connections to events, locations and persons.

### 2.1.3 *Implicit Interaction with Artefacts*

With digital aids, geo-locating artefacts to make them reappear where they have been benefits the cultural heritage stakeholders, such as the locals of and travellers visiting the artefact-related places—arguably a larger group that includes the content-motivated museum visitors—as to:

- Being able to encounter artefacts serendipitously
- Engaging in enhanced content built on top of geo-aware artefacts
- Enriching artefact metadata
- Bringing in and allowing different voices to characterise the artefact (Bearman, 2011).

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<sup>9</sup> The United Nations Educational, Scientific and Cultural Organization

A more inclusive conception of what constitute a museum-accessioned artefact can involve the original physical piece or replica, information as part of physical and/or digital signs (Dudley, 2012; Roberts, et al., 2018), proximate technologies such as Bluetooth sensors (Yoshimura, Krebs, & Ratti, 2017; Not, Cavada, Maule, Pisetti, & Venturini, 2019) and digital surrogates (Cushing & Cowan, 2017). Pinning the digital surrogates of heritage items on the grids of the earth is a sound departure point, given more considerations are needed for the practices like planning a walk through Paris in 1870 to meet the artefacts (Bearman, 2011). The notion of *implicit interaction*—especially when the state of being unaware or something demanding less attention from a visitor is referred to as implicit (Serim & Janucci, 2019; Ju, 2015)—offers extra support to designing such object-centric interactions. More specifically, defined as “an action performed by the user that is not primarily aimed to interact with a computerised system but which such a system understands as input” (Schmidt, 2000), implicit interaction serves and can meet the needs of addressing location, time and memorability-related design challenges.

A person paying a visit to Paris may be aware of some historical events or the existence of several landmarks back to the time, though not much on the circumstances of particular objects, which makes geo-location-based serendipitous discoveries a design direction. No matter whether the locations are indoor, outdoor or both (like the boundary stone of the Hanyang Ironworks and the lily pendant/gilded lotus earring), the growing sensing solutions provides a basis for facilitating implicit interactions.

Projects such as recording visitor behaviours at the Louvre (Yoshimura, Krebs, & Ratti, 2017) and *Walk1916*<sup>10</sup>—a mobile app that featured the items collected by the heritage institutions in Dublin (Cushing & Cowan, 2017) have taken this route. The former placed non-invasive Bluetooth sensors in close proximity to the physical originals to track the length of stay of a Bluetooth-activated device and thus that of the visitor in the chosen areas of the museum for visitor study purposes (Yoshimura, Krebs, & Ratti, 2017). The *Walk1916* app employed the Global Positioning System (GPS) module of a visitor’s mobile phone to track if the coordinates of the phone matched those of the item-paired locations in order to enable item information presentations on arrival (Cushing & Cowan, 2017).

A time-enhanced physical visit to a memory institution implies that a visitor can travel imaginarily or with sensory aids back and forth between the present time and whenever that

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<sup>10</sup> <https://walk1916.wordpress.com/>

is worth noting in the past. Similarly, a background of interacting with geo-aware artefacts in Paris could be the current time and 1870.

For example, *Streetmuseum*—a mobile app that was offered by the Museum of London<sup>11</sup>—and the aforementioned *Walk1916* enabled overlaying the digital surrogates of the accessioned photographs and paintings on present-day street scenes (Jeater, 2012; Cushing & Cowan, 2017). A series of workshops that was held at and around the Tate Britain aimed at presenting the migrants with an opportunity to compare and contrast an area of London and its depictions on the digital surrogates of the museum-collected artworks using both the mobile and desktop versions of a crowdsourcing tool—*ArtMaps*<sup>12</sup> (Locatelli, Giannachi, & Sinker, 2014; Coughlan, et al., 2015). In this way, the ArtMaps project experimented the other envisaged uses of the artefact location-based applications to enable participation in metadata creation and so bring in diverse alternative voices.

The geo-aware surrogates of some artefacts will be present and contextualised in an increased number of places for an indefinite period of time—an advantage that the other originals in heritage institutions may not be able to possess (Marty, 2007; Bearman, 2011). On the visitor side, the sustained engagements worked more effectively for the subgroups of the audiences such as enthusiasts, teachers, hobbyists who have specific themed interests (Hornecker & Ciolfi, 2019). Consequently, time points in the future lie ahead and can be used to facilitate both implicit and explicit interactions and thus build on and actualise more potential uses of geo-aware items.

A memorable visit is a goal that museums strive to achieve (Eardley, Mineiro, Neves, & Ride, 2016). Memories of completed interactions with artefacts are usually accompanied by “oblivion” (Hoelscher, 2006)—merging into the background of life. In addition to remembering, forgetting is a strategic and crucial factor of a long-term experience with heritage (Hoelscher, 2006). Similar to the original artefacts (Hoelscher, 2006), the geo-aware surrogates of the artefacts can blend the latter into the landscapes of a visitor’s daily life and reappear at a future time point to declare attention. Designing implicit interactions properly can apply the ephemerality—a weakness but also a strength (Hoelscher, 2006)—of a heritage item-centric encounter for social good—working towards a long-term memorability of and thus a deeper bond with heritage artefacts.

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<sup>11</sup> <https://www.museumoflondon.org.uk/discover/museum-london-apps>

<sup>12</sup> <https://www.tate.org.uk/about-us/projects/art-maps>

Table 2.2 Digital heritage applications that are used outside LAMs or in open-air museums

Application	LD	Primary Information Focus	Outside	Implicitness	Genre	Data Connection Not Required on the Go	Note
<i>CrossCult: Cities</i> (CrossCult, 2019; Jones, Theodosis, & Lykourantzou, 2019)	Yes	Place	Yes	Yes	Serious game Walking tour	No	Mobile app; Available on Google Play Store as of 1 July 2019
<i>Walk1916</i> (Gushing & Cowan, 2017)	-	Event	Yes	Yes	Walking tour	No	Mobile app; Location-based augmented reality (AR)
<i>Svevo Tour</i> (Fenu & Pittarello, 2018)	-	Person	Yes	-	Walking tour	No	Mobile app; Location-based AR
<i>Explorer</i> (McGookin, et al., 2019)	-	Place	Yes	Yes	Walking tour	No	Mobile app
<i>Streetmuseum Londinium</i> (Jeater, 2012)	-	Artefact	Yes	-	Walking & virtual tour	No	Mobile app; Location-based AR Unavailable as of 1 July 2019
<i>ArtMaps</i> (Coughlan, et al., 2015)	Yes	Artefact	Yes	-	Crowdsourcing tool	-	Web app
<i>Port of Sheffield</i> (Park & Peng, 2016)	-	Place	Yes	-	Walking tour	No	Mobile app
<i>Lost State College</i> (Han, Shih, Rosson, & Carroll, 2014)	-	Architecture	Yes	-	Walking tour	No	Mobile app
<i>Wray Photo Display</i> (Cheverst, Taylor, & Do, 2020)	-	Artefact	No	-	Virtual tour	-	Situated display

A closer examination was made on Walk1916, Streetmuseum, ArtMaps and six more related digital heritage applications that feature artefacts at large outside the physical memory institutions as shown in Table 2.2.

All applications are related to location, and apart from Wray Photo Display which offers “locative media experiences” (Cheverst, Taylor, & Do, 2020), all the other applications can be used as a walking tour guide featuring cultural heritage content. A limitation of the papers

is that they do not provide explicit and complete explanations on the data used, nor indications about whether implicit interactions are facilitated. With two of the applications—ArtMaps and Wray Photo Display—concentrating on artefacts, the rest seemingly shifted their foci in between persons, events, scenes and artefacts. Most of the applications enable visitors to ‘travel’ between a time point in the past and the present time; as a strong focus on photographic and video resources inherently locates attention to a particular place and time. An architectural focus is common in these applications, and in other tours, as it naturally fits with walking in urban areas. Other resources are typically customised especially for the specific application. In general, these types of applications largely do not integrate the ‘thingness’ of complementary artefacts from local museums: we suggest that this is due to the lack of appropriate biographical metadata for those items.

## 2.2 Descriptive Metadata of Artefacts

The information professionals in the cultural heritage field, for example the museum registrars, practically refer to the information created by them about artefacts as metadata. Descriptive metadata is something that physically we can see, hear and touch from the labels, placards and guides, digitally it is key for us to retrieve and access surrogates of artefacts (Gilliland, 2016). It can and should be the thing that enables audiences to interact with artefacts during their on-site visit or at other occasions when they are in other places.

Creating descriptive metadata and linked data ((LD) and its subset “released under open license” (Berners-Lee, 2006)—linked open data (LOD)) for heritage artefacts can be a difficult and laborious task. Unlike books and other similar items, heritage objects are not often self-documenting: metadata is not easily derivable from an object itself. Except for some details such as dimensions, most metadata values must be derived by practiced analysis and careful scholarship. Consequently, there is a very clear long tail with a few star artefacts having rich metadata and most having minimalist sparse metadata (Newbury & Lippincott, 2019; Friberg & Huvila, 2019). Together with digitisation initiatives, metadata and linked data can noteworthily lift access to heritage artefacts (Baca, 2016a).

### 2.2.1 *Description of Artefacts*

Metadata and LD can describe and order the information objects of, and be directly connected to, physical artefacts and items (Gilliland, 2016). Such information objects may include descriptions of an artefact contributed by the creator, cultural heritage information professionals via administrative and curatorial process, or wider communities via

crowdsourcing and other types of user-generated content. Information communities have established an awareness that more structured information objects can better serve the needs of retrieval and reuse (Gilliland, 2016). Metadata and LD can, and should, represent *content*, *context* and *structure* of all information objects, be it a single item, a set of items or a complete collection (Gilliland, 2016). Gilliland also described three features of an information object:

Content relates to what the object contains or is about and is intrinsic to an information object.

Context indicates the who, what, why, where, and how aspects associated with the object's creation and subsequent life and is extrinsic to an information object.

Structure relates to the formal set of associations within or among individual information objects and can be intrinsic, extrinsic, or both. (para. 4)

Intended to assure quality, consistency and interoperability of information object documentation, the standardisation efforts are made for the following aspects of data: structure, value, content and format (Boughida, 2005; Gilliland, 2016).

*Data structure standards*, also known as *metadata element sets* or *metadata schemas*, act as containers of data that address the content, context and structure of an information object (Gilliland, 2016). Relevant data structure standards are considered as key to this thesis because of their potential for enabling artefact-centric interaction (see Section 2.1). We group some frequently used data structure standards in the cultural heritage domain into *artefact-centric* (Bearman, 2008; Hyvönen, 2012), *process-centric* (Bearman, 2008) and *event-centric* types (Doerr, 2003) according to their foci of knowledge representation (see Table 2.3).

Table 2.3 Types of data structure standards (Adapted from Hyvönen, 2012)

	Artefact-Centric	Process-Centric	Event-Centric
Example	<ul style="list-style-type: none"> <li>• CDWA (Categories for Description of Works of Art)</li> <li>• DC (Dublin Core)</li> <li>• VRA (Visual Resources Association) Core Categories</li> </ul>	<ul style="list-style-type: none"> <li>• SPECTRUM (Standard Procedures for Collections Recording Used in Museums)</li> </ul>	<ul style="list-style-type: none"> <li>• CIDOC CRM (CIDOC Conceptual Reference Model)</li> <li>• FRBROO (Functional Requirements for Bibliographic Records object-oriented)</li> </ul>

Aiming at facilitating information retrieval and use based on item properties, the artefact-centric data model was used for organising documents in museums with the arrival of computers (Bearman, 2008). Despite a share of the term *artefact-centric* as an endeavour to

indicate their data modelling focus, the data structure standards are not directly linked with the notion of, nor in themselves support, the artefact-centric interactions (see Section 2.1). SPECTRUM<sup>13</sup> models data that is employed for museum operations and reflects the way museums work (Bearman, 2008). CIDOC CRM<sup>14</sup>, as an event-centric data structure standard enables documenting any events that semantically glue other facets of a heritage artefact (Hyvönen, 2012). Given the variety of collections and materials that are being described, relying on any single metadata standard or set of standards is insufficient for documenting a particular item (Baca, 2016b). We select the following LOD of a grappling hook<sup>15</sup> (see Figure 2.3, coded below as EO1) and a grain jar<sup>16</sup> (see Figure 2.4, coded below as EO2) for explaining the data structure standards and other related fundamental concepts. The partial LOD of the grappling hook was recreated from the publicly available data of the object<sup>17</sup>. The Turtle file (20200115-rma-edm-collection\_pt1.ttl, the most recent version by the time of downloading) containing the LOD of the grain jar was downloaded from the Rijks Data website<sup>18</sup> on 8 December 2020:



Figure 2.3 Grappling hook (EO1, Accession Number: 2018.16.1). Photograph courtesy of the Auckland Museum Tāmaki Paenga Hira

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@prefix ecrm: <http://erlangen-crm.org/current/> .
@prefix amo: <http://collections.aucklandmuseum.com/ontology/core/>
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<sup>13</sup> <https://collectionstrust.org.uk/spectrum/>

<sup>14</sup> <http://cidoc-crm.org/>

<sup>15</sup> [https://www.aucklandmuseum.com/collections-research/collections/record/am\\_humanhistory-object-862398](https://www.aucklandmuseum.com/collections-research/collections/record/am_humanhistory-object-862398)

<sup>16</sup> <http://hdl.handle.net/10934/RM0001.COLLECT.663>

<sup>17</sup> <https://api.aucklandmuseum.com/id/humanhistory/object/862398>

<sup>18</sup> <https://data.rijksmuseum.nl/object-metadata/download/>

```

<http://api.aucklandmuseum.com/id/humanhistory/object/862398>
ecrm:P108i_was_produced_by
<http://api.aucklandmuseum.com/id/humanhistory/object/862398/
production> ;
amo:refersToEvent
<http://api.aucklandmuseum.com/id/event/310> ;
ecrm:P3_has_note
"This grappling hook was made in late August/ early September 1981.
The donor took part in several of the anti-apartheid protests
organised around the Springbok rugby tour, and for the Eden Park
test was part of the Biko Squad (named for South African activist
Steve Biko). According to the donor, the hook was used to get over
walls and fences if necessary - \"Never used in anger though\".
This potent object speaks directly to a significant event in the
history of civil disturbance and race relations in New Zealand. As
a handmade object, it captures the \"rough and ready\" approach
everyday citizens took when mobilising against the tour." .

```



Figure 2.4 Grain jar, anonymous, c. -206 - c. 220 (EO2, Object Number: AK-MAK-293). Photograph courtesy of the Rijksmuseum

```

@prefix dc: <http://purl.org/dc/elements/1.1/> .
@prefix dct: <http://purl.org/dc/terms/> .
@prefix edm: <http://www.europeana.eu/schemas/edm/> .

```

```

@prefix edmf: <http://www.europeanafashion.eu/edmf/> .
@prefix mrel: <http://id.loc.gov/vocabulary/relators/> .
@prefix ore: <http://www.openarchives.org/ore/terms/> .
@prefix rdaGr2: <http://rdvocab.info/ElementsGr2/> .
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix skos: <http://www.w3.org/2004/02/skos/core#> .
@prefix wgs84_pos: <http://www.w3.org/2003/01/geo/wgs84_pos#> .
@prefix xml: <http://www.w3.org/XML/1998/namespace> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .

<http://hdl.handle.net/10934/RM0001.COLLECT.663> a edm:ProvidedCHO
;
    mrel:spn "On loan from the Asian Art Society in The Netherlands
(purchase Jacques Aalderink, Amsterdam, 1957)"@en,
    "Bruikleen van de Vereniging van Vrienden der Aziatische
Kunst (aankoop Jacques Aalderink, Amsterdam, 1957)"@nl ;
    dc:creator <http://hdl.handle.net/10934/RM0001.PEOPLE.54> ;
    dc:description "Shortly before the Han period (206 BC-AD 220),
the idea developed that the hereafter was a reflection of life on
earth. People therefore needed the same things in the period
immediately after their death as they had used in life. So
miniature worlds were created for tombs, with objects relevant to
the deceased, such as this grain jar."@en,
    "Even voor de Han-periode (206 v.Chr.-220 n.Chr.) groeide
het idee dat het hiernamaals een afspiegeling was van het leven op
aarde. Een mens had in de periode vlak na zijn overlijden dezelfde
dingen nodig als tijdens zijn leven. In het graf werden dan ook
miniatuurwerelden geschapen, met voorwerpen die voor de overledene
relevant waren, zoals deze graansilo."@nl ;
    dc:format <http://vocab.getty.edu/aat/300010669>,
    <http://vocab.getty.edu/aat/300233430> ;
    dc:identifier "AK-MAK-293" ;
    dc:language "nl" ;
    dc:publisher "Rijksmuseum" ;
    dc:title "Grain jar"@en,
    "Graansilo"@nl ;
    dc:type <http://hdl.handle.net/10934/RM0001.THESAU.263> ;
    dct:created "c. -206 - c. 220"@en,
    "ca. -206 - ca. 220"@nl ;
    dct:extent "diameter 21.3 cm"@en,
    "height 35.0 cm"@en,
    "diameter 21,3 cm"@nl,
    "hoogte 35,0 cm"@nl ;
    dct:isPartOf "Collectie: China (collectie)"@nl ;
    dct:provenance "...; from the dealer Jacques Aalderink,
Amsterdam, fl. 1,200, to the Vereniging van Vrienden der Aziatische
Kunst, 1957;{Note RMA.} from whom on loan to the museum, 1972"@nl ;
    dct:spatial <http://hdl.handle.net/10934/RM0001.THESAU.403> ;
    dct:temporal "1st century"@en,
    "2nd century"@en,
    "first quarter 3rd century"@en,
    "1e eeuw"@nl,

```

```
"2e eeuw"@nl,  
"eerste kwart 3e eeuw"@nl ;  
edm:type "IMAGE" .
```

Based on the definition of metadata given in Chapter 1, a machine-readable statement of for example the grappling hook—and this can be any documented object—consists of three parts (The World Wide Web Consortium (W3C), 2014; Pomerantz, 2015):

- *Subject:*  
<<http://api.aucklandmuseum.com/id/humanhistory/object/862398>>
- *Predicate:*  
amo:refersToEvent
- *Object:*  
<<http://api.aucklandmuseum.com/id/event/310>>

The natural language counterpart of the statement: *The grappling hook refers to (an) event that is numbered as 310*. Such simple subject-predicate-object statements are referred as *triples* (The World Wide Web Consortium (W3C), 2014; Pomerantz, 2015), which offers flexibility as to describing any information object (van Hooland & Verborgh, 2014). Arguably the LOD of the grappling hook was primarily modelled using an event-centric approach, whereas the LOD of the grain jar was artefact-centric. Despite the different ways of structuring artefact metadata, we can see free-text or literal values from both the examples convey rich information but not otherwise represented, although the metadata structure standards used, especially in the case of the grappling hook has classes for details.

### 2.2.2 Descriptive Metadata Practice in Memory Institutions

Memory institutions are the primary creator and custodian of artefact metadata and LD. Museums create a knowledge representation of their collections, which traditionally covers what have been conveyed to the institutional knowledge base by creators, scientists, collectors and cultural heritage professionals themselves (Bearman, 2008). The information professionals of the institutions tend to refer the information they created for improving access to information objects and the represented physical artefacts as metadata (Gilliland, 2016). Largely based on provenance nowadays (Newbury & Lippincott, 2019), such information may include those relating to arrangement, description, track and so forth of the information objects and the corresponding physical counterparts (Gilliland, 2016). The present practice can be summarised into two mutually dependent themes with the first being

preserving, publishing and enriching artefact metadata and LD, and experimenting and promoting more uses of the data as the second.

The American Art Collaborative (AAC)<sup>19</sup> succeeded in creating “2,714 R2RML rules<sup>20</sup> and 9,700,000 triples” for the collections of its 14 participating memory institutions (Knoblock, et al., 2017, p. 263). The Georgia O’Keeffe Museum in Santa Fe, a smaller thematic museum was also working with AAC on its own LOD project (Cossu, 2019). The Italian cultural heritage knowledge graph—ArCo<sup>21</sup> maintained by the Institute of General Catalogue and Documentation of the Italian Ministry of Cultural Heritage and Activities similarly derives data from the existing database, now comprises of a dataset of 169,151,644 triples (Carriero, et al., 2019). The Rijksmuseum houses 22,846,996 triples of 351,814 artefacts modelled conforming to the Europeana Data Model (EDM)<sup>22</sup> and converted from their collection management system by March 2016 (Dijkshoorn, 2019).

In addition to the increasing number of triples and practising institutions, various initiatives are undertaken for improving artefact metadata and LD qualities for use. The Rijksmuseum establishes their modelling requirements as to “specialization, object- and event-centric approaches, temporality, representations, views and subject matter” based on their experiences of publishing LD (Dijkshoorn, 2019). The National Library of Wales derived new metadata from the existing image metadata, stylistic data and content to date the work of Sir John ‘Kyffin’ Williams by year, and to perform analysis of paintings (Dee, Hughes, Roderick, & Brown, 2016). By collaborating with the National Gallery, London, a CIDOC CRM-compliant venue ontology is proposed to address the needs of modelling different spatial arrangements of smaller museums, cultural heritage sites and wider environments (Padfield, Kontiza, Bikakis, & Vlachidis, 2019). Similarly, an affective response metadata model in compliance with CIDOC CRM is proposed and evaluated at the Art Gallery of Ontario (Canning, 2019).

## 2.3 Object Biography

The term *biography* has its root in the ways of documenting or supplementing history (Titchener, 2003). One definition of biography from the Oxford English Dictionary (2010) is:

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<sup>19</sup> <http://americanartcollaborative.org/>

<sup>20</sup> <https://www.w3.org/TR/r2rml/>

<sup>21</sup> <http://dati.beniculturali.it/arco/?lang=en>

<sup>22</sup> <https://pro.europeana.eu/resources/standardization-tools/edm-documentation>

... A written account of the life of an individual, esp. a historical or public figure; (also) a brief profile of a person's life or work. Later more generally: a themed narrative history of a specific subject in any of various written, recorded, or visual media. (para. 1)

The digitisation of human biographies takes multiple forms, notably in a relational model of data such as China Biographical Database<sup>23</sup> (Tsui & Wang, 2019) and Japan Biographical DB<sup>24</sup> (Born, 2018) and as LOD (Hyvönen, et al., 2019). Some work has been undertaken into computational human biographies for historical or digital humanities investigation (Hyvönen, et al., 2019; Larson, 2010; Kaiser, Lejtovicz, Schlögl, & Rumpolt, 2018). In the fields of landscape research, archaeology and museum studies, the biographies of other entities have been explored, including: landscape (Samuels, 1979; Roymans, Gerritsen, van der Heijden, Bosma, & Kolen, 2009; Given, Aldred, Grant, McNiven, & Poller, 2019) and object (Kopytoff, 1986; Gosden & Marshall, 1999; Joy, 2009).

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<sup>23</sup> <https://projects.iq.harvard.edu/cbdb>

<sup>24</sup> <https://jbdb.jp/>

### 2.3.1 Provenance and Object Biography

The similarities and differences of the notions of provenance and object biography as to documenting artefacts are worth noting. The definitions and descriptions of both terms exhibit levels of variability in a context of being involved in more theoretical inquiries and as part of the common practice in museums (Straughn-Navarro, 2016; Papathoma, 2019; Jones M. , 2019; Kopytoff, 1986; Gosden & Marshall, 1999; Joy, 2009; Waller & Waller, 2018), an overview is presented in Table 2.4.

The Getty Research Institute (n.d.) and Milosch and Hull (2019) define provenance as “history of ownership” of an artefact. For the documenting purposes in particular, the International Council for Documentation of the International Council of Museums (ICOM-CIDOC) (2012) advises covering the data of production, collection, ownership and context of use. One approach for museums to elicit such data is to routinely work with previous owner or custodian of an artefact during the acquisition phase (International Council for Documentation, International Council of Museums (ICOM-CIDOC), 2012). In practice, provenance records are in a transition from “simple lists” to event-centric object biographies (Newbury & Lippincott, 2019).

Table 2.4 Definitions of object biography and provenance

	Provenance	Object Biography
Definition	“[H]istory of ownership of a valued objects ...” (Getty Research Institute, n.d.) “[P]rovenance research seeks to document the history of the ownership of a work of art from creation to the present, through an (ideally) unbroken sequence of previous owners and transactions.” (Milosch & Hull, 2019)	“[N]on-linear ... sum of the social relationships that constitute an object ...” (Joy, 2009)
When documenting objects	“[M]useum must record [object] provenance ... including its production, collection, ownership and contextual details about its use ... it is particularly important to obtain ... an object’s use and history from the donor or vendor as a routine part of the acquisition process.” (International Council for Documentation, International Council of Museums (ICOM-CIDOC), 2012)	To record “processes” or “stories” that are both involved in and “left out” in provenance research and are “set within [an object’s] social contexts and consequences” using “narrative structure” (Gosden & Marshall, 1999; Hyvönen, 2012).

Object biography on the other hand was originally proposed as a conceptual framework to describe and learn more from the past life histories of an artefact or an assemblage (Kopytoff, 1986; Gosden & Marshall, 1999; Joy, 2009), which can be regarded as the sum of divergent spheres of social relationships that embody an artefact (Joy, 2009). This definition suggests the inclusion of all occurrences an artefact attended in a non-linear fashion, and thus the notion incorporates polyvocality contributed by different actors who were involved in the occurrences (Joy, 2009; Burström, 2014; Newbury & Lippincott, 2019). The space for suggesting how to apply this notion to documenting objects remains open. One project that did not use object biography as the conceptual framework, though explicitly modelled time and space for medieval and Renaissance manuscripts, had an expectation of generalising the outcome to all types of artefacts (Burrows, Hyvönen, Ransom, & Wijsman, 2018). Several classes relating to an object biography—manuscript, actor, time and location at regional, national and international levels—are used for a structured description (Burrows, Hyvönen, Ransom, & Wijsman, 2018).

### 2.3.2 *Qualities of Object Biography*

Following the work of Kopytoff (1986), Gosden and Marshall (1999) and Joy (2009), we focus on four qualities of object biography that are potentially pertinent to enabling artefact-centric interaction:

- Intersection with human biographies
- Life stage
- Ways of gaining meanings
- Multiple voices

We illustrate each of the qualities with one example that includes two artefacts—both are presented in the ongoing exhibition of the Three Kingdoms (as on 31 March 2021)<sup>25</sup>—The lacquer plate with pattern of children exercising with *gun* the staff weapon<sup>26</sup> (see Figure 2.5,

<sup>25</sup> [https://www.tnm.jp/modules/r\\_free\\_page/index.php?id=1953&lang=en](https://www.tnm.jp/modules/r_free_page/index.php?id=1953&lang=en); <https://weibo.com/1579099842/K8MIk0tQb> (micro-blog in Simplified Chinese)

<sup>26</sup> in Simplified Chinese: 童子对棍图漆盘



Figure 2.5 Top left and bottom left—Lacquer plate with pattern of children exercising with *gun* the staff weapon (EO3); Right—Statue of Guan Yu (EO4). On display as part of the *Culture of Three Kingdoms* exhibition (in Simplified Chinese: 三国志文化展) on 13 October 2020 in Nanshan Museum, Shenzhen (in Simplified Chinese: 深圳南山博物馆). Photograph courtesy of Hao Deng

coded below as EO3) (Ding, 1986; Kyushu National Museum, 2019) and the statue of Guan Yu<sup>27</sup> (see Figure 2.5, coded below as EO4) (Wang, 2020; Kyushu National Museum, 2019).

*Intersection with human biographies.* Object-person intersection was deemed by Gosden and Marshall (1999) as the central idea of biography: “as people and objects gather time, movement and change, they are constantly transformed, and these transformations of person and objects are tied up with each other”. Hoskins (1998) observed that asking people about the stories of significant artefacts conveyed noticeably richer results than simply eliciting human biographies. By looking at EO3 and EO4, the evidence of the links between the privileged persons—a portion of the people the artefacts are associated with—and artefacts is clear, though at least for EO4, not necessarily direct. EO3 was excavated from the tomb of Zhu Ran<sup>28</sup> (see Figure 2.6) and his spouse (Ding, 1986). The former deceased in 249 CE and

<sup>27</sup> in Simplified Chinese: 关羽像

<sup>28</sup> in Simplified Chinese: 朱然

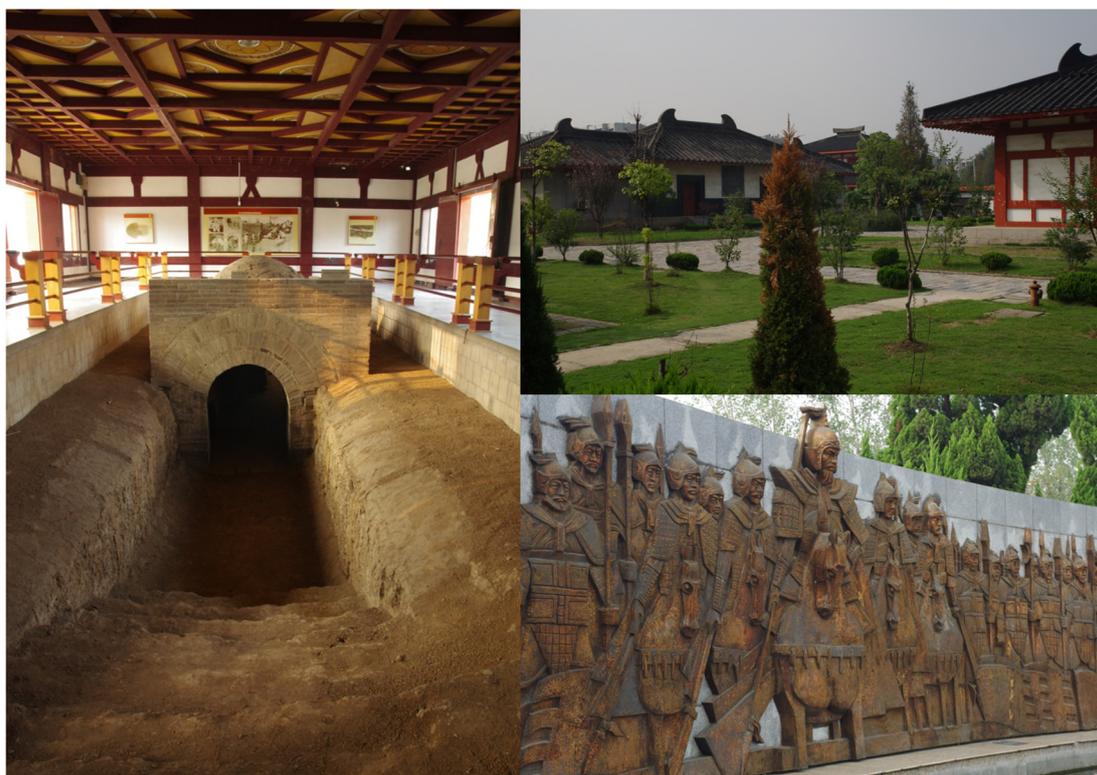


Figure 2.6 Three Kingdoms Zhu Ran Family Cemetery Museum (in Simplified Chinese: 三国朱然家族墓地博物馆) located in Zhu Ran Culture Park, Ma'anshan (in Simplified Chinese: 马鞍山朱然文化公园), the place relating to the lacquer plate (EO3): Left—Tomb of Zhu Ran and the findspot of EO3; Top right—Exterior view of the museum; Bottom right—Sculpture of Zhu Ran and military personnel of Wu in the park. Photographs by Can Zhao on 29 September 2013

was by the time the Marquis of Dangyang<sup>29</sup>, the Left Grand Marshal<sup>30</sup> and the Right Military Adviser<sup>31</sup> of Wu<sup>32</sup> (Chen S. , n.d.-d). EO4 was made in circa 17th century (Wang, 2018) as a deified and idealised portrayal of Guan Yu. Guan Yu was the Marquis of Hanshou Village<sup>33</sup>, the General of Vanguard<sup>34</sup> and the Administrator of Xiangyang Commandery<sup>35</sup> of Han<sup>36</sup> under Liu Bei<sup>37</sup> in 220 CE when he was captured and executed by the forces of Wu (Chen S. , n.d.-a; Chen S. , n.d.-d).

<sup>29</sup> in Simplified Chinese: 当阳侯

<sup>30</sup> in Simplified Chinese: 左大司马

<sup>31</sup> in Simplified Chinese: 右军师

<sup>32</sup> in Simplified Chinese: 吴

<sup>33</sup> in Simplified Chinese: 汉寿亭侯

<sup>34</sup> in Simplified Chinese: 前将军

<sup>35</sup> in Simplified Chinese: 襄阳太守

<sup>36</sup> or Eastern Han, 25–220 CE, in Simplified Chinese: 汉 or 东汉

<sup>37</sup> in Simplified Chinese: 刘备

*Life stage.* Like human biographies, object biographies can be composed following a sequence from birth to death (Kopytoff, 1986). Instead of death, an alternative way to look at an artefact no longer being involved in certain “social spheres” (Joy, 2009) and being accessioned by a memory institution is that the artefact starts a new life stage (Tythacott, 2012; Friberg & Huvila, 2019). Dividing life stages can be dependent on the intersections between object and human biographies in specific “social spheres” and life stages themselves do not necessarily follow a linear order (Joy, 2009). For example, EO3 is known for having been through its creation in Shu Commandery<sup>38</sup>, use as a funerary object for Zhu Ran and/or his spouse, at least one tomb robbery, excavation (Ding, 1986) and use as a museum artefact (Kyushu National Museum, 2019). In the case of EO4, the statue was created in Ming<sup>39</sup> for worshipping purposes, then relocated for the first time to a Buddhist temple in the old town of Fan County<sup>40</sup> during Qing<sup>41</sup> (Wang, 2020). The following life stages of EO4 include the relocations due to the societal turmoil in 1920s and 1930s and World War II from 1930s to 1940s, as well as use as a museum artefact (Wang, 2020).

*Ways of gaining meanings.* An artefact can gain new meanings from the persons who practise “different systems of understanding” at particular spatio-temporal points throughout its *life stages* (Joy, 2009). Such meanings can be picked up by an undistinguished thus “lived object” via social actions or a self-announcing thus “inscribed object” via both its creation as a valuable and subsequent life stages, if any (Marshall, 2008; Joy, 2009). The meanings can also be embedded in the events, in which an object was exchanged as gift or commodity or otherwise used for ritual purposes (Kopytoff, 1986; Gosden & Marshall, 1999). The approach of “creating and maintaining” object biographies needs to acknowledge this variety of meanings (Gosden & Marshall, 1999). EO3 was probably not self-announcing when it was created (Yang, 1986), but meanings can be derived from the facts of the lacquer plate being arranged as a funerary object for a member (or members) of the ruling class and later not taken by the tomb robbers. Created as an object that embodied rich religious connotations for a community (Wang, 2020), EO4 is now a key artefact in the touring exhibition (Kyushu National Museum, 2019; Wang, 2020) and receives admiration that is addressed to the

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<sup>38</sup> in Simplified Chinese: 蜀郡

<sup>39</sup> in Simplified Chinese: 明, 1368–1644

<sup>40</sup> in Simplified Chinese: 范县旧城

<sup>41</sup> in Simplified Chinese: 清, 1644–1912

novelised figure of Guan Yu in *Romance of the Three Kingdoms*<sup>42</sup> from audiences (including the screen names yockdesign<sup>43</sup> (2019) and A Qia (2020)).

*Multiple voices.* An object having different *ways of gaining meanings* suggests object biographies can incorporate multiple voices from the related people rather than “one institutional voice” (Burström, 2014; Ciolfi, 2018). The meanings made and noted down by the persons in the past, with whom the artefacts were directly or indirectly associated, can often be incomplete. Finding information for filling in the blanks can be a demanding task. Although the historian Chen Shou<sup>44</sup> (n.d.-b) recorded the voice of Zhuge Liang<sup>45</sup> when he saw the objects gifted by Sun Song<sup>46</sup> who had deceased by then, nothing more (including meanings) is known about these objects. Probably contemporaneously, the meanings made by the creators of EO3, and related administrators of lacquerware production remain unknown. On the other hand, multiple meanings made by present-day museum goers at the object-visitor intersection are available and can contribute to the richness of object biographies. The findspot of EO3 being Ma’anshan—the hometown of the screen name Nie Bo Rui (2020)—allowed the visitor to appreciate their close relationship with the touring artefact. The emphasis of EO3 being a Shu Commandery-made object but unearthed in a tomb in the territory of Wu left the screen name Bencov (2019) an impression that objects were barely circulated across the borders in the Three Kingdom period. EO4 combined with a reconstructed battle scene allowed the screen name ayumi (2019) to capture the immensity of the past events, the energy of the museum staff and their love of the subject matter.

### 2.3.3 *Object Biography as Conceptual Framework*

Since the coinage of the term (Kopytoff, 1986), object biography has been applied as a conceptual framework by inquiries to examine a variety of artefacts for addressing primarily, archaeological and museological issues. The effectiveness of object biography as a conceptual framework has in turn been validated by case studies. We consider the commonly seen aims of such inquiries as developing the conceptual framework.

One approach of developing and generalising the conceptual framework was to reveal the life histories, or life history possibilities, of the artefacts via incorporating archaeological methods, for example the Iron Age Portesham mirror (Joy, 2009), the Bronze Age moulds

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<sup>42</sup> in Simplified Chinese: 三国演义, <https://ctext.org/sanguo-yanyi/ens>

<sup>43</sup> The micro-blogs originally written in Japanese on Twitter by the screen names yockdesign, Bencov and ayumi were first translated to Chinese by Hao Gong.

<sup>44</sup> in Simplified Chinese: 陈寿

<sup>45</sup> in Simplified Chinese: 诸葛亮

<sup>46</sup> in Simplified Chinese: 孙松

(Webley & Adams, 2016) and the Roman bronze lamp (Oras, Higham, Cramp, & Bull, 2017). Another approach was to conceptualise and interpret “physical man-made things” (CIDOC CRM Special Interest Group, 2021) as objects with biographies (Clarke & Frederick, 2012). Such examples include the archived police surveillance files (Carbone, 2020), the cliff and rock ledge inscriptions (Clarke & Frederick, 2012) and the houses (Kay, 2020). Depending on the research aims served, these two approaches may not always use or pay attention to the four qualities of object biography (see Section 2.3.2) consistently. The use of the two approaches was also largely limited to scientific investigation and discourse, not for potential interest of the public.

Object biography was employed by Friberg and Huvila (2019) to describe a museum collection for coping with the curation problems due to poor documentation, organisation and use of artefacts. Related to artefact descriptions, Newbury and Lippincott (2019) noted provenance records are being transformed into event-centric life histories of objects using a biographical means. Outside museums, Barthel et al. (2013) claimed that technologies of Quick Response (QR) codes and Radio Frequency Identification (RFID) enabled objects to support storytelling on their biographies. By combining their viewpoints (Friberg & Huvila, 2019; Newbury & Lippincott, 2019; Barthel, et al., 2013), a potentially third approach that is more relevant to the present research can be explored by using object biography as a guide to digitise the continuing life stories of artefacts into metadata. The focus of this metadata is likely to centre on how best to represent the four qualities of object biography (see Section 2.3.2). As such, a metadata basis can be created for facilitating interactions with artefacts beyond the walls of memory institutions.

## 2.4 Summary

Artefact-centric interaction remains largely an on-site experience. Ciolfi (2018) argued that a variety of technological platforms and their applications have largely recreated one restricted model to engage with heritage that offers a sole institutional voice to visitors. In fact, museum objects have rich and complex relationships with the wider environment beyond the walls of memory institutions. Implicit interactions are able to provide the artefact with more touchpoints and alternative paradigms to engage the interested visitors but this need supports from descriptive metadata.

The descriptive metadata of heritage artefacts that are available to date can be partial, sparse and un-interesting to visitors. They can contain free-text that is rich in semantic

meanings but is not machine-readable. On the other hand, machine-readable metadata such as that of the grappling hook or the grain jar (see Section 2.2.1) are not necessarily biographical.

Employing object biography as a conceptual framework together with the potentially useful qualities for enabling novel artefact-centric interactions outside physical memory institutions are worth studying. Embracing the notion of object biography is one mechanism for structuring artefact metadata. Current metadata has not been created with this application in mind and so we need to explore specific biographical capture.

## 3. Acquiring Object Biography Metadata

Previous studies using object biography have dealt with developing and enriching biographical description of artefacts (Allen, 2012; Oras, Higham, Cramp, & Bull, 2017; Waller & Waller, 2018; Portland Art Museum, 2016). However, the details of acquiring biographical metadata of heritage artefacts and the potential of such metadata that might be useful for interactive heritage applications remains under-examined.

The study we performed with key informants focussed on exploring how employing a biographical approach could contribute to documenting heritage artefact metadata, which was set to address the Research Questions 1 and 2 (see Section 1.2), particularly in a contextual and structural sense. This chapter revises and expands on an earlier description of the study (Zhao, Twidale, & Nichols, 2018). We describe the detail of biographical metadata acquisition and analysis, and discuss the prospect of the metadata supporting new audience-object interaction in the wider environment.

The chapter is organised into four sections. Section 3.1 describes the design of the exploratory study and its three aspects: participants, biographical metadata collection method and material and apparatus. Section 3.2 presents the study results. The quality of the acquired biographical metadata is analysed via a comparison with the existing structured descriptive metadata. Section 3.3 considers the critical success of the acquisition method and the potential of the acquired metadata. Lastly, Section 3.4 offers a summary and suggests further work.

### 3.1 Study Design

An interview-based data collection method was devised to capture heritage object metadata. The method included inviting local participants to select a wide spectrum of objects and gathering the existing structured descriptive and biographical metadata.

Given the nature of exploratory study and our interests in contextual and structural connections of artefacts, we could not predicate the likely responses offered by participants. The main technique—semi-structured key informant interview allowed us to offer flexibility in a session so that crucial information could emerge from open-ended questions (Pickard, 2013) or via deviating from any given data (Adams & Cox, 2008). The location marking activity—a key feature of the study—was designed to draw a baseline at the start of each

session for the biographical metadata of the selected artefacts and serving as a cue thereafter for both participant and researcher.

Two pilot sessions were performed to examine the effectiveness of the provisional interview protocols and the use of the material and apparatus in the Usability Laboratory of the Department of Computer Science in 2017. The detailed findings and changes to the study design can be found in Appendix A.

### 3.1.1 *Participants*

The prospective participants of the study were initially set to be local memory institution professionals and heritage experts—key informants who possess in-depth domain knowledge though do not currently work at memory institutions. A limited pool of the potential participants with such backgrounds was considered as a practical constraint.

The pilot sessions were conducted with two proxy participants, who were academic staff members from the supervisory panel of the researcher. The second proxy participant was a heritage enthusiast who selected two sets of privately held artefacts. The pilot session results demonstrated that pertinent metadata can be acquired from enthusiastic and artefact retaining amateurs. Thus, they were incorporated into the pool of potential participants (see Section 3.2 for a description of the recruited participants).

To justify this inclusion: Zastrow (2014) noted the participation of the former students in the Edgerton Digital Collections project to transcribe the notes of a professor. Dijkshoorn (2019) documented a nichesourcing method for eliciting heritage artefact annotations from enthusiast groups. In addition, studying with the owners to examine what constituted the qualities of their valued objects such as “Captain Marius”—a played and displayed wargaming miniature, a lost belt and a worn plant stand can be found from the respective works of Darzentas, Brown, Flintham and Benford (2015), Marschall (2019) and Tsai and van den Hoven (2018). The inclusion of enthusiastic and artefact retaining amateurs further permitted us to explore possibilities in the “multiple communities that heritage engages” (Ciolfi, 2018).

### 3.1.2 *Data Collection Method*

Prior to each interview session, we sent a request to the participant to select two to four heritage artefacts and produce a short note of the reasons as per six criteria. The artefacts should be:

- The ones that had travelled to different places
- Studied by the participant

- Related to each other (the interpretation of relatedness was at the participant's discretion)
- Presented in the institution's or participant's work (e.g., exhibitions, exhibition-accompanying publications, etc.)
- Enquired of, or received feedback from the public (an indicator of the audience interest towards an artefact), as well as
- Varied in classification (the classification of each artefact was at the participant's discretion).

Meanwhile, we refrained from taking part in choosing artefacts and offered some flexibility so that not all criteria had to be met when accepting each set of choices (see Section 3.2.1 for the selected artefacts).

Gathering the existing structured descriptive metadata of each selected artefact was primarily conducted via email in parallel with confirming the selection. The term *existing structured descriptive metadata*—abbreviated hereafter as *existing metadata*—were employed to signify the currently available triples that supports penetrating the character and use of an artefact with machine-readable structures (Buckland, 2017; Berners-Lee, 2006), in both schema-compliant and non-standard forms. Since the participants might perceive the notion of existing metadata differently due to inevitable “overlap between administrative and descriptive metadata schemas” (Pomerantz, 2015, p. 116), the gathering was conducted on a case-by-case basis. Further verbal or written requests were also made at the researcher's discretion, either during or after the interview.

A semi-structured key informant interview followed the object selection and first run of existing metadata gathering. The interview concentrated on acquiring a new set of metadata—abbreviated hereafter as *acquired metadata*—in one hour via obtaining:

- The participants' experience with their selected artefacts
- *Direct and relevant locations* of the artefacts marked on maps (see Section 3.1.3 for more details)
- The participants' view of the artefacts' information that a general audience could find interesting and that they were eager to convey, as well as
- Remembered communication between the participants and audiences based on the artefacts (see A12, A13, A14 and A15 for the interview protocols).

The strength of interviews in reconstructing past, describing current events and anticipating future circumstances (Pickard, 2013) was needed for capturing not only the acquired metadata, sometimes for identifying the wanted existing metadata. For instance, the fact that the book associated with a selected map—O16 in Table 3.3 was catalogued was a response by P2 to the researcher’s query on whether the map had been catalogued (see Section 3.2.2). The existing metadata of the associated book was then shown on a computer.

One concern of applying an interview method was about the difference between elicited information and factual data (Pickard, 2013), specifically relating to acquiring the contextual and structural connections of artefacts in this exploratory study. We encouraged our participants at the beginning of each study session to refer to their own material at any time if they want to be certain about any given information. Such an approach was designed to acquire more contextual and structural connections of any given artefact (e.g., the description of a dress in *Patterns of Fashion 2* that shared similar design with a selected dress—O18 in Table 3.3, see Figure 3.1).

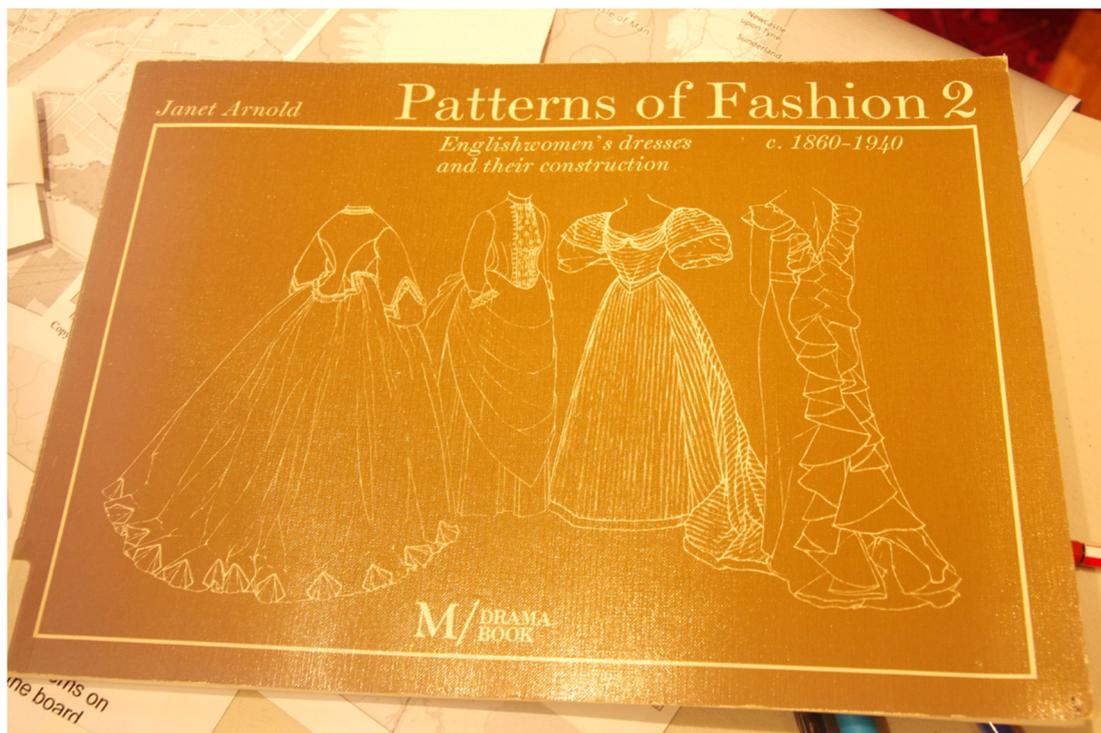


Figure 3.1 *Patterns of Fashion 2* as supplementary material to O18 in Table 3.3 in the third study session

### 3.1.3 *Material and Apparatus*

The selected objects were an integral part of the material in the pilot and study sessions. The objects were brought to the second pilot session and first (including the printed copies of the digital surrogates), second and fifth study sessions by the participants. The third and fourth study sessions were performed in the museum galleries in which the objects were displayed (see Figure 3.2 for example). The digital surrogates of the three objects (i.e., O36, O37 and O38 in Table 3.3) that included the images and existing metadata were printed out and copies were provided in the sixth study session. Other supplementary material including photos posted on Facebook, library catalogue result page, reference books (see Figure 3.1) and archived files was also consulted in the first, second, third, fourth and fifth study sessions by the participants.

We provided the non-digital resources to the participants to mark locations that each selected artefact has been (i.e., direct location), and to where an artefact is relevant (i.e., relevant location). Each location had an associated time and if a participant deemed as applicable, other contextual description (see Questions 4 of A12, A13 and A14, Question 3 of A15, Section 3.1.2 and Figure 3.3). The physical resources included:

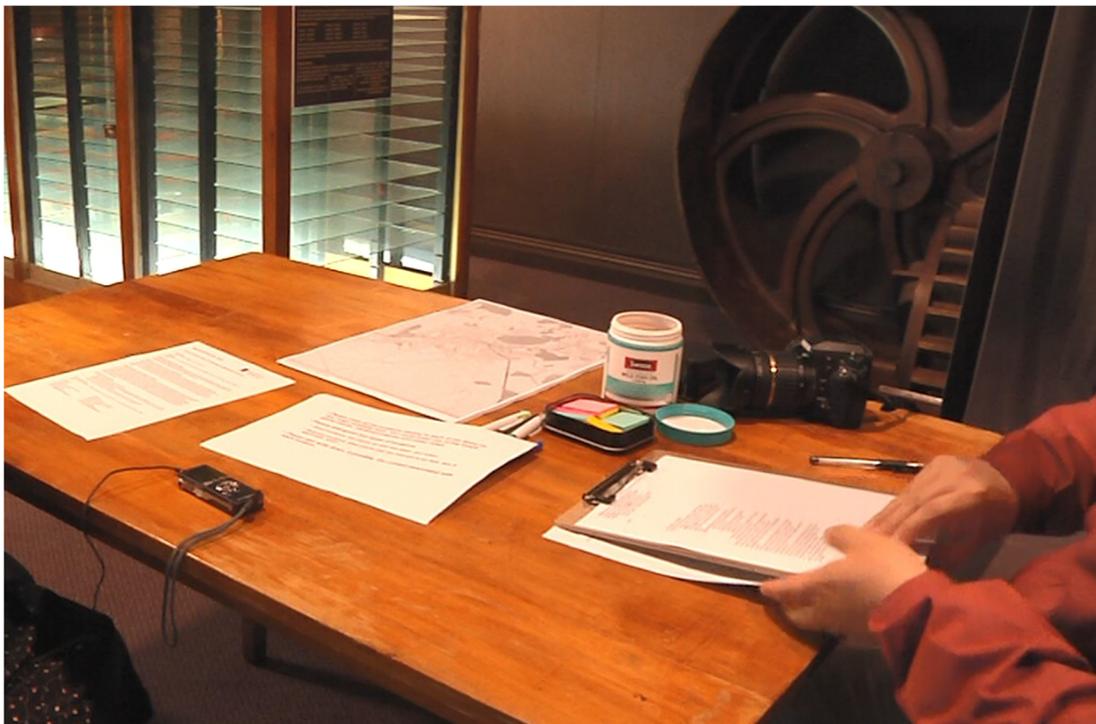


Figure 3.2 Two wooden patterns of S7 in Table 3.3, audio recorder and still camera in the fourth study session

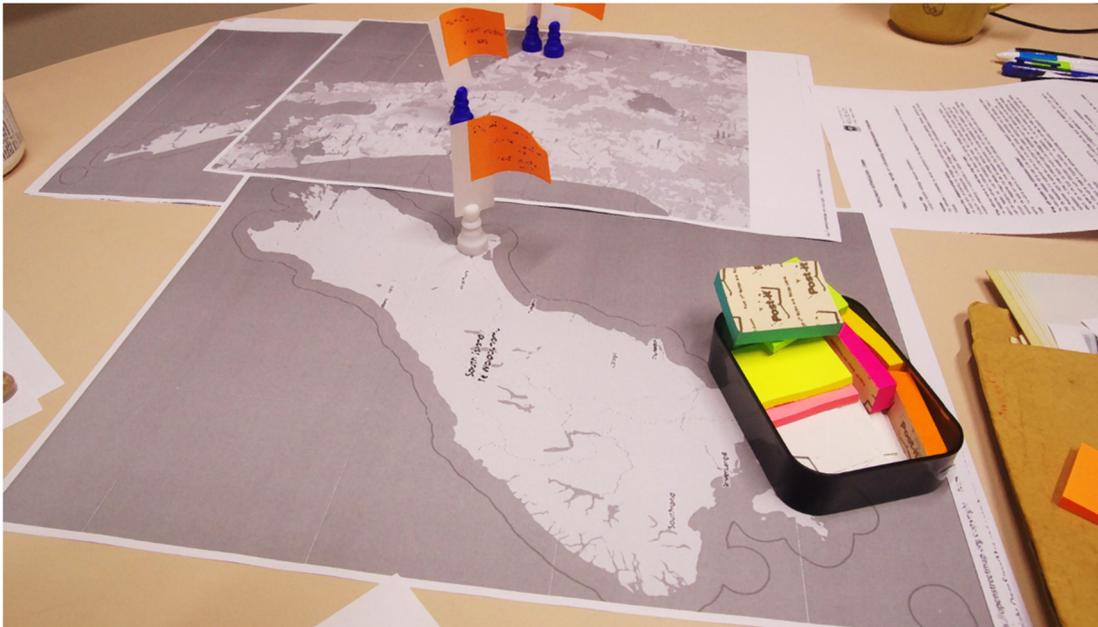


Figure 3.3 Markers (comprised of board game pieces, cut cardboard pieces and sticky notes), physical maps and pens used for the location marking activity

- Board game pieces (12 in 2 colours, 6 pieces per colour for the pilot sessions; 30 in 5 colours, 6 pieces per colour for the study sessions)
- Sticky page markers and notes (5 strips of page markers in 5 colours for the pilot sessions; 10 strips of page markers and notes in 5 colours for the study sessions)
- 29 cardboard pieces (used to work with the board game pieces and attach sticky page markers and notes)
- 27 A3-sized physical maps printed from *OpenStreetMap*<sup>47</sup> showing various regions (see Table 3.1 for the respective numbers made available for each session), and
- 5 pens.

A Yaegaki-hime doll (see Figure 3.4) is used as an example to illustrate the use of location marking resources. Table 3.2 showed four sets of exemplar metadata of differing levels of certainty and granularity. A participant would write each set of *location*, *time* and *other*

Table 3.1 Numbers of physical maps available for each session

	Pilot Session		Study Session					
	1 <sup>st</sup>	2 <sup>nd</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	6 <sup>th</sup>
Map Number	8	12	15	16	17	19	20	17

<sup>47</sup> <https://www.openstreetmap.org>



Figure 3.4 Yaegaki-hime doll with calligraphed kanji “八重垣 鳳玉作 (Yaegaki, Hogyoku’s work)” on the smaller label on display in Chengdu Museum. Photograph by Can Zhao on 1 January 2018

*contextual description* on a sticky note, which would be stuck to a cardboard piece. Blue and white board game pieces (see Figure 3.3) would be chosen to represent *direct* and *relevant* locations. The participant would then insert each cardboard piece into the slot of a board game piece to complete the marker, which would be placed onto a related spot on a physical map.

All the sessions were recorded using either a professional camcorder (see Figure 3.5) or a portable video camera supported by their associated tripods, and an audio recorder subsequent to obtaining participant consents. A still camera (see Figure 3.2) was employed to document the selected artefacts and if applicable, the contexts of being in-museum displays as in the third and fourth study sessions; as well as other supplementary material and outcomes of the location marking activities.

Table 3.2 Exemplar location information marked for the Yaegaki-hime doll

Location	Direct / Relevant	Time	Other Contextual Information	Certainty
Probably Kōfu	Direct	circa 1994	Bespoke Japanese doll crafted by a specialist	Uncertain
Possibly Kōfu City Hall	Direct	circa 1994	Purchased by Kōfu City Council, present to Chengdu commemorating the 10 <sup>th</sup> anniversary of being sister cities	Uncertain
25 Hongmen Street, Chengdu	Relevant	1995	Visit to a primary school by teacher delegates of Kōfu, a commemoration event	Certain
Chengdu Museum	Direct	1 January 2018	Displayed, exhibition on communication with international friendship cities	Certain



Figure 3.5 A professional camcorder used to record the first pilot session

## 3.2 Results

Six participants were recruited for the study sessions. Four of them were invited via personal contact and the other two were approached using snowball sampling. The participants included one enthusiastic amateur who donated personal collections to museum (P1), two librarians (P2 and P6) and three museum professionals (P3, P4 and P5). P2, P3, P5 and P6 were based at publicly funded or council-operated institutions, whilst P4 was affiliated to their local museum, where volunteers from the community played an active role in operation. Selecting heritage artefacts went smoothly—the 38 individual objects (see Table 3.3) generally met the preferred criteria (see Section 3.1.2) and no change was requested. Moreover, the existing metadata of 15 single objects—O16, O17, O18, O19 through O22 of S5, O31, O32 and O33 of S8, O34 and O35 of S9, O36, O37, as well as O38—was gathered.

The subsequent interviews lasted for approximately 6.9 hours in total. The interview with P1 was completed in the Usability Laboratory of the Department of Computer Science, and the remainder were performed in the respective institutions. The verbal data including the acquired metadata of the selected objects was collected from the interviews, transcribed and then coded in *NVivo 12*. The initial codes of the verbal data from the earlier sessions were generated inductively as per the interview questions (e.g., “context”, “direct location”, see A13 and A15) or via in vivo coding (e.g. “finding out what people are interested in from the conversations”). The deductive coding was also used to disassemble the verbal data when the category codes corresponded to various facets of object biography and other interlinked biographies (e.g., of “related persons”, “other tangible” and “intangible items that are associated with the related persons”, see Figure 3.7).

### 3.2.1 Selected Artefacts

The selection incorporated 38 individual objects—represented as O1 through O38 in Table 3.3, namely 18 sets of heritage objects—represented as S1 through S9 and O4, O15 through O18, O31 and O36 through O38 (these were deemed as a set of objects that consisted of one item)—were presented in the study sessions. The inclusions of personal memorabilia, library holdings and museum artefacts and archives met our expectation that a wide spectrum of artefacts would be featured by referring to the criteria (see Section 3.1.2). For any artefacts that had had publicly available digital surrogates such as O36, O37 and O38, the biographical metadata acquisition was built on the originals and if applicable, the private digital copy kept or once handled by the related persons (e.g., O37).

Table 3.3 The selected objects used in the study sessions

Object Number	Object
S1 incl. O1 – O3	3 Uniform Patches
O4	Official Photo of Air Training Corps (ATC) Flying Scholarship
S2 incl. O5 – O7	3 Photos of ATC Flying Scholarship Cadets
S3 incl. O8 – O11	4 Pieces of ATC Course Documentation
S4 incl. O12 – O14	3 Photos of Cadet in Uniform
O15	Jansson Map
O16	Stokes Map
O17	Printing Press – ‘Excelsior’
O18	Wedding Dress – Bodice and Skirt
S5 incl. O19 – O22	4 Pieces of Buckland China
S6 incl. O23 – O25	3 Illuminated Manuscripts
S7 incl. O26 – O30	5 Wooden Patterns for Moulding Mine Machinery Wheels
O31	Camera
S8 incl. O32 – O33	Cup and Plate
S9 incl. O34 – O35	2 Pamphlets – <i>Maori Settlement of the Waikato District</i>
O36	Photo of Carbolic Sand Soap Store
O37	Film Footage of the Removal of a Hill
O38	Flyer for Chiropractic Business

The primary reason behind the choice was the meaning attached to each set of artefacts by the participant and custodian based on their previous experience including those with the artefacts. For instance, P4 commented on S7: “[Y]ou could write a lot of information about the wooden patterns because they were a very essential part of producing huge pieces of machinery. ... I’m fortunate that I’ve got the knowledge of mining ...”. P6, likewise reflected on the characteristics of O37: “[W]e’ve got a lot of just images of that—the removal [of a hill] ... I think I like the fact that [O37] just brings things to life a bit more.” Similarly, the motivations can be exemplified by O3—a customised patch—that was regarded by P1 as “the most private” item, O15 that was linked by P2 to an era in which cartographers flaunted conquests through their works, as well as P3-selected O17 and P5-selected S8.

### 3.2.2 Extent

Among the selected objects with existing metadata, the one associated with O16 primarily described a facsimile edition of *Discoveries in Australia* in MARC standards<sup>48</sup>, as O16 was attached to the book. O17, O18, S5, O31, S8 and S9 were recorded in compliance with Spectrum format (see Figure 3.6). For S5 and S9, the existing metadata were at the set level. O32 and O33, both part of S8, however had been individually recorded with the same *Acquisition Notes*. The documentation of O36, O37 and O38 adopted a non-standard format.

<sup>48</sup> <https://www.loc.gov/marc/>

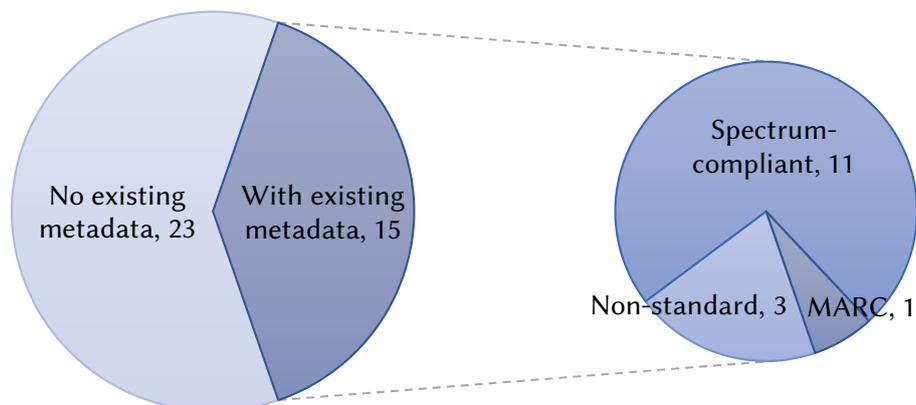


Figure 3.6 The existing metadata and their formats—Spectrum-compliant format for 11 museum artefacts, MARC and a non-standard format for 4 pieces of library holdings

The other 23 pieces did not have any structured descriptive metadata digitised by July 2018: S1, O4, S2, S3 and S4 were recently donated to museum; O15 was rediscovered in 2017 and not catalogued; S6 and S7 also had no digitised structured information (see Figure 3.6).

The acquired metadata were free-flowing, narrative and thus less scholarly. For example, the description relating to the production of S5 by P3 included:

“[F]rom 1825 onwards was when [Mason’s] were using the particular mark that’s on the back of it. So yes, we do know Stoke-on-Trent. ...

“... [W]ithin about a decade is when the particular mark ... was used. It’s a crown mark. I’ve got you the information on that. ...

“... [S5] [i]s not exactly workaday china, is it? It seems to have been ceremonial. They would have got it out for special occasions is my understanding. ... [T]he design was chosen by the manufacturers, the flower design.”

Eight types of interlinked biographies were covered in the acquired metadata (see Figure 3.7): three types of object biography—that of selected objects, “typical life” of the similar objects (Joy, 2009) and others associated with related persons—and five other types of biographies—that of related places, time periods, events, persons and other intangible items associated with the related persons (see Figure 3.7).

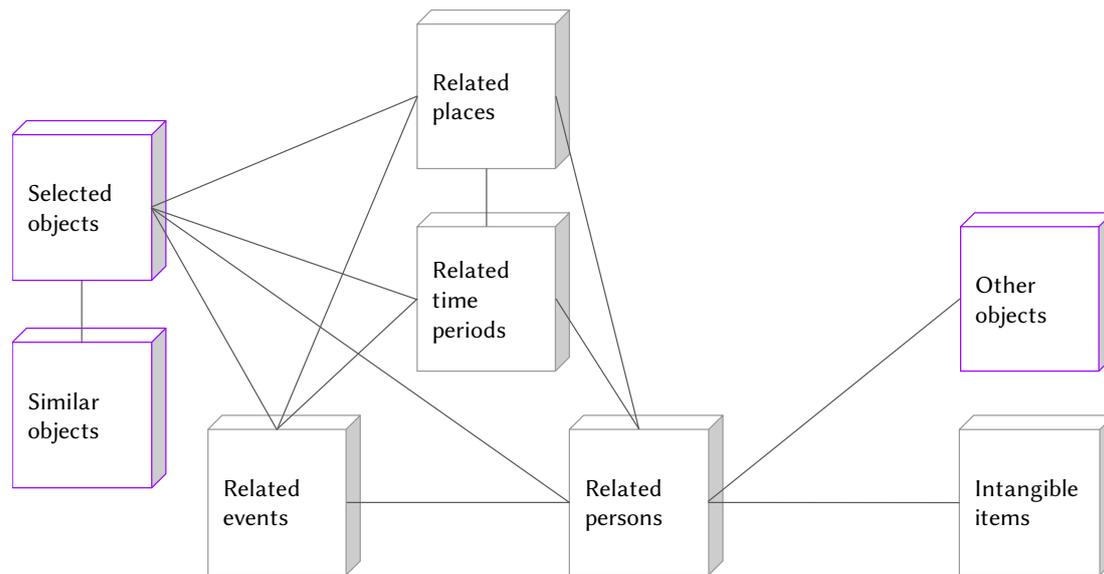


Figure 3.7 Eight types of interlinked biographies covered in the acquired metadata

Employing object biography as a conceptual tool enabled the comparison shown in Table 3.4 of the extent and certainty (see Section 3.2.3) between the two sets of metadata across three object life stages—being made (*Made*), being exchanged, used or owned (*Exchanged*) and being collected (*Collected*)—informed by Joy (2009). Six metadata property categories: location, time, person, event, value and meaning and context were abbreviated as *L*, *T*, *P*, *E*, *V* and *C*. Hyphens (-) symbolise no existing metadata. Black circles represent metadata values that were certain, whereas white circles represent the involvement of at least one uncertain value. The quality of being certain or uncertain was determined via analysing the data we collected from the study sessions. Blank cells indicate no existing metadata and no metadata was acquired.

The details of the existing metadata and the acquired metadata were predominately given multiple labels from the six property categories. For example, one of the *Provenance Notes* of O17’s existing metadata contained “... [a] Maori newspaper called ‘Te Paki o Te Matariki’ ... was also published at the Parliament from 1891 to 1902, reputedly by this press, but it would seem to be too small for the pages.” The implication was that there were events examining and cataloguing the use of O17 in a museum practice context. The related metadata acquired from P3 included some extra details: “... I know that [O17] is not likely to have been used for the newspaper and is more likely to have been maybe a notice or used for that kind of publication. “... [I]t would only have been a single sheet from this printing press, so we need to have an example of that and we don’t have any here at the museum.”

Table 3.4 Extent and certainty of the existing and acquired metadata

Object No.	Existing metadata divided by different life stages										Acquired metadata divided by different life stages																													
	Made					Exchanged					Collected					Made					Exchanged					Collected														
	L	T	P	E	V	C	L	T	P	E	V	C	L	T	P	E	V	C	L	T	P	E	V	C	L	T	P	E	V	C	L	T	P	E	V	C	L	T	P	E
S1 incl. O1 – O3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S2 incl. O5 – O7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S3 incl. O8 – O11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
S4 incl. O12 – O14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O16	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
O17	•	•	•	•	•	•	•	•	•	•	○	○	○	○	○	•	•	•	•	•	○	○	○	○	○	•	•	•	•	•	○	○	○	○	○	•	•	•	•	•
O18	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	○	○	○	○	○	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
S5 incl. O19 – O22	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	○	○	○	○	○	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
S6 incl. O23 – O25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	○	○	○	○	○	-	-	-	-	-	○	○	○	○	○	-	-	-	-	-
S7 incl. O26 – O30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	•	•	•	•	•	-	-	-	-	-	•	•	•	•	•
O31	-	-	-	-	-	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
S8 incl. O32 – O33	-	-	-	-	-	•	•	•	•	•	•	•	•	•	•	○	○	○	○	○	•	•	•	•	•	○	○	○	○	○	•	•	•	•	•	•	•	•	•	•
S9 incl. O34 – O35	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	○	○	○	○	○	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
O36	-	-	-	-	-	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
O37	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	○	○	○	○	○	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
O38	-	-	-	-	-	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	○	○	○	○	○	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

The details of the existing metadata and the acquired metadata were predominately given multiple labels from the six property categories. For example, one of the *Provenance Notes* of O17's existing metadata contained "... [a] Maori newspaper called 'Te Paki o Te Matariki' ... was also published at the Parliament from 1891 to 1902, reputedly by this press, but it would seem to be too small for the pages." The implication was that there were events examining and cataloguing the use of O17 in a museum practice context. The related metadata acquired from P3 included some extra details: "... I know that [O17] is not likely to have been used for the newspaper and is more likely to have been maybe a notice or used for that kind of publication. "... [I]t would only have been a single sheet from this printing press, so we need to have an example of that and we don't have any here at the museum."

The acquired metadata overall covered a greater extent than the existing metadata, even with the differing amounts of existing detail. The information of the objects across their lives was difficult to derive from the existing metadata, particularly for the first and second life stages. The acquired metadata bridged some of the gaps with more details that embraced a higher level of uncertainty.

### 3.2.3 *Detail, Certainty, Spatial and Temporal Granularity*

The detail of the metadata varied among the artefacts, or sets of artefacts, from being fully catalogued to being produced using limited resources. The existing metadata were machine-readable in principle, yet the catalogued details that were biographical and potentially useful for enabling access to artefacts in wider environment commonly existed in free-text form as descriptions and notes, very occasionally with uncertainties (e.g. one of the *Provenance Notes* of O17).

The acquired metadata yielded a considerable amount of details of each set of artefacts. The participants were willing to supply uncertain information that was either rarely catalogued or not included in the existing metadata. The amount of uncertain information therefore markedly increased in the acquired metadata. Among the spatial and temporal details that were certain, some were clearly not fine-grained (e.g., how S8 saved their donor's life).

One observation was that raising the mutual relationships between the certainties or uncertainties in one set of objects and the uncertainties or certainties in the similar objects or the objects associated with the related persons was spontaneous and sometimes connected with the reasoning behind the information. P1 recalled the production of O3 of S1: "Because this shop [that did monograms] was literally across the road from the barracks we were in ...

and we'd seen people going out with patches and so I just went: 'Why don't we get one?'. I'm guessing there were probably other [cadets who took the] courses that did the same thing, I'd never seen one. So, in that sense I thought 'what's the rarity value?', put it on display." The location, value and context of O15's second life stage, as well as time, person and event across its second and third stages involved uncertainty. The reason was the purchase and acquisition events of O15 were associated by P2 with a deceased person and were "impossible to confirm": "It just is a very strong feeling on my part that that is what [they] did, because our careers overlapped and [they] would do this ... We have a lot of good maps because of [them], so I think this is one of those."

The supplied spatial and temporal granularity was another recurring theme. The grain-size of the location properties frequently stayed at city or town level, whilst that of the time properties varied from within months to two decades. P6 talked about the journey of O37: "[O37] travelled from [a library] to across the river to [the owner]'s house to potentially somewhere like Dunedin, I can't remember what the company was, ... [O37] travelled back to ... where it was filmed." P5 explained how S8 saved their donor's life: "... [T]hey were used during World War I. "We're not exactly sure where [the related person] was, at what point in time, but it's believed that he was drinking, and the bullet came through. ... [T]hat hit the cup and [plate] instead of him."

### 3.2.4 *Biographical Intersections*

Artefact metadata that a general audience might find interesting and that the participants wanted an audience to remember were acquired. A pattern was that the interesting and valued points of the metadata were strengthened by the intersections of the biographies (i.e., the eight types of biographies identified in Section 3.2.2), both factual and imaginary. The visitors made meanings via intersecting their own biographies—one sub-type under the biography of related persons—with other types of perceived biographies (e.g., "people putting themselves in the shoes of people in that time and thinking about that", said P3). The pattern was captured from the acquired metadata including those of O3 of S1, O15, O17 and S8. One example was a part of S6's (i.e., three illuminated manuscripts "for retiring local personalities") metadata offered by P4:

"... A lot of them haven't survived because they've been poorly stored ... and then people can't see the value. ... I think it depicts an era where your service to a business, organisation or whatever, was valued.

“... I say it compares [with medieval illustrated manuscripts] because the artwork is similar but now that’s been done with pen, ... It makes you think, doesn’t it?”

“... [A lady] said to me this is a medieval skill. I was thrilled ... I said: ‘Yes, it is a medieval skill.’ She said: ‘I didn’t realise that in modern times that that skill had carried through.’ ... She was just blown away that the museum had gone to the trouble of raising money, finding a conservator and getting them [restored] in such high quality.

“... [T]he message ... is that first of all the volunteers for this museum are trying to preserve this community’s unique history. ... I want people to go away and think hey, pretty interesting community, and that’s what I’d like to work towards.”

### 3.3 Discussion

The notion of object biography was used in this study as:

- A conceptual tool for designing the metadata acquisition method, analysing and understanding the existing and acquired metadata
- A potential structure of the acquired metadata.

The method was successful in establishing the viability of metadata acquisition for biographies of the selected objects, however, time constraints meant that some follow-up would be needed to produce complete descriptions suitable for implementation. The method might also only work with a relatively small number of objects, the focus is nevertheless on quality of artefact description (e.g., via the acquisition of time-location pairs). For some artefacts and for some participants, an acquisition tool could possibly be used on location or remotely with digital mapping services. Future prototyping could help participants with temporal and spatial granularity as providing metadata for a novel visitor interaction may well be too abstract.

One aspiration of heritage artefact documentation was to capture the interaction history between an object and other objects, places, persons, events and actions (Bearman, 2008). The acquired metadata look promising considering its extent and detail. The acquired metadata has the potential of being transformed into structured biographical metadata and therefore, supporting novel interactions with heritage artefacts.

#### 3.3.1 *Creating Object Biographies*

The biography of an artefact should comprise “a reasonable number of actual life histories” (Kopytoff, 1986), though it does not have to tell “a neat linear life story” when the

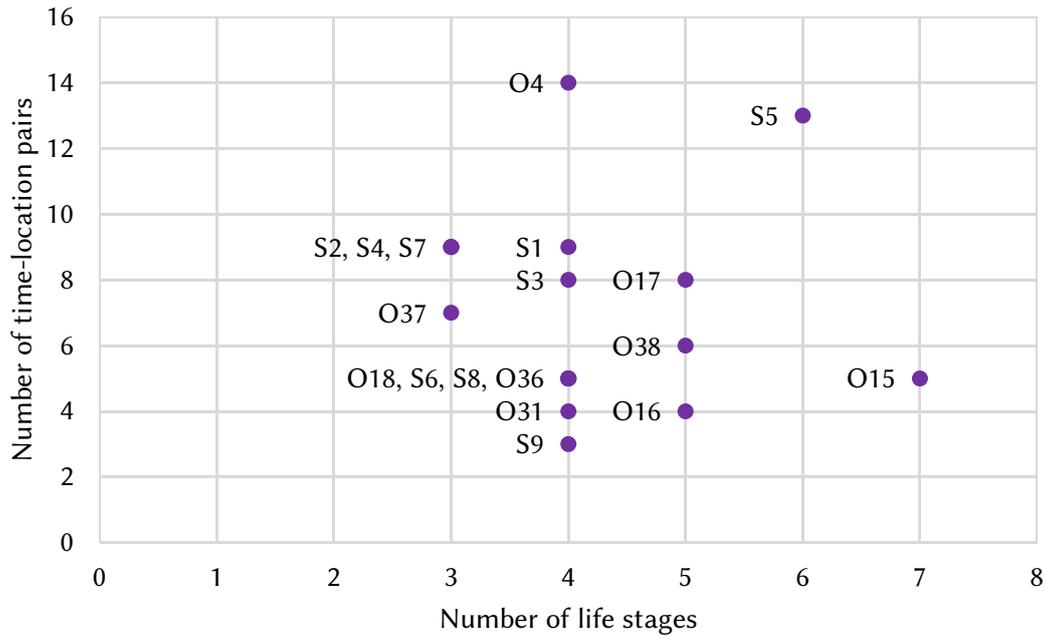


Figure 3.8 Numbers of life stages and time-location pairs

evidence is lacking (Joy, 2009). As objects join in and depart from different relationship spheres, they have multiple life stages (Joy, 2009). In each stage at different times, they could travel to or stay at and be linked to many locations.

We use biographically inspired *numbers of life stages* and *time-location pairs* as two dimensions to illustrate the acquired metadata of related consequences of events, time periods and places in Figure 3.8. The diagram represents the scattered relative positions of the selected artefacts in a two-dimensional biographical space. The majority of the selected objects had an adequate number of life stages that were between 3 and 5 and associated time and place information that were between 3 and 9. The acquired life stage, time and place metadata of the other three artefacts—O4, O15 and S5 conveyed a larger amount of information.

We understand from the study results that the acquired details could be a resource for creating the biographies of the similar artefacts with insufficient records (Joy, 2009; Kopytoff, 1986). For example, the rich stories of the wooden patterns of S7 might be extendable to other industrial artefacts in the region with a mining context. Besides, the interestingness of an artefact perceived by general audience could be from biographical intersections. The mutual relationships between the certainties/uncertainties in one object and the uncertainties/certainties in the similar objects or the objects associated with the related persons, signifies alternative approaches for representing uncertainty that could in turn lead

to new user experiences. Further research can be performed focussing on the interplay between structuring biographical metadata and these topics.

### 3.3.2 *Creating New Access Models*

By adopting the biographical viewpoint, we could assist a user to not only appreciate the object's remembered past, but also connect with the object's co-created present in their life (Chen & Marty, 2005; Marty, 2011). Vassilakis et al. (2018) suggested shifting the viewpoint of a collection to an artefact and allowing the artefact to present itself to visitors. The approach can be extended through allowing the artefacts to be present across the external environment to facilitate novel interactions.

We have seen that the participants can express biographical metadata about the objects in their collections and this potentially enables these new forms of access. The implication of a user expressing interest by whatever means in an object is that their interest is spread to the biographical trail of that object across time and space. This transfer of user interest enables new scenarios of use that can take objects outside museums and place them into their geographical context. Conversely, in-museum recommendation can utilise history of user locations, where the recent biography of the user intersects with the biographies of the artefacts. For example:

*Jane is visiting a foreign country. When she was on holiday somewhere, she'd go to a museum and find out about that place because what happened in the places she visited was interesting.*

*Jane uses an audio tour guide to access enhanced descriptions of selected objects during a museum visit. Later in her trip she visits a different town and her mobile device notifies her that several of those objects including a doll that resembles the Yaegaki-hime doll in Figure 3.4 had been present in this town. Her device offers to customise a tour of the locales in chronological order and suggests other related objects in the local museum.*

*Jane then meets some other objects in the local museum. Some of them have also been to the places, at where she has recently had great experiences. Several objects have been associated with the topics, on which Jane has expressed her interest.*

## 3.4 **Summary**

The potential of object biographies to enable new forms of context-rich interactions is constrained by the available metadata. Artefact records typically do not contain the type or detail of machine-readable metadata needed to support the projection of objects from

physical museums to the wider environment. Although a small scale, exploratory study, we believe we have shown the potential of the approach as a method to gather object biography metadata. Participants seemed to find the study enjoyable with relatively low effort: which is important if we are to ask busy people with expertise to share insights. The acquired metadata was somewhat different from the existing metadata:

- More extensive, narrative and less scholarly
- More mutually informed uncertain and certain information among the artefacts
- More focus on biographically intersected topics that would be of interest to a visitor
- Less consistent as to the level of detail, spatial and temporal granularity.

As such, although we refer to the information obtained as artefact metadata, it has many features more in common with the kinds of information provided on interpretive displays next to artefacts in exhibits, than to the fields in an artefact collections database.

In this chapter, we described our approach of adapting the notion of object biography as a conceptual framework to support new forms of context-dependent interaction with museum artefacts. A metadata acquisition method was tailored for acquiring biographical details and the metadata collected via this method has properties which seem promising for creating engaging user experiences. We aim to investigate the biographical intersection between places and more artefacts in Chapter 4 to work towards a biographical metadata structure and a mobile application that implements these ideas.

## 4. Acquiring Place-Centric Object Biography Metadata

The previous chapter established an initial approach for capturing metadata using the conceptual framework of object biography. In this chapter, we extend the results with a more detailed place-centric investigation that was directly related to the Research Questions 2 and 3 (see Section 1.2). We worked with key informants—the local heritage enthusiasts and experts in the Waikato Region to gather:

- Elements that formed object biographies, and
- Imagined functionalities of telling object biographies at the past or present places of the objects, primarily in an outdoor environment.

Place is used to refer to any spot “with properties that give it shape and character and which enable conversations” (Vasardani & Winter, 2016). In this chapter, we document an in-situ acquisition of the object biography that intersects with specific physical locations. The object biography elements and the imagined functionalities of telling such object biographies were extracted from the rich narratives we gathered.

The chapter is divided into three sections. Section 4.1 presents the design of the study including recruiting key informants, combining semi-structured interview and bodystorming techniques as the data collection method and preparing the corresponding study material and apparatus. Section 4.2 describes the artefacts and places the study employed, the captured object biography elements and the suggested functionalities for presenting object biographies. Section 4.3 is a discussion and summary that links to a more practical acquisition of sample metadata for creating proof-of-concept prototype.

### 4.1 Study Design

Four pilot sessions were performed to examine the effectiveness of the provisional study protocols and the use of the material and apparatus on the Hamilton Campus of the University of Waikato in December 2018, January, February and June 2019. A selection of artefacts was initially not requested yet became essential based on a finding from the first three pilot sessions. By solely specifying one location, the proxy participants concentrated on discussing the artefacts that were embedded in-situ (e.g., a plaque, certain architectural features of a building or a set of outdoor table and benches). Although the artefacts examined

in the pilot sessions were technically movable, they were prior to performing study sessions, considered as being instrumental in the making of the place.

#### 4.1.1 *Participants*

The key informants were local memory institution professionals, heritage experts and enthusiastic amateurs (see Section 3.1.1), who should be familiar with specific locales. The familiarity could be substantiated by the fact that a key informant is residing in, working there or both. To address the limited pool of participants, four pilot sessions were conducted on campus with participants outside the precise target group. The four proxy participants including two academic staff members who were on the supervisory panel of the researcher, a research staff member and a postgraduate student from the Department of Computer Science.

We learned that the statuses of being a memory institution professional, a heritage expert or an enthusiast may coexist from performing the previous study (see Section 3.2). Additionally, approximately 90% of 471 New Zealand museums in 2012 were staffed by either entirely volunteers or with up to five paid fulltime professionals (McCarthy, 2014). As a result, we used a simpler term—*heritage enthusiasts and experts* in our correspondence with the potential participants.

We initially attempted contacting potential participants who resided in Hamilton for the anticipated convenience of evaluating the mobile app prototype that employs local object biography metadata. The participant recruitment posters (see Appendix B) were placed at the Hamilton City Libraries Te Ohomauri o Kirikiriroa and the Waimarie Community House in Hamilton East. A request was also made to the Waikato Historical Society in person as to circulating the posters. However, these two approaches were unsuccessful in yielding any responses. We consequently decided to invite two of our previous participants and adopt snowball sampling to seek participation from potential participants in the Waikato Region.

#### 4.1.2 *Data Collection Method*

We employed a data collection method combining semi-structured interview and bodystorming techniques (Oulasvirta, Kurvinen, & Kankainen, 2003) with a customised tour, in which a key informant and the researcher visit two outdoor locations in a city or town in the Waikato Region. Bodystorming was chosen a method that combines a strong sense of place with exploring new possible interaction models.

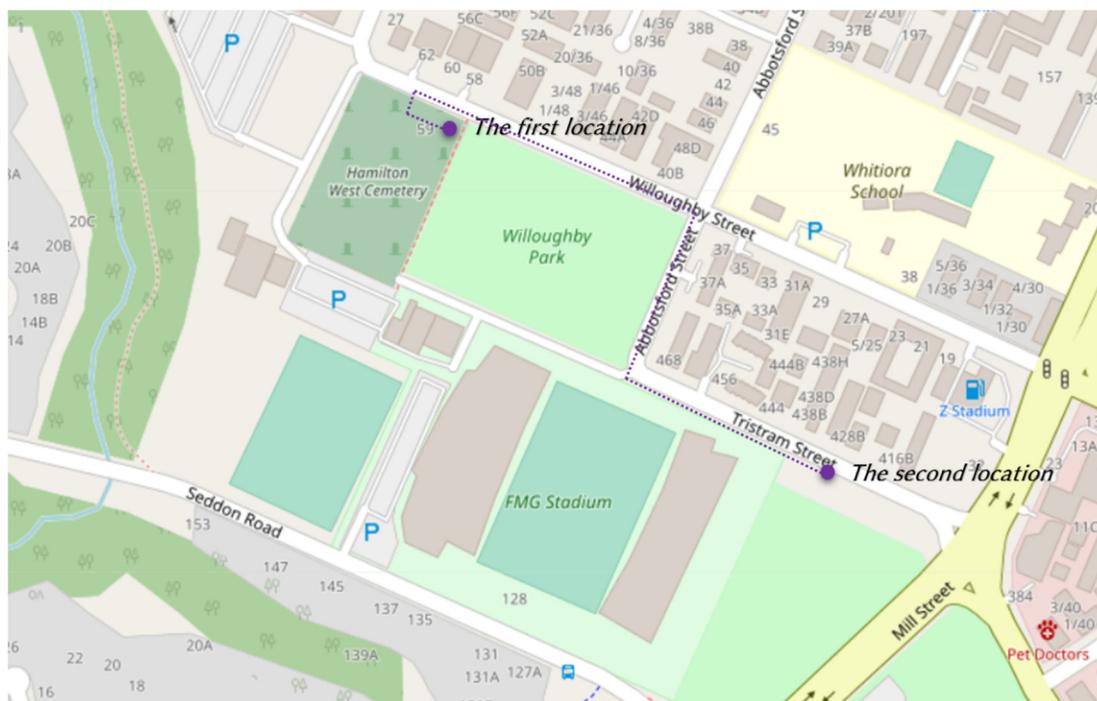


Figure 4.1 A Hamilton-based artificial example of the selected locations shown on OpenStreetMap—the grave of the Gwynne family at the northeast corner of Hamilton West Cemetery as *the first location* and a spot outside Waikato Stadium on a pavement of Tristram Street as *the second location*

The two outdoor locations would be specified prior to each study session. Upon our request, the participant would select the first location—abbreviated hereafter as *first location* (see Figure 4.1) together with up to two heritage artefacts or taonga<sup>49</sup> that are associated with the location, be the relationship a direct or relevant one (see Figure 4.2). The participant could select from the memory institution collections and the artefacts that are privately held, given away or lost but remembered. The private artefact-participant pair could assist us to explore the location-artefact intersection from the desirable second-person perspective, to complement those taken from the third-person one (see Figure 4.3). We established three criteria for the selection of first location and heritage artefacts or taonga:

- One location could be chosen for the different sessions to be performed in one city or town
- One artefact or taonga could only be chosen once for the sessions to be performed in one city or town, and
- The participants from the previous study would be requested to select one of the previously chosen artefacts (see Table 3.3 and Table 4.1).

<sup>49</sup> <https://maoridictionary.co.nz/search?keywords=taonga>



Figure 4.2 A Hamilton-based artificial example of two selected artefacts that are relevant to Location 1: *Photograph of Gwynne's Hamilton Hotel* (Accession Number: HCL\_01440) on the left, Historical Photographs Collection, Hamilton City Libraries Te Ohomauri o Kirikiriroa; *Pearson's Carbolic Sand Soap* (Accession Number: 1979/29/3) on the right, Collection of Waikato Museum Te Whare Taonga o Waikato

The latter two criteria would be notified to the relevant participants. The second criterion would be applied before conducting the second study session in one city or town, though we would be open to any discussion with the participant on an individual basis. If we knew that the respective participants are from the same memory institution or organisation and the selected artefacts of the earlier session are part of the memory institution collections, the names and accession numbers of the objects would be given to the participant of the subsequent session.

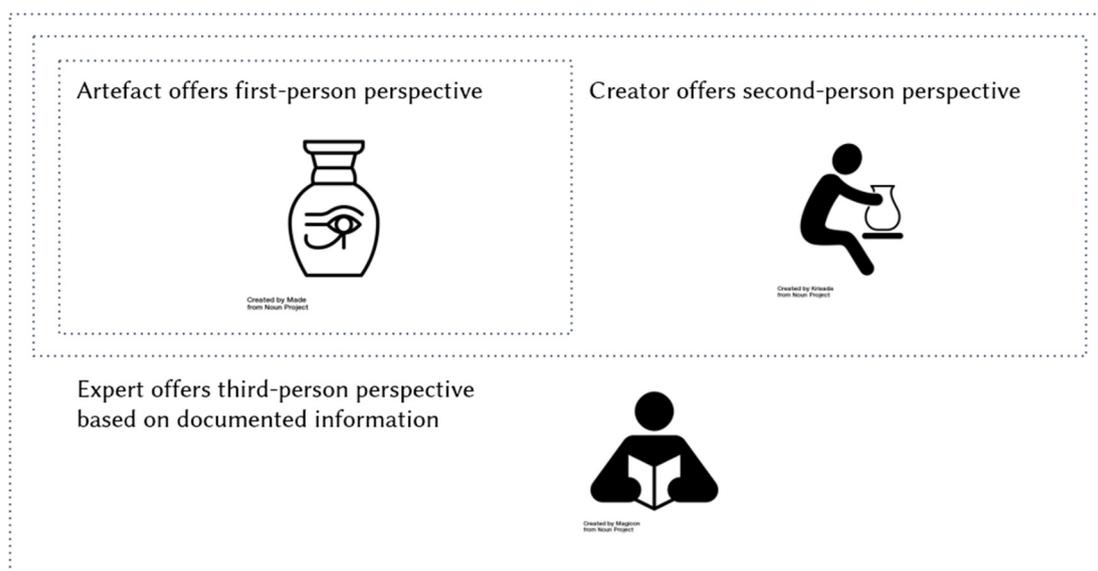


Figure 4.3 An example of the first-, second- and third-person perspectives (the icons of [Pottery](#), [Potter](#) and [Reading](#) were created by Made, Krisada and Magicon from the Noun Project)



Figure 4.4 The participants interpreting the making of the locations (two images captured from the recordings at the top); The participants interpreting the relationship between the artefact and the location (two images captured from the recordings at the bottom)

We would ask the participant for a short note on their selection of the first location and the associated artefacts, each with an image. The printouts of the artefact images would be brought by the researcher to each study session and serve as a cue when the conversation move onto the artefacts (see Appendix B). The existing structured descriptive metadata of the objects would be gathered if they are collected and catalogued by memory institutions. We would reply to and confirm with the participant about the other location that would be selected by us—abbreviated hereafter as *second location* (see Figure 4.1), and the plan of walking to the second location from the first as a part of the session. The second location should be:

- Within a ten-minute walk from the first location, and
- Varied from the first location concerning the types of their overarching public space (e.g., cemetery, church, marae, park, street, etc.)

We would not specify any artefact connected with the second location, nor request the participant to do so in advance. Figure 4.1 and Figure 4.2 illustrate the method with artificial



Figure 4.5 Choosing and explaining how the magical powers would assist in-situ storytelling

examples of locations and artefacts from Hamilton; the main studies were performed in other areas in the Waikato Region.

The study sessions would be performed under suitable weather conditions. Each study session would be completed in one hour and consist of three parts, which are termed as *being at the first location*, *walk* and *being at the second location* (see Figure 4.7). The researcher would meet with the participant at either the first location or their institution, then walk to the closely located first location. Once the participant consent was received at the location, we would start audio and video recording (also see Section 4.1.3).

For both the parts of being at the first and second locations, we would start with a semi-structured interview with the participant (see Figure 4.7). The focus would be acquiring place-centric object biography metadata, specifically on obtaining:

- The making of and the stories occurred at or relevant to the location



Figure 4.6 Walking or driving to the second location

- The relationship between the selected artefacts and the location (e.g., the roles played by the artefacts in the stories), and
- The themes relating to the artefact-location pair.

The researcher would switch his roles, first to an *international traveller* then a *different person* who the participant could imagine and specify (see Figure 4.7 and Figure 4.10), to explore if varied characters would induce the participant to present more metadata.

The researcher and the participant would then proceed to a prototyping activity, again for both being at the first and second locations. The participant would be requested to choose two ‘magical powers’—namely imagined functionalities (Axup & Viller, 2005)—and envisage if they are empowered with such abilities, how could the abilities assist in telling the artefact stories in-situ. The participant would be given seven magical power-representing cardboard pieces:

- *Label building*
- *Draw attention*
- *Reconstruct setting*
- *Show timeline*
- *Show around*
- *Let artefacts speak*
- *Let people speak.*

Each of the imagined functionalities would be labelled by a one-line description. One glowing light bulb—denoting *wild card* would also be given if the participant has another magical ability to suggest (see Figure 4.5 and Figure 4.11). They could choose two at each location. The participant would be informed that any power is limited to a single use before

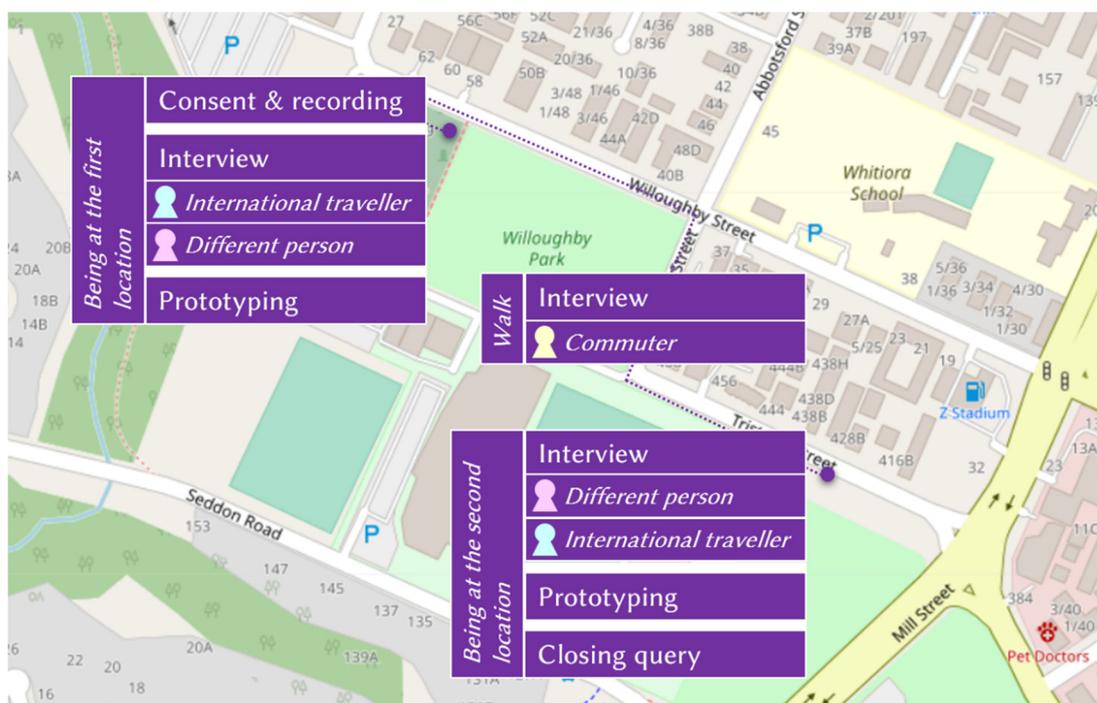


Figure 4.7 Structure of a session: the Hamilton-based artificial example

deciding on the two at the first location, the powers that could be used for the second location would be from the six remaining options.

The participant and the researcher would walk from the first location to the second when the first prototyping activity was accomplished (see Figure 4.6). Driving would be allowed under the circumstances:

- Having a look around at the nearby locations is beneficial and the traffic en route is low (e.g., in the 4th and 6th sessions)
- Travelling by car is more controllable (e.g., in the 7th session)
- The distance between the two locations is too far to walk (e.g., in the 10th session).

The researcher would once more switch his role to a *commuter* (see Figure 4.7 and Figure 4.10) at the start of the travel and enquire the participant about the making of and the stories occurred at or relevant to the streets and buildings along the way.

The differences between the interviews of being at the first and second locations would be:

- The sequence of the roles played by the researcher—first the different person then the international traveller at the second location (see Figure 4.7), and

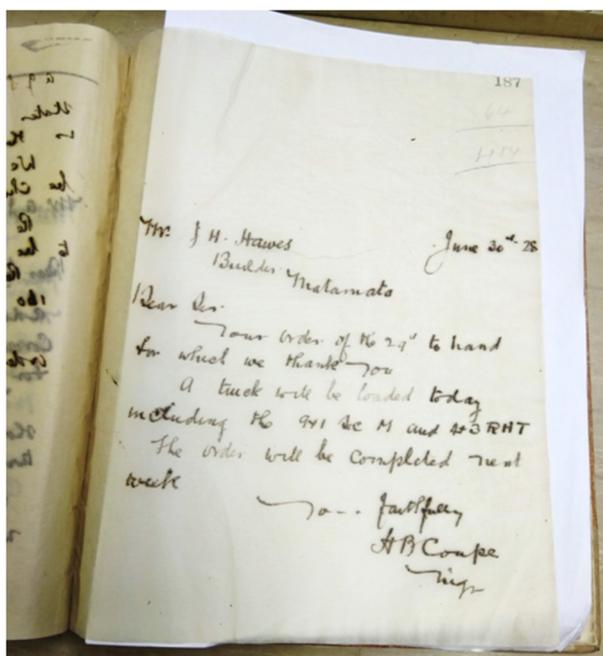


Figure 4.8 Printed copy of a P10-selected artefact—a carbon copy of a business letter dated on 30 June 1928 from a letter book, printed copy used in the 10<sup>th</sup> session, artefact photograph taken at a meeting before the session

- Encouraging an exploration of and questioning the second location if an insufficient number of stories and artefacts is identified.

We would enquire the participant if they had any other thoughts on utilising the relationship between location and artefact. the participant would then be thanked for their participation at the end of the session.



Figure 4.10 Three persona badges and a badge-carrying lanyard worn by the researcher

Lastly, the researcher would request the images and if any, the structured descriptive metadata of the artefacts associated with the second location from the participant or the relevant LAMs.



Figure 4.9 P6-selected taonga—a pūkorō (pouch) that was being woven, the photo was taken at the beginning of the session with P6 at the first location

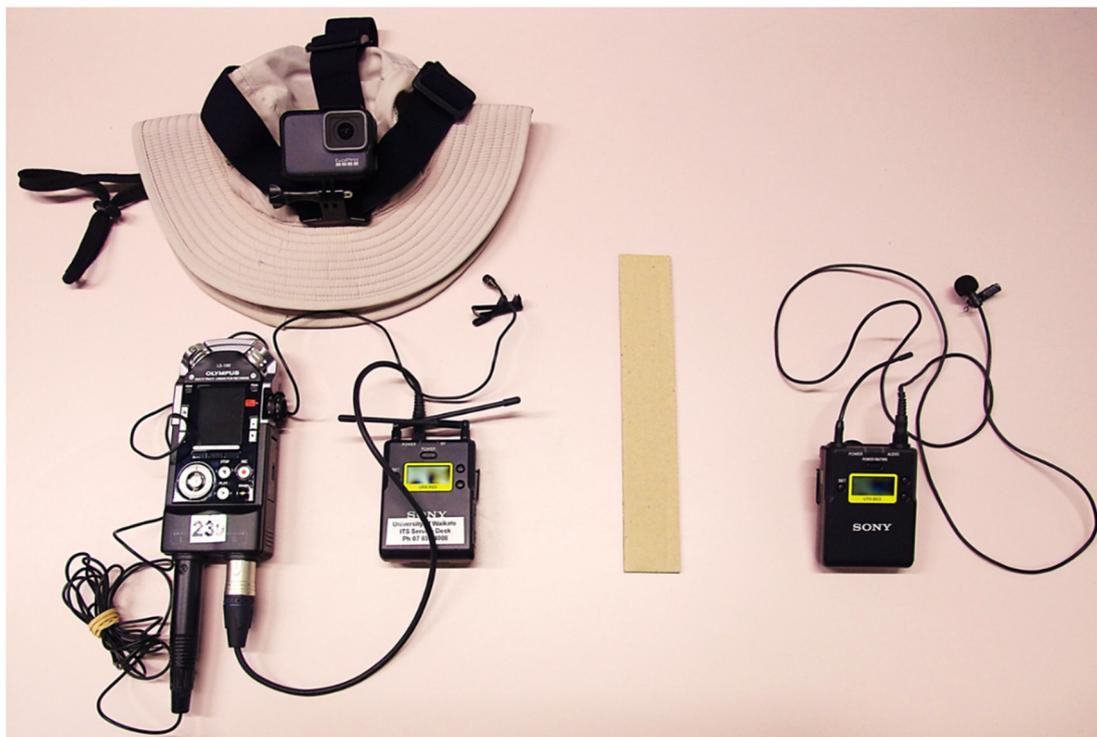


Figure 4.12 The recording devices worn by the researcher on the left: a head-mounted action camera and a hat, audio recorder with a laval microphone and a belt-pack transmitter. The recording devices worn by the participant on the right: a belt-pack receiver and a laval microphone

#### 4.1.3 Material and Apparatus

The outdoor nature of the study entailed the qualities of being portable and requiring minimum adjustment from the material and apparatus. The digital photographs and printouts of the selected objects, and occasionally the objects themselves were used in the sessions. Most of the artefact photographs were received before a session from the participants. The photographs could also be taken after meeting with a participant at a memory institution if we went there to invite their participation and explain the study (see Figure 4.8). A tablet

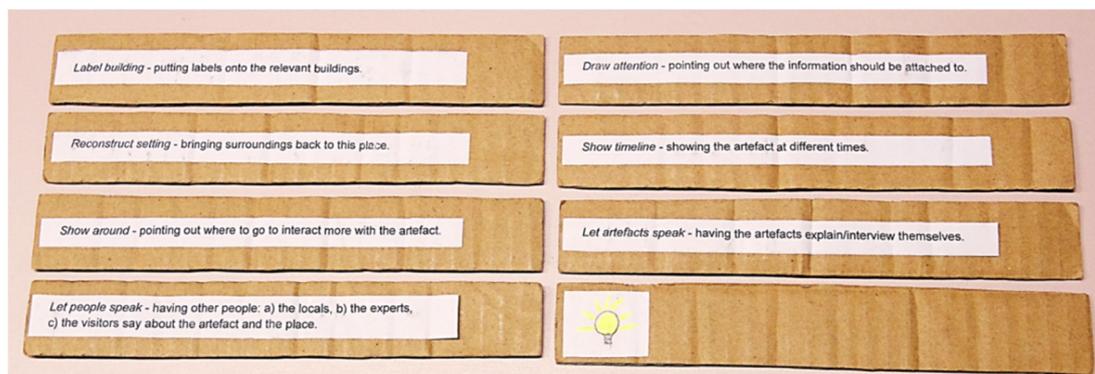


Figure 4.11 Eight magical power-representing cardboard pieces

computer with the digital photographs was carried to the 1st and 3rd study sessions but was thereafter replaced by preparing physical printouts. Occasionally, no printed copy was prepared because the artefacts or taonga could be preferably seen at the first location (see Figure 4.9) or were temporarily unavailable (e.g., the 2nd session).

The researcher wore a lanyard carrying an *international traveller*, a *different person* and a *commuter* badges (see Figure 4.10) in the study sessions. The badges would be switched to the appropriate one when probing into the making of the place at the first and second locations, as well as during the walk from the first location to the second.

Eight cardboard pieces including seven with printed one-line description of magical power and one hand-drawn glowing light bulb-symbolising wild card were employed for the prototyping activity. We presented all of them to the participants at the first location, and the remaining six to them at the second location after acquiring place-centric object biography metadata.

The lanyard, role badges and magical power-representing cardboard pieces were prepared with little effort. The lanyard was given to the researcher at a university-wide activity. The badges and cardboard pieces were all cut from the materials at hand with printed descriptions glued onto them.

All the sessions were audio and video recorded. The researcher carried most of the recording devices (see Figure 4.12), whilst the participant was requested to equip a lapel microphone-plugged receiver (see Figure 4.12). The recording solution was verified as being able to clearly capture the actions on the move and the voices when the environmental noise was presented, for example, standing near or on a road.

## 4.2 Results

We contacted 35 heritage enthusiasts and experts in a four-month period. Ten of the contacted enthusiasts and experts—two participated in the earlier study, six via snowball sampling and two via direct contacting—were recruited for the study sessions. Overall, we had seven museum professionals (P1, P3, P4, P7, P8, P9 and P10), one museum volunteer (P5), one academic (P2) and one postgraduate student who was also a craftsman (P6). Among the museum professionals, P1, P3, P8 and P9 worked at publicly funded or council-operated institutions. P4, P7 and P10 were from the museums, where the relevant societies from the communities played an active role in operation.

The total length of the interviews was approximately 10.33 hours. The majority of the locations were outdoor whilst several of them were inside particular buildings given the complex relationships between the locations and artefacts. The verbal data of the interviews was transcribed and analysed in *NVivo 12* using primarily deductive coding.

#### 4.2.1 *Artefact-Place Pairs*

Table 4.1 lists the settlements (7 in total), session numbers, first and second locations (10 pairs in total) and the corresponding objects (38 single objects or 32 sets of objects in total).

Some selected artefacts—be it a personal or museum-accessioned item—had spent a considerable amount of time with the participants. In the beginning of this study, we conceptualised any items that were installed or situated at certain locations as a part of a place (e.g., Letterbox on Victoria Road as the second location in the 1st session). After the 5th session was completed, such items were reconsidered as being placed at an end of the artefact spectrum and we started to explore other possible artefact-location pairs that exhibited

Table 4.1 Places, study sessions, locations and artefacts

Settlement	Session	First and Second Locations	Object Number and Name
Cambridge	1st	1st: Town Hall	S1 incl. O1 – O4: Buckland China (S5 in Table 3.3)
		2nd: Letterbox, Victoria Road	O5: Trowel O6: Letter
	5th	1st: St Andrews Kindergarten	S5 incl. O18 – O19: Photos of P5
		2nd: Viewing Platform of Te Koutu Lake	S6 incl. O20 – O21: Photos of the lake O22: Tree label
Hamilton campus, University of Waikato	2nd	1st: Te Kohinga Mārama Marae (indoor and outdoor)	O7: Whakairo (carving) O8: Tokotoko (walking stick) of P2
		2nd: <i>Aurei</i> (sculpture) outside Student Centre	O8: Tokotoko of P2
	9th	1st: Foyer of Te Pua Wānanga ki te Ao Faculty of Māori and Indigenous Studies (indoor)	O34: Ballantrae windows
		2nd: Chapel Lake	O35: <i>The Last of the Just</i> (sculpture)
Pirongia	4th	1st: Armed Constabulary Redoubt	S3 incl. O14 – O15: Photo of the first bridge, Photo of the Alexandra Redoubt O16: Telescope used by Neil McLeod
		2nd: Northwest Corner, Junction of Crozier and Franklin Streets	O17: Map
Te Awamutu	3rd	1st: Anzac Green	S2 incl. O9 – O10: Cup and Plate (S8 in Table 3.3) O11: Badge
		2nd: Selwyn Park	O12: Brick O13: Flour mill
	8th	1st: Dairy Company	O31: Butter impression
		2nd: Railway Station	O32: Railway signal lamp O33: My great grandfather's tape measure
Te Kūiti	6th	1st: Residence of P6 (indoor)	O23: Pūkoro (pouch) being weaved O24: Pūkoro collected by Otago Museum
		2nd: Te Kūiti Pā (indoor and outdoor)	O25: Taiaha (long wooden weapon) of Rewi Manga Maniapoto O26: Tukutuku (ornamental lattice-work) panel
	7th	1st: Railway Station	O27: 1885 Wheelbarrow
Otorohanga	7th	2nd: Former Courthouse (indoor)	O28: "My grandmother's potty", termed by a visitor O29: Lion in a cage O30: Judge's mallet
		1st: Railway Station	O27: 1885 Wheelbarrow
		2nd: Former Courthouse (indoor)	O28: "My grandmother's potty", termed by a visitor O29: Lion in a cage O30: Judge's mallet
Putaruru	10th	1st: Taupo Totara Timber Co Ltd Office Building	O36: Carbon copy of a business letter O37: Model of Waikato River wooden bridge
		2nd: Old Post Office and Water Park	O38: Brick with handprints

diversity. In the 9th session, one artwork (O34) that was installed onto a building in the first location was selected and another sculpture (O35) was encountered at the second location.

Each participant selected their first location and we specified the second location, which was in some cases another potential first location suggested by the participant. Not all the locations were open-air ones. We had the opportunities to complete a part of the respective session in Te Ao Hurihuri whareni<sup>50</sup> (meeting house) of Te Kohinga Mārama Marae<sup>51</sup>, the residence of P6, Te Tokanganui-a-Noho whareni of Te Kūiti Pā<sup>52</sup> and the former courthouse of Otorohanga with at least one item placed in the interior spaces.

There were three reasons for the first location-associated artefacts being chosen:

- They were owned or made/being made by the participant
- They were studied by the participant
- They were familiar.

For the artefacts that were connected to the second location and were not pre-selected, in addition to the reasons listed above, the participants provided the following reasons:

- They were recently accessioned
- They were recently referenced
- They were accessioned by the participant
- They were situated there
- They were given earlier as part of an optional artefact-first location pair.

#### 4.2.2 *Object Biography Elements*

The rich narratives we gathered from the study sessions conveyed many stories that were supported by the respective artefacts at the different places. The participants covered the following elements and their properties that collectively framed the biographies of the items.

- Artefact—different names, other artefacts used for creation
- Place—different names, location
- Building—location, artefacts used for creation
- Vegetation—different plants, locations

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<sup>50</sup> <https://maoridictionary.co.nz/search?keywords=whareniui>

<sup>51</sup> <https://www.waikato.ac.nz/marae/>

<sup>52</sup> <https://www.tekuitipa.com/>

- Landform—different rivers and mountains, locations
- Time
- Weather
- Season
- Period—extent
- Person—names, different roles
- Event—interrelationships.

*Artefact.* Artefact names were context-dependant in the conversation between the participants and researcher, which could be descriptive or short. An artefact could be created by using other artefacts. According to P9, for example, O34 was made of stained glass and “... it’s quite a unique piece of art being stained glass created by a contemporary Māori artist. [Paratene Matchitt] was not a stained glass artist, so it was quite a different medium for him to be working in.”

*Place.* Different participants could use different place names, and such different places could be overlapping with each other as to their geo-locations. The place that neighboured the very locale of the letterbox on Victoria Road was referred to as the Anglican Church by P1. For P5, it was the St Andrews Kindergarten. The kindergarten “was in this building here which was the original church. It was used as a classroom for Sunday School and other things, but mornings it was certainly used for the kindergarten.”

*Building.* Buildings were made of artefacts. For example, P3 introduced the present-day Selwyn Park upon arrival: “This place was originally the Otawhao Mission Station which was built to convert the local Maori that were living here to the Anglican faith, which is what connects with St John across the road. That was the church that was built. It’s not here anymore, but you can kind of see there’s some concrete or some brick outlines, and so that was where the original mission station was built.”

*Vegetation.* Vegetation could be a feature of a place. By comparing the view of the present-day Te Koutu Lake, P5 shared two photographs with the researcher: “I’ve got [them] in the car you might like of this 1900 looking down that way... Just see the development without all the trees and things like that.”

*Landform.* Landform could be a reason for the making of a place. “The reason [the Otawhao Mission Station] was built in this location is because that is where the river or the stream is and so they would take the stream to get here if they didn’t come by foot.”

*Time.* In response to the researcher's query about the *Hop Wall 2000*—a wall that comprised of bricks that showed different kinds of self-made patterns by hands or other tools, P10 recalled the time: “That would have been 25 years ago because my three children and my [spouse] and I are on it and I'm thinking [one of the children] was three. So you're talking 1990s.”

*Weather.* P1 told the researcher the stories about the Anglian Church starting from the weather, in which their study session—an event was taking place and among others the recording devices were attending: “... it's seen as very picturesque. We're see it on a windy day and a bit cloudy...”

*Season.* The storytelling was continued by P1 at the Anglian Church: “... [B]ut [the church] is a beautiful one—now it's autumn with the trees, but I know that people like to take photos of the spire, maybe to hear the bell ringing, because it's got bells.”

*Period.* P4 provided an example of this time and place-specific notion: “By the 1880s, the roads were getting better so that was less the way into town. [A hotelier] bought this section and put up a rather flash hotel here. But it was the beginning of the Depression of the 1880s. Historians sometimes talk about the hungry 80s, it was a pretty tough time. It was a bad time to start a new business.”

*Person.* Persons were introduced with different roles in different events by the participants. Two militiamen/suitors were featured in a story given by P4 at the Pirongia Armed Constabulary Redoubt: “[Finch's] daughter was the apple of the eye of Neil McLeod... [T]here was a big competition where he and another militiaman named Kirk, who she eventually married. But McLeod tells in his diary they came up here for a look one day and then he saw them disappearing into the cabbage trees ... across in that direction, quite a long way away... There are those human stories that become part of it, but he must have been using a telescope.”

*Event.* The participants described events as being interrelated and not necessarily in a linear order. “... [T]hat lion over there, people say why have you got one of those things in a cage, tourists wouldn't understand it at all. But our Lioness Club, which is a female part of Lions, Lioness Club was very big at one stage here and we competed for winning the trophy for the various things we did. When they closed down, I grabbed that because it had been competed for and the Lionesses would come in and say, ‘Oh I remember that.’”, said P7.

Some participants considered different aspects of an object biography can be tailored for different groups of potential visitors as per their content-related interests and their

familiarity with the local events. For example, P8 considered they “would more elaborate for an international traveller more on the impact on the land wars and the land confiscation which was obviously connected to the railway story. And the fact that [Te Awamutu railway station] was the terminus and why it was the terminus for such a long time.”

#### 4.2.3 *Biography-Telling Functionalities*

The participants also made their choices as to which ‘magic power’ could assist them interpret the objects and the object-location relationship (see Table 4.2). While ‘magic powers’ as an analogy was useful in communicating what we wanted the participants to consider, two participants had different understandings. P7 found “the word magical difficult to define”, though they responded to the ‘power’ of *Draw Attention* by saying “[w]e could put up a lovely big photo on the railway station. I never thought of that before. It would create a talking point... [Anyone arriving at the station] could read a story, I suppose.”

P6 shared their imagined functionality (i.e., equivalent to picking up a wild card) instead of choosing any such ‘powers’ at the Te Kūiti Pā: “Each carving inside [the Te Tokanganui-a-Noho wharenuī] is ... a different ancestor. ... one of the carvings in there is called Māui and Māui is known to have captured the sun, the light, and you can see it in the carving.

“... [T]he ancestors, they’re still taonga. ... They’re carved but our relationship to what they represent and who they represent is still very much on our conscious mind.

“... [T]o hear the voices of our tupuna<sup>53</sup>s (ancestors’) talking about this place and how it was established, all the stories and histories behind it by using a hologram to show our future generation of who they were and what they endured and how they existed. I don’t think it takes magic; I think it takes belief.”

The imagined functionalities selected by the other participants can be categorised into three types as to their intended use being:

- More consistent—reconstruct setting, show timeline, let artefact speak and let people speak
- More diverse—label building (combined with show around) and draw attention

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<sup>53</sup> <https://maoridictionary.co.nz/search?keywords=tupuna>

Table 4.2 ‘Magic powers’ chosen by each participant

		P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
First location	Label building		•								
	Draw attention					•		•		•	
	Reconstruct setting				•						
	Show timeline			•	•	•			•		
	Show around										
	Let artefact speak	•		•							
	Let people speak	•							•	•	•
	Wild card										•
Second location	Label building								•		
	Draw attention			•							
	Reconstruct setting			•						•	•
	Show timeline	•									
	Show around	•			•	•			•		
	Let artefact speak					•				•	
	Let people speak		•		•						
	Wild card		•				•				

- Customised (i.e., by choosing the wild card)—switch season and immense oneself in role-playing.

The imagined uses of each functionality are explained and exemplified below:

*Reconstruct setting.* One example was provided by P9 on reconstructing the artist’s studio around O35 for “bringing [the scene] to life to tell more of [Molly] as an artist”. Another previous setting was “[O35]’s first spot in that school room and the staff and students around him who purchased the sculpture...”.

*Show timeline.* P1 presented a representative view of using timeline for “... getting a sense of [an object] might have stayed the same but the people and the ways in which it’s been interacted with would have changed”.

*Let artefact speak.* P3 reflected that the objects had different journeys that the heritage professionals know little about. “I was just talking about this at work, actually. To know about how the bullet got in the cup ..., we don’t know for sure, so to actually know what happened would be awesome. You’d only get that from the artefacts.”

*Let people speak.* A summary was given by P8 outside the Dairy Company: “It’s always valuable having people who directly involved with the industry to share their stories because they know what they do. I’m only a person looking from the outside. ... Letting people tell their own stories is really important to get different perspectives.”

*Label building and show around.* In addition to the applications that employed the literal meaning of the functionality, an extended use of the functionality drew inspirations from the

fact that the Te Kohinga Mārama Marae was embodied by O8. In such ways, a place-object-place relationship can be presented:

“... [T]he tokotoko’s story supports the building’s story; not so much the other way around. ... Visitors [to the marae] are welcomed from the gate, they sit down, and hosts are sitting down. I would have my tokotoko here, and then when it comes my turn to speak, I would stand, and I would use the tokotoko in various ways... [T]he easiness of the proceedings in order to support the principles of the ancestral house and the people who belong to that ancestral house are supported by the way that I use that tokotoko. ... The tokotoko is taken to other spaces representative of this building and also of my home marae, so that when I represent the University of Waikato overseas or in other national places, that tokotoko tells that story, supports that story.”

*Draw attention.* Unlike the approach of embedding artefact photographs in place suggested by P7, P9 recommended an alternative means to draw attention for installed artefacts. “... [W]e can’t really see [O34] much outside which I think is the real pity of the artwork is that they’re not revealed until you’re inside, which is also intriguing, but to be able to see them and to sort of see them like a hologram sort of pop out and entice you in and then when you’re in, to see the different forms which create the story and how those different panels are formed to create the story, for them to pop out so you can see... That can all sort of visually pop out at the visitor.”

*Switch season.* P2 thought “... one of the magical powers would be to make these clouds go away and make this a summer day, because then we could look across and see the sacred mountain of the Waikato people, Taupiri, to the north.”

*Immense oneself in role-playing.* “... [Y]ou could put yourself back in time, you could live what those people lived, I suppose, and know what they were really feeling and how hard it was to get to these places and to work in those places, the life they led. And you would see all these buildings and all the plant and the equipment that they have these days, but it’s much newer of course”, said P10.

### 4.3 Discussion

Although we had a wide range of artefact-place pair selection in this study, a limitation was that the potentially different requirements of documenting individual object or set of objects remained unaddressed.

The gathered fact that artefacts witnessed and sometimes contributed (e.g., O8, S5, O32 and O34) to forming the shared identity of a place (Purves, Winter, & Kuhn, 2019) indicated a potential overlap of the biographical elements of objects and places. A conceptualisation of

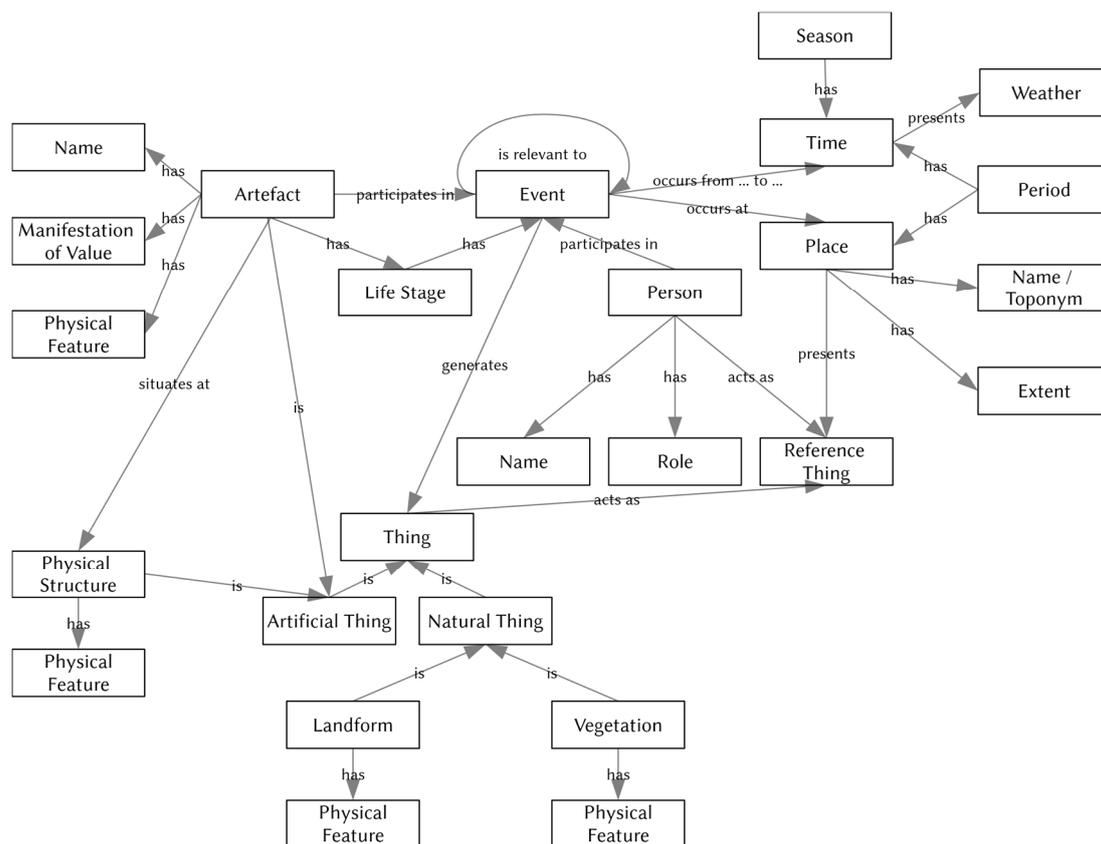


Figure 4.13 A conceptualisation of object biography metadata

object biography metadata was created (see Figure 4.13). The sole purpose of this conceptual model was to develop an understanding of the interrelationships between the acquired elements and a few concepts such as *manifestation of value* and *life stage* derived from the literature (Gosden & Marshall, 1999; Joy, 2009) and CIDOC CRM ontology definition (CIDOC CRM Special Interest Group, 2021).

Primarily based on the acquired elements described in Section 4.2.2, the conceptualisation presented certain level of abstraction for the elements such as *physical structure* for *building*. The complex properties between events at different levels were simplified as *is relevant to*. Another element introduced was *reference thing* which referred to any *Thing* that attended the same event with *Artefact* and had presented or have been presenting themselves in *Place*.

The adaptations made to the original biography-telling functionalities by the participants was noted. Being prototyped in the wider environment, these refined functionalities showed a potential to inform designing for object biography-centric interactions.

Further investigations could be made in formalising the object biography conceptualisation using CIDOC CRM and its compatible models. The adapted biography-

telling functionalities could also be further designed and evaluated. In Chapter 5, we will acquire object biography metadata samples from a local heritage institution using some of the elements extracted from the results of the present study to work towards creating a proof-of-concept mobile application prototype (see Chapter 6).

## 5. Acquiring Object Biography Metadata Samples

Given the potential impact to the use of metadata caused by its complexity (van Hooland & Verborgh, 2014), five sets of metadata samples based on a condensed and tabular version of object biography metadata were acquired from the Waikato Museum Te Whare Taonga o Waikato.

This sample metadata acquisition study was performed with a curatorial staff member from the museum aimed at forming a metadata basis for building a proof-of-concept mobile prototype and more importantly, together with the prototype development, reinforcing the previous outcomes that address the Research Questions 1 and 2 (see Section 1.2). We record the detail of the design of the study and an analysis of the verbal data gathered from the follow-up interview that complements the initial metadata. A discussion on possible solutions to improve the understandability of the object biography metadata elements and further works that could be built on the potential of the acquired metadata is also provided.

The chapter is arranged into three sections. Section 5.1 describes the study preparations including condensing the conceptual model of the object biography metadata and devising a fully labelled spreadsheet. Section 5.2 presents the selected artefacts, the quality issues and potential of the extracted metadata. Section 5.3 is a discussion and summary that links to the use of this metadata in the prototype in Chapter 6.

### 5.1 Study Design

The conceptual model of the object biography metadata was condensed into a minimum version that contains nine elements (see Table 5.1) in order to improving the feasibility and efficiency of performing metadata extraction from available sources. The nine elements were grouped into four categories—*Artefact*, *Person*, *Time* and *Place*. Apart from the fundamental elements such as *names of artefacts*, *persons* and *places*, *extent of places* and *time*, the other four (i.e., *other artefact used*, *manifestation of exchange value*, *person role* and *name of relevant places*) represented some basic characteristics of object biography as to various social spheres an item joined (Joy, 2009). Each of these elements occupied a column in the spreadsheet that was used as the acquisition tool. *Events* that acted as a pivot for the nine elements were simplified and put into five generic types—*creation*, *exchange*, *pre-accession event*, *accession* and *in-museum event*. The other side of such simplification was a potential ambiguity that

Table 5.1 Fields of the condensed object biography metadata

Category	Field
Artefact	Name
	Other artefact used
	Manifestation of exchange value (primarily for <i>exchange</i> and <i>accession</i> events)
Person	Name
	Role
Time	
Place	Name/Toponym
	Location/Extent
	Name/Toponym of Relevant Place

implied all events took place in a linear fashion. The instances of each type (e.g., creation, exchange 1, exchange 2, etc.) headed a row of the spreadsheet.

### 5.1.1 Data Collection Method

Because of the idiosyncrasies of artefacts, nature of information-intensive work and relative easiness of conducting evaluation locally at a later stage, we sought the participation of the only staff member at the Waikato Museum Te Whare Taonga o Waikato, whose curatorial responsibilities were pertinent to our inquiries. The participant was invited to accomplish the following three tasks:

- Select several heritage artefacts collected by the museum
- Fill in the cells of each corresponding spreadsheet with the metadata of an artefact
- Have an interview in a debriefing meeting form to discuss the metadata samples.

Before the research activity started, an instruction was supplied in a sample spreadsheet file to the participant (see Appendix C). The concepts of *Direct Place*, *Relevant Place* and *Hybrid Place* were first introduced:

- *Direct Place*: a place where an artefact has been (e.g., the places an artefact was created, stayed, etc.).
- *Relevant Place*: a place where an event occurred but was not attended by an artefact, though the event is relevant to another event that occurred in another place and was attended by the artefact.
- *Hybrid Place*: a place is both a direct place for one or more artefacts and a relevant place for another or more artefacts.

Four criteria were then given to the participant as a guide for selecting artefacts:

- Five places. The selection should include a mixture of direct places and relevant places (e.g. three direct, two relevant). The inclusion of hybrid places is ideal but not compulsory.
- At least one of the places should be either a direct place to two or more artefacts or a hybrid place.
- The five places should be located close to each other (i.e., take less than ten minutes to walk from one to another), ideally in the city centre.
- At least three artefacts should be selected. We would suggest selecting Ticket to South Africa vs. Waikato, Rugby Park, Hamilton (Accession Number: 1985/12/88) collected by the museum as one of them.

The spreadsheet file had an empty biographical metadata table with notes (see *Additional notes provided on columns and rows of Artefact metadata sheet* in Appendix C) on a separate worksheet. In addition to the nine metadata elements, *an additional note/miscellaneous* was provided for any values that would be deemed by the participant as not fitting into the other fields. The participant was informed that they could use any materials, a fictional artefact example (see *A fictional artefact example on Sheet3* in Appendix C) that was given on another sheet of the file for accomplishing the second task. Filling in as many cells as possible was encouraged.

A semi-structured interview with the participant was then arranged at a place with access to the used materials to discuss the results, anything that they believed to be worth noting and their experience of performing the metadata extraction tasks.

### 5.1.2 *Material and Apparatus*

Once the participant gave their consent, the session was recorded using a portable video camera supported by a tripod, and an audio recorder. The researcher also employed a clipboard that held the printed copies of the Participant Information Sheet and Consent Form and protocol during the interview. A laptop with the finished sample metadata spreadsheet file was also taken to the interview venue for discussing specific details.

## 5.2 **Results**

The study request was made to the Waikato Museum on 20 November 2019 as to obtaining metadata samples of at least three artefacts that were to be selected by a curatorial staff member.

Table 5.2 The selected objects for acquiring biographical metadata

Object Number	Object	Accession Number
O1	Ticket, Waikato vs. South Africa	1985/12/88
O2	Anti Springbok Tour Drawing	L2019/35/6
O3	Photograph, Springbok Tour Protest	1986/33/1
O4	Vending Box for Waikato Times	2015/19/1.1-2
O5	Family Crest, Captain James McPherson	1964/153/4

The items were selected and communicated on 11 and 12 February 2020, followed by the receipt of the sample object biography metadata of all five selected items on 26 February. The study was concluded by an approximately 43-minute long interview in a debriefing meeting form, which was conducted in a meeting room of the Waikato Museum on 5 March. The verbal data was transcribed and coded deductively in *NVivo 12*.

### 5.2.1 Selected Artefacts

Table 5.2 lists the five heritage items that were selected by the participant including the suggested rugby game ticket. The participant communicated the selection result with the researcher prior to commencing the main task—extracting metadata field values from the museum collections database.

The other four artefacts were chosen because either they were related to the rugby game ticket—and one of the related items was recently accessioned—or relating to the wider event (i.e., 1981 Springbok Tour) and “the peripheral places of the [1981 Springbok] tour-related items”. The participant concluded their choices in the interview: “It was just like you’ve given me that ticket as the starting point and then I just looked for a network that I could find around it.”

### 5.2.2 Missing and Presented Field Values

The received spreadsheet file contained five sets of object biography metadata with some empty grids (see Table 5.3, Table 5.4, Table 5.5, Table 5.6 and Table 5.7). One primary issue was the metadata element values being unknown. “... [A] lot of the [required] information was peripheral to what we have and a lot of it we simply don’t have. [W]e are more interested in where [an item] was used and when it was used in a bubble that makes it interesting to us. Then we know where it is when we get it here but we’re not necessarily wiring it down where it was in the interim. ... So, finding out information around that was quite hard. It was looking back in old records and seeing if anyone happened to have mentioned something”, said the participant.

Table 5.3 Metadata of Ticket, Waikato vs. South Africa

Event	Artefact	Person	Time	Place	Location & Extent	Name or Toponym of Relevant Place	Additional Note or Miscellaneous
Creation	Name Other Artefact Used	Manifestation of Name Exchange Value	Role	between 13 and 25 July 1981	Rugby Park	Seddon Road, Hamilton	Creation was at ticket kiosks within Rugby Park, exact location of kiosks unknown
Accession	Ticket 1981 Saturday 25 July 1981 Springbok Tour	donation	Rose Young	15th October 1985	Waikato Art Museum	1 Grantham Street, Hamilton	
			David Woodings Registrar	15th October 1985			
In-Museum Event	1985/12/88 Ticket 1981 Saturday 25 July 1981 Springbok Tour				Main Collection Store, Waikato Art Museum	Ephemera Box 13/2/5/2/Lundia 2, basement, 1 Grantham Street	
In-Museum Event 2	Ticket, Waikato vs South Africa, Rugby Park Hamilton July 1981	Dan Morrow	Curator	25 March 2014 - 5 April 2015	Fight the Power: Protest and Change 1970-1987 [Exhibition title], Waikato Museum	River View Level, 1 Grantham Street	
In-Museum Event 3	Ticket, Waikato vs South Africa, Rugby Park Hamilton July 1981	Leafa Wilson	Curator	March 2017 - May 2017	30th Anniversary Show of Waikato Museum being down by the Riverside [Exhibition Title], Waikato Museum	Gallery 9, Street level, 1 Grantham Street	

Table 5.4 Metadata of Anti Springbok Tour Drawing

Event	Artifact	Person	Time	Place	Additional Note or Miscellaneous
	Name	Other Artifact Used	Manifestation of Name Exchange Value	Role	Name or Toponym
					Name or Toponym of Relevant Place
Creation		Ruth Davey	1981	Likely drawn at Garden Place	Hamilton CBD Rugby Park, Hamilton
					Have you missed out the possibility that an item will move without an exchange taking place? i.e. Ruth brought this sketch home, but that is not an exchange so it is not documented here
Exchange		David Fowler	2019	David's house	River Road, Hamilton
					The exact address for David's house is known, but not given to protect the privacy of the donor
Accession	Anti Springbok Tour Drawings	At the WAM opening, Ian Wedde, New Museum, L2019/35/14	20-21 December 2019	Waikato Museum	1 Grantham Street, Hamilton
					The listed additional artefacts were donated by the Bequests Trust alongside the Springbok Tour sketch
		Opening of Waikato Art Museum, L2019/35/13			
		Rua Kenana, L2019/35/2			
		Anita Robertson Senior Registrar Waikato Museum			
		Untitled, L2019/35/3			
		Untitled, L2019/35/8			
		Untitled, L2019/35/9			
		Untitled, L2019/35/10			
		Untitled, L2019/35/11			
		Wayne R, L2019/35/5			
		Jessie Flannery Assistant Waikato			
In-Museum Event	L2019/35/6		13 January 2020	Main Collection Store, Waikato Museum Te Whare Taonga o Waikato	Metal Drawer 128, Drawer Store, Basement, 1 Grantham Street, Hamilton
	Anti Springbok Tour Drawing				

Table 5.5 Metadata of Photograph, Springbok Tour Protest

Event	Artefact	Person	Time	Place	Additional Note or Miscellaneous			
	Name	Other Artefact Used	Manifestation of Exchange Value	Name or Toponym	Location & Extent	Name or Toponym of Relevant Place		
Creation		Person	Role					
		Kees Sprengers	Photographer	25 July 1981	Garden Place	Hamilton CBD	Rugby Park, Hamilton	Eva Ricard was known for her earlier protest around and relationship with, Raglan
		Eva Ricard	Subject					
Accession	Photograph - Springbok tour protest	donation	Kees Sprengers	Donor and Museum employee	21 July 1986	Waikato Art Museum	1 I Grantham Street, Hamilton	
In-Museum Event	1986/33/1 Photograph - Springbok tour protest					Collections Store, Waikato Art Museum	Photofile/2/5/4/ Iundia 2 Basement, 1 Grantham Street, Hamilton	
In-Museum Event 2	Eva Rickard addressing crowd in Garden Place, July 25				25 March 2014 - 5 April 2015	Fight the Power: Protest and Change 1970-1987 [Exhibition title], Waikato Museum	River View Level, 1 Grantham Street	

Table 5.6 Metadata of Vending Box for Waikato Times

Event	Artefact	Person	Time	Place	Location & Extent	Name or Toponym of Relevant Place	Additional Note or Miscellaneous
Creation	Name Other Artefact Used	Manifestation of Name Exchange Value	Role	Unknown	Unknown	Unknown	
Exchange	Unknown	Waikato Times Corporate body/purchaser	Unknown	Unknown	Unknown	Garden Place, Hamilton	This box was in use in Garden Place, Hamilton, from 1890s until c.2010
Accession	Vending Box for Waikato Times newspapers "Waikato Times as Waikato as it gets"; "Honesty Box"	Donation Waikato Times, Donor Hamilton Office	4 August 2015	Waikato Times, Hamilton Office	70 Foreman Road, Te Rapa, Hamilton		
In-Museum Event	2015/19/1-2 Vending Box for Waikato Times newspapers "Waikato Times as Waikato as it gets"; "Honesty Box"	Pauline FarguharRegistrar Dan Morrow Curator		Main Collection Store, Waikato Museum Te Whare Taonga o Waikato	10/1/2/Jundia 10, Basement, 1 Granttham Street, Hamilton		

Table 5.7 Metadata of Family Crest, Captain James McPherson

Event	Artefact	Person	Time	Place	Location & Extent	Name or Toponym of Relevant Place	Additional Note or Miscellaneous
Exchange 2	Family Crest Captain James McPherson	Unknown	Unknown	Unknown	Unknown	Unknown	
Exchange	Other Artefact Used	Manifestation of Name Exchange Value	Unknown	Aberdeen, Scotland	Aberdeen, Scotland	Riverlea	This would have been at James McPherson's house, 'Riverlea', at Silva Crescent, from c:1875 - 1905.
Creation	Name	Maker	Unknown	Aberdeen, Scotland	Aberdeen, Scotland		
Exchange	Role	Owner	c:1864	Unknown	Unknown		
Exchange 2	Role	Donor	1958	Unknown	Unknown		
Accession	Role	Recipient organisation					
Accession	Role	Donor [the WHS collection became the Waikato Museum collection]					In 1965 the museum opened on the top floor of Hamilton Public Library, this item would have been there, I am unsure of where it would have been when it was accessioned.
In-Museum Event	1964/153/4 Family Crest Captain James McPherson	Waikato Historical Society		Waikato Museum	Unknown		
In-Museum Event 2	1964/153/4 Family Crest Captain James McPherson			Waikato Museum	Bledisloe Stack, Alexandra Street (now Worley Place), Hamilton		

Some attempts to find information for O5 including retrieving “reference to Sangster Aberdeen as a maker of crests” from old newspapers and online searches were made, although they were not successful. Additionally, a guiding principle practised by the participant as a curatorial staff member was “... if I wasn’t 80% sure something was true, I didn’t put it in.”

These reasons among others, led to a result in which Other Artefact Used and Manifestation of Exchange Value were left almost entirely blank. The exceptions were for the accession events of O1, O2, O3 and O4, “donation” was filled in as the respective manifestation of exchange value. The other artefacts used when O2 was donated included a list of artworks which were also donated at the same time. The participant explained another reason: “... [S]ome of these headings and the requests were hard for me to get my head around what it was you wanted. ... [I]n terms of Other Artefacts Used [in accession event of O2], I put down, for example all the other items that came in at the same batch of succession. But it felt like what you wanted to know was artefacts used in some way with an interaction with [a selected item] and it was a bit hard to understand what you were after.”

Although we requested the further specifications of the events via offering a note for each cell, none of the events were further specified except for an added “In-Museum Event 3” of O1. A misunderstanding was relating to these customisable event grids: “I was just presuming that you wanted to know where the items had been throughout their lives but that wasn’t a field that came up in your spreadsheet. ... For us, our interest is a little bit more directed to where it was at a certain time... There’s just that extra layer that was missed out of your spreadsheet...”

On the other hand, the non-linear nature of the object biographies was well presented by the selected objects and their metadata, in particular the values of Name/Toponym of Relevant Place. Some metadata field values further conveyed information relating to the potentially more engaging side of working with objects in museum. The following examples were another demonstration of the potential ‘interestingness’ that can be uncovered at the intersections of the biographies.

Three types of artefact names to cater for different purposes were exhibited in the spreadsheet including record names (e.g., O1 was called as “1985/12/88 Ticket 1981 Saturday 25 July 1981 Springbok Tour” in the records), exhibition (e.g., O1 was described on the exhibition label as “Ticket, Waikato vrs South Africa, Rugby Park Hamilton July 1981”) and descriptive (e.g., “2015/19/1.1-2 Vending Box for Waikato Times newspapers "Waikato Times

as Waikato as it gets"; "Honesty Box" for O4") titles. The latter was "... an attempt to acknowledge all the potential titles that [an item] could have had. Partly in case if someone was searching ... in our database, they'd get a hint."

The participant also recalled how the depiction on O2 was identified before its accession: "It's likely [that the drawing was made during the period of 1981 Springbok Tour in Hamilton]. ... [W]e have people who are going through the artist's collection of drawings and they're very generously donating some to us ... Partly based on where they found them in amongst her collection, because she was very methodical and she documented her daily life almost. So, these presumably turned up as a batch in a box or whatever and so they've been able to guess that this is when it was made and the fact that it is showing protestors, puts it in that period. ... That's the thing, unless an artist in this case writes on the bottom, this is the date I did it then we just go, well, it's a cool example of protest art but we're not sure 100% when".

### 5.3 Discussion

Although the spreadsheet was carefully designed and thoroughly labelled, we identified a lack of common understanding of the object biography metadata elements that in turn hindered placing the available information into appropriate data fields. The sample metadata acquisition study presented relatively labour-intensive tasks to the participant. By borrowing the key elements of designing a questionnaire—understandability, interpretability and easiness for completion (Adams & Cox, 2008), a likely improvement could be made by offering a mini session to go through data fields in the spreadsheet prior to the commencement of the main task.

As a case study, the collected metadata samples were a starting point and set a practical baseline for creating the object biographies. Given the observed consistency in some local LAMs (i.e., P2 and P5 of the object biography metadata acquisition described in Chapter 3 and the participant of the present study) as to documenting and maintaining reliable information, some metadata field values may seem like another sign implying certain items became orphaned (Friberg & Huvila, 2019) to some extent. However, complemented by the verbal responses they did exhibit a potential in unfolding the in-museum social lives of the artefacts (Friberg & Huvila, 2019; Tythacott, 2012). Further studies could be performed in investigating whether and how using in-museum event values could assist forming narratives for object biography-centric interactions.

In Chapter 6, we will implement a proof-of-concept mobile application prototype using the gathered metadata samples and evaluate the effectiveness of the object biography-centric interactions in a user study.

## 6. Designing and Evaluating Object Biography Application Prototype

An Android application prototype was created after receiving five sets of metadata samples from Waikato Museum Te Whare Taonga o Waikato to demonstrate the potential of the object biography-centric interactions. We selected four sets of the object biography metadata samples. The Family Crest of Captain James McPherson was not chosen due to the long distance between the only local location of the item—Silva Crescent, Riverlea, Hamilton, a predominantly residential area—and the city centre.

A series of evaluations that featured each participant and the researcher walking in the city centre was run to primarily examine the effectiveness of interactions with biography-enhanced items. We note down the preliminary findings of the evaluation and consider the possible research directions based on the feedback provided by the participants as to the perceived quality of the object biography metadata samples. The reflection joins the previous study results and makes new contributions to address all three Research Questions (see Section 1.2).

The chapter is structured into four sections. Section 6.1 offers a step-by-step description of the design of interaction and the corresponding processing of the sample metadata. Section 6.2 presents the design and results of the proof-of-concept prototype evaluation. Section 6.3 discusses the potential of acquiring metadata from more cultural heritage stakeholders and presenting biographical intersections. Finally, Section 6.4 is a summary that links the prototype to previous work.

### 6.1 Design

The following design principles were established when creating early sketches:

- Centring on object biographies
- Keeping object biographies geographically connected
- Indicating biographical intersections.

The focus of the prototype was object biography, which implied we would embed the values of metadata fields such as place and event onto artefact-centric screens rather than offering dedicated user interfaces. The object biographies naturally tied up with specific places, since the prototype would take a walking tour form, so the place-related metadata

element values would be employed throughout. Biographical intersections—a part of the findings of the first study (i.e., object biography metadata acquisition, see Section 3.2.4) would also be featured via the relevance between any two object biographies.

The item images included in the prototype came with permission granted by the museum free of charge (see Appendix D). Except for the self-made icon sets to represent each stop on item trails, the Scalable Vector Graphics (SVG) files of all icons appeared in the prototype were downloaded from the Material Design website<sup>54</sup>. The use of colours was a result of utilising the Material Design colour system<sup>55</sup>.

### 6.1.1 Prototyping Process

We went through both low- and high-fidelity prototyping activities and produced three sets of paper prototypes, two sets of digital wireframes and a software prototype. The prototyping activities were predominantly carried out in parallel with acquiring the object biography metadata samples as described in Chapter 5.

For low-fidelity prototyping, two designs were initially conceptualised and a paper prototype for each (abbreviated hereafter as *PP1* and *PP2*) was made. *PP1* (see Appendix D) was more leaned toward visualising item history without considering the expensiveness of implementing the design, whereas *PP2* (see Appendix D) adopted a more conventional approach. *PP3* (see Appendix D) was a refined version of *PP2*. Balsamiq Mockups for Desktop<sup>56</sup> (version: 3.5.17) was used to create wireframes. The first version (abbreviated hereafter as *DW1*, see Appendix D) was based on the design of *PP2*. The second version (abbreviated hereafter as *DW2*, see Appendix D) was derived from *PP3*.

The first version of high-fidelity prototype was developed in late February and early March 2020. Several iterations of prototyping activities took place in April and May—a work-from-home period in which New Zealand was at the COVID-19 Alert Levels 4 (i.e., the national lockdown), 3 and 2. We also made some changes in June to respond to the pilot evaluation feedback, more details will be provided in the description of the designs for each screen (see Sections 6.1.3, 6.1.4, 6.1.5 and 6.1.6). The high-fidelity prototype was subsequently implemented in Java utilising Android Studio<sup>57</sup> (version: 4.0, prior to conducting the first evaluation session).

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<sup>54</sup> <https://material.io/resources/icons/>

<sup>55</sup> <https://material.io/design/color/the-color-system.html>

<sup>56</sup> <https://balsamiq.com/wireframes/desktop/>

<sup>57</sup> <https://developer.android.com/studio>

### 6.1.2 Prototype Overview

The three screens that were ideated at the beginning of the prototyping activities were titled as *Neighbourhood* (later changed to *Local Items*), *Item* and *Event* (later changed to *Episode*). The *Welcome* screen was added prior to the commencement of the first evaluation session. Figure 6.1 shows the navigation show of the proof-of-concept prototype that was employed in the evaluation sessions.

By going through four slides on the Welcome screen, a user would land on the Local Items screen. Tapping a particular item choice would lead the user to go to the Item screen. The user could proceed to the Episode screen by tapping an episode choice. All episodes in which a heritage item attended could be viewed via tapping on the arrow buttons or tapping any circles and if multiple episodes took place in one location, using the circular chart. Relevant episodes of other items could be explored using the bottom sheet.

Table 6.1 lists the use of metadata field values by each screen to exhibit different aspects of object biography. The metadata such as the GPS coordinates of the locations that was not a part of the sample metadata yet derived from the latter, was categorised and included under the collective name of *Other Derived Metadata*. More interaction design and metadata processing details will be shown on a screen-by-screen basis (see Sections 6.1.3, 6.1.4, 6.1.5 and 6.1.6).

### 6.1.3 Welcome Screen

The Welcome screen was added after the pilot evaluations as one part of the response (see the other part on the Local Items and Episode screens in Sections 6.1.4 and 6.1.6) to the feedback about the unavailability of the help and documentation. We attempted applying a set of four slides<sup>58</sup> on the screen to convey the crucial design choices and concepts such as *episode* and *item trail* to the users in the first instance (see Figure 6.3, Figure 6.3, Figure 6.4 and Figure 6.5). The screen did not utilise any sample biographical or derived metadata. The first slide presented a welcome message and purpose of the prototype in three lines. The remainder communicated a short summary of what a user could do on each of the three main screens—those of *Local Items*, *Item* and *Episode*. The dots indicator at the bottom of each slide—one orange dot representing the position of the current slide, three light purple dots for those of the other slides—was one of the two widgets to reinforce the dual colour-coded

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<sup>58</sup> <https://developer.android.com/training/animation/screen-slide>

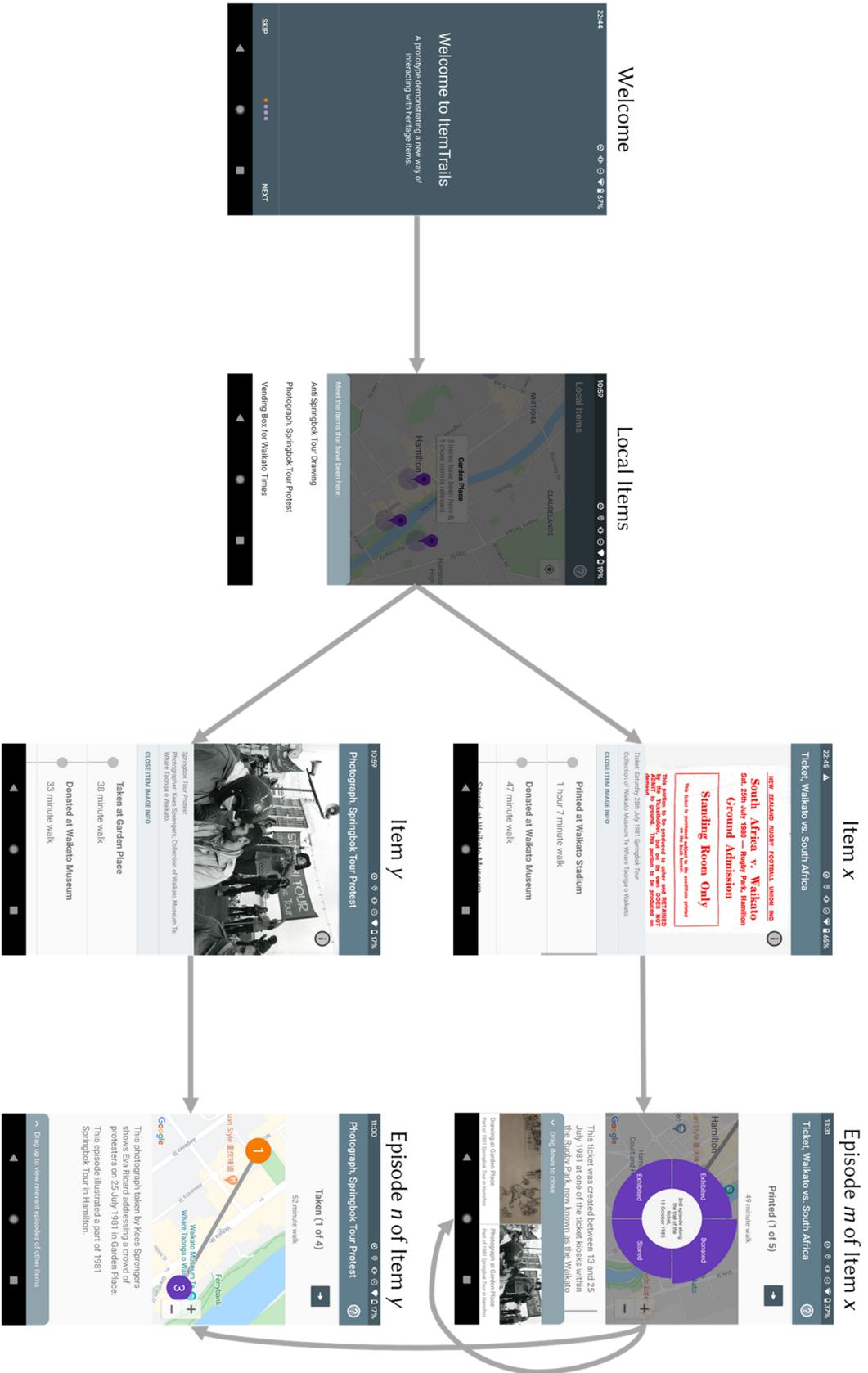


Figure 6.1 Navigation diagram of the prototype

Table 6.1 Metadata field value use by each screen

	Metadata Field	Local Items	Item	Episode
<i>Sample Metadata</i>				
Artefact	Name	•	•	•
	Other artefact used			
	Manifestation of exchange value			
Person	Name		•	•
	Role		•	•
Time			•	•
Place	Name/Toponym	•	•	•
	Location & extent			
	Name/Toponym of relevant place	•		•
Additional note/Miscellaneous				•
<i>Other Derived Metadata</i>				
Artefact	Name in short form			•
	Number of artefacts been to a place	•		
	Number of artefacts relevant to a place	•		
	Supplementary information		•	
Place	GPS coordinates (both direct and relevant places)	•	•	•
	Geofence radius (100 m)	•	•	•
Event (Episode)	Number			•
	Ordinal number		•	•
	Number occurred in a place			•
	Number occurred in other places			•
Wider Event	Name		•	•
				•
User	GPS coordinates of mobile phone	•	•	•

design choice (see the other widget—the place-representing circles<sup>59</sup> and circular charts—on the item trail map in Section 6.1.6).

The Welcome screen was shown during the first launch of the prototype. A user could swipe from right to left or tap the *Next* button to go forward, or swipe to the opposite direction to return to the previous slide. They could tap the *Skip* button on any of the first three slides or the *Got It* button on the fourth slide to proceed to the Local Items screen.

<sup>59</sup> <https://developers.google.com/maps/documentation/android-sdk/shapes#circles>



Figure 6.2 ItemTrails slide (overall 1 of 4), Welcome screen



Figure 6.3 Local Items slide (overall 2 of 4), Welcome screen

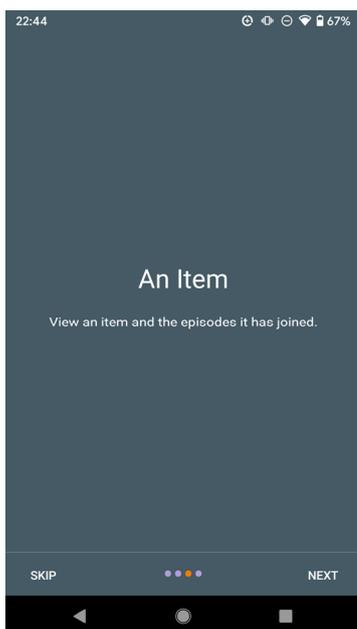


Figure 6.4 Item slide (overall 3 of 4), Welcome screen

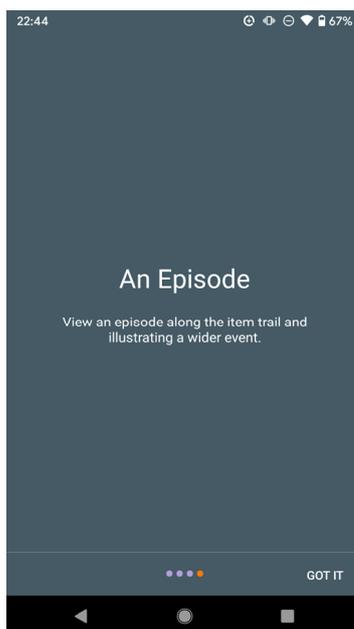


Figure 6.5 Episode slide (overall 4 of 4), Welcome screen

#### 6.1.4 Local Items Screen

The Local Items screen was initially titled as the Neighbourhood screen. In addition to avoiding the ambiguity of the term *neighbourhood*, the term *local items* was adopted to emphasise the connection between the local area and heritage artefacts.

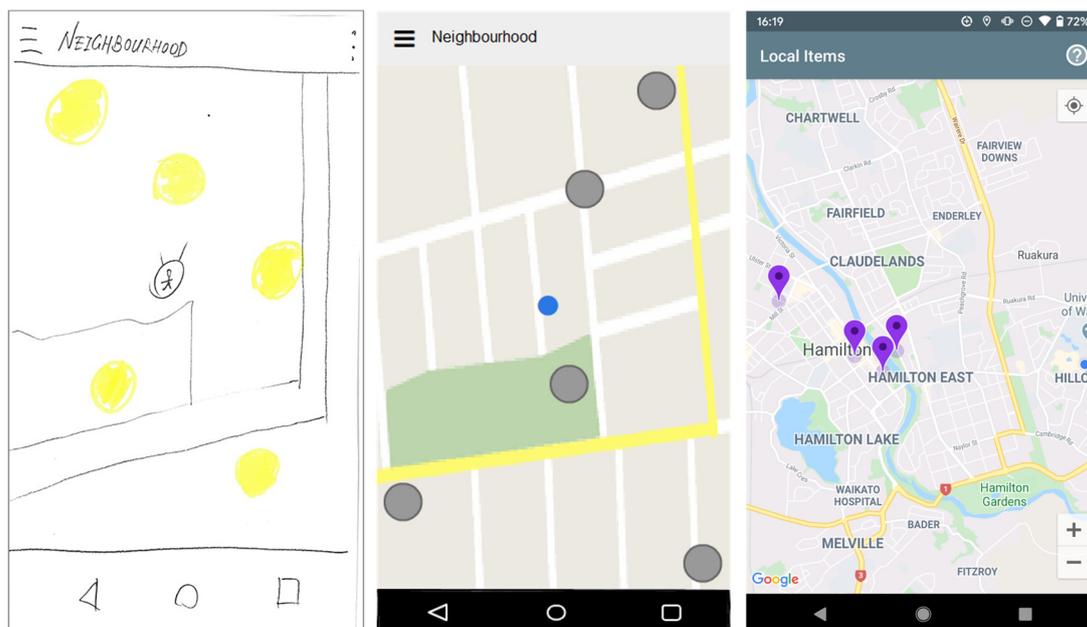


Figure 6.6 Local Items screen during different phases of prototyping

The screen design stayed identical since PP1 was created (see Figure 6.6). The differences were the global hamburger menu button on the left of and the question mark button on the right of the Toolbar<sup>60</sup>. Together with a navigation drawer<sup>61</sup>, namely a menu, the former was given a low priority to implement because of the potentially high cost and the primary purpose of this prototype being demonstrating what could be conveyed with low effort using biographical metadata. The latter was added in conjunction with a CardView<sup>62</sup> after the pilot evaluations for delivering necessary help and documentation (see Figure 6.7). The CardView widget was hidden by default. A user could tap the question mark and *Close Help Info* buttons to open and close the widget.

Table 6.2 shows more details of the other interactions on Local Items screen, each produced a presentation using one or more metadata element values for the first time (cf. Local Items column in Table 6.1). Sample Biographical Metadata and Other Derived Metadata are abbreviated as *Sample* and *Other* in Table 6.2. These interaction details are reported below.

<sup>60</sup> <https://developer.android.com/reference/android/widget/Toolbar>

<sup>61</sup> <https://material.io/components/navigation-drawer>

<sup>62</sup> <https://developer.android.com/jetpack/androidx/releases/cardview>

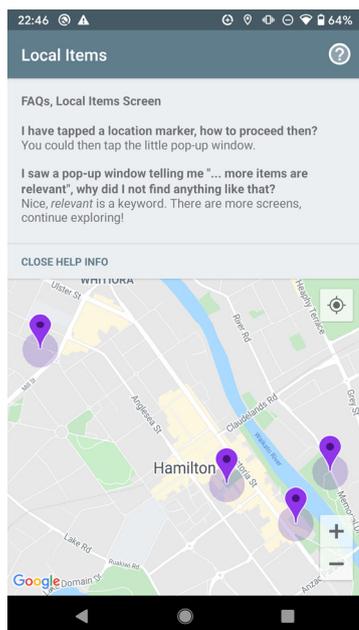


Figure 6.7 CardView widget (help information) opened, Local Items screen

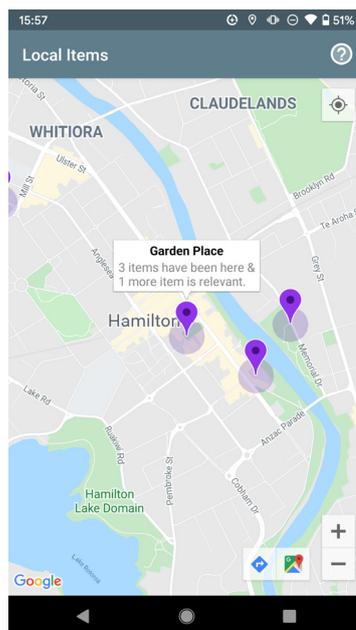


Figure 6.8 Info window of a POI, Local Items screen

Upon tapping any POI marker, an info window<sup>63</sup> would pop up showing the current name of the place, the numbers of the items that had been and were relevant to the place (see Interaction 2 in Table 6.2 and Figure 6.8). *Relevance* between any two episodes played an important role of our biographical metadata model and thus of the prototype. We chose to signal the existence of episode relevance using the relevant place name values then show the reasons on the Episode screen, where the specific item episodes and wider events were

Table 6.2 Interaction details and metadata field values used in new information presentations on Local Items screen

Interaction Number	Input	Output	Metadata Field Value Used	
			Sample	Other
1	Tap Got It or Skip buttons on Welcome screen	Local Items screen		<ul style="list-style-type: none"> <li>Place GPS coordinates</li> <li>Geofence radius (100 m)</li> <li>Mobile phone GPS coordinates</li> </ul>
2	Tap a marker	Info window	<ul style="list-style-type: none"> <li>Place name/toponym</li> <li>Name/toponym of relevant place</li> </ul>	<ul style="list-style-type: none"> <li>Number of artefacts been to the place</li> <li>Number of artefacts relevant to the place</li> </ul>
3	Tap an info window or, Arrive in a geofence	Bottom sheet	<ul style="list-style-type: none"> <li>Artefact name</li> </ul>	

<sup>63</sup> <https://developers.google.com/maps/documentation/android-sdk/infowindows>

described (see Section 6.1.6). An additional help message on why a user might not find out the items relevant to a place was provided (see Figure 6.7) to prompt users to further explore the notion of relevance.

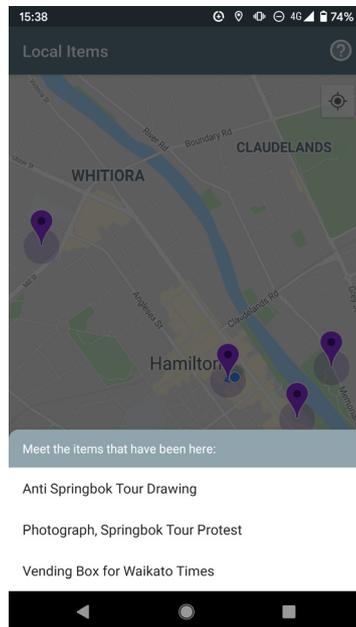


Figure 6.9 Modal bottom sheet listing the choices of the items that had been to a PoI, Local Items screen

Two approaches—tapping the info window following the output of Interaction 2 or physically arriving in the geofence (see Interaction 3 in Table 6.2 and Figure 6.9) could enable a modal bottom sheet<sup>64</sup> incorporating a `TextView`<sup>65</sup> as the top bar and a `ListView`<sup>66</sup> to appear. As indicated on the top bar, only the names of the artefacts that had been to the PoIs were enumerated on the `ListView`. The top bar colour and the top corners were changed to Blue Gray 300 (i.e., #90A4AE in hexadecimal format)<sup>67</sup> and round-shaped after the pilot evaluations for keeping the design of the bottom sheets consistent (see the other bottom sheet in Section 6.1.6). A user could tap any item row to go to the Item screen.

### 6.1.5 Item Screen

The design of the Item screen was inherited from that of PP3 (see Figure 6.10). The Toolbar would display the current name of the item that was selected on the modal bottom sheet of the Local Items screen. Because of the relatively smooth process of interacting with

<sup>64</sup> <https://material.io/components/sheets-bottom#modal-bottom-sheet>

<sup>65</sup> <https://developer.android.com/reference/kotlin/android/widget/TextView>

<sup>66</sup> <https://developer.android.com/reference/android/widget/ListView>

<sup>67</sup> <https://material.io/design/color/the-color-system.html#tools-for-picking-colors>

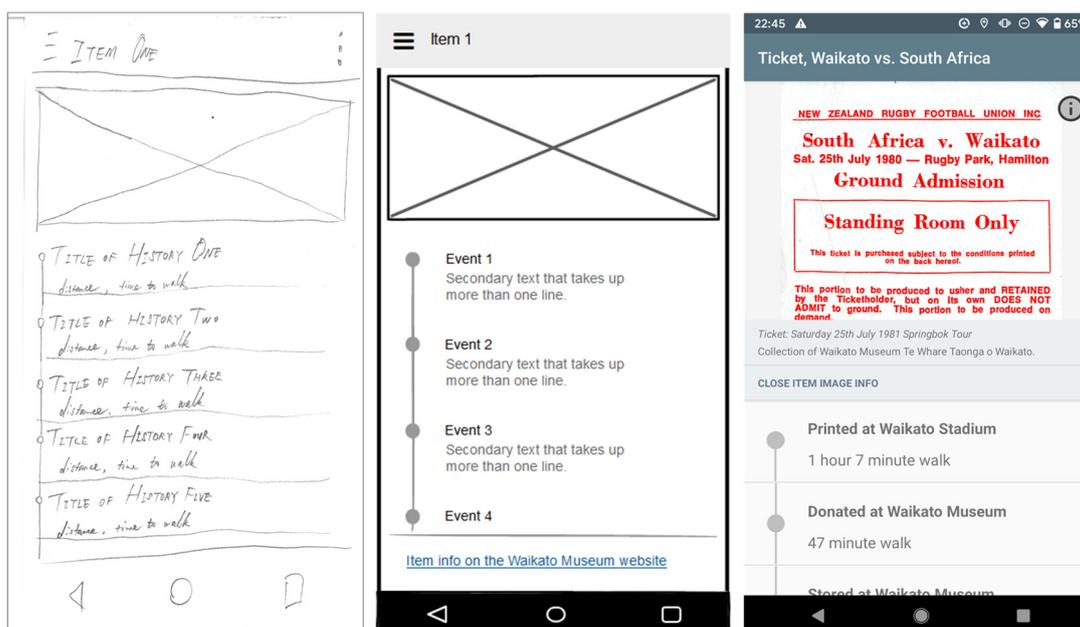


Figure 6.10 Item screen during different phases of prototyping

the widgets during the pilot evaluation phase, help information was not offered for the screen. Despite the removal of the global hamburger menu button as described in Section 6.1.4, the external link at the bottom of the wireframe was discarded due to the fact that none of the four items had its collection page on the website of the Waikato Museum Te Whare Taonga o Waikato by the time of prototyping. We received in total 15 images of all five items listed in Table 5.2 from the museum along with a piece of information supplementing each set of item images on 19 June 2020. One JPEG image of each item was chosen to replace each of the four JPEG images<sup>68</sup> downloaded earlier from Flickr<sup>69</sup> and included in the ImageView<sup>70</sup> of the high-fidelity prototype for the pilot evaluations (see the right of Figure 6.10).

Table 6.3 shows the details of the interaction starting from tapping an item row on the Local Items screen to landing on the Item screen, as well as the metadata element values behind the new information presentations (cf. Item column in Table 6.1).

The supplementary information that consisted of the item name—some with a degree of variation compared to what we previously gathered—and credit line was shown in a LinearLayout<sup>71</sup> below the ImageView. The LinearLayout was reset to being displayed by default according to the pilot evaluation feedback. Additional interactions could be done via

<sup>68</sup> Three of the downloaded images came with *CC BY-NC-SA 2.0* and the other one came with *CC BY-NC 2.0* licenses, see <https://creativecommons.org/licenses/> for more details.

<sup>69</sup> <https://www.flickr.com/>

<sup>70</sup> <https://developer.android.com/reference/android/widget/ImageView>

<sup>71</sup> <https://developer.android.com/reference/android/widget/LinearLayout>

Table 6.3 Interaction details and metadata field values used in new information presentations on Item screen

Interaction Number	Input	Output	Metadata Field Value Used	
			Sample	Other
1	Tap an item row on modal bottom sheet, Local Items screen	Item screen	<ul style="list-style-type: none"> <li>Place name/Toponym</li> </ul>	<ul style="list-style-type: none"> <li>Supplementary information to item</li> <li>Ordinal number of the episode</li> <li>Episode name</li> <li>Place GPS coordinates</li> <li>Geofence radius (100 m)</li> <li>Mobile phone GPS coordinates</li> </ul>

tapping *Close Item Image Info* button to hide the `LinearLayout`. If the *i* button was tapped when the widget was not displayed, the supplementary information and the close button would become visible again. Otherwise, the user would see a toast<sup>72</sup> notifying that *the information is being presented below the item image*.

The `ListView` underneath presented all episodes the item had joined. A set of icons were created to disclose the item trial concept, for example, the first and last episodes employed the starting and ending point icons. In each episode row, the primary text<sup>73</sup> included:

- the name of an episode that the item attended, together with the current name of the place in which the episode occurred in a format of *the past participle of a verb at a place* (e.g., *Printed at Waikato Stadium* in the right of Figure 6.10)
- the computed walk distance value making use of the GPS coordinates of both a PoI and the mobile phone of the user and the geofence radius in a format of *x hour y minute walk* (if the distance was less than or equalled the geofence radius, *Arrived* would be presented).

The user could tap any episode row to proceed to the Episode screen.

### 6.1.6 Episode Screen

The Episode screen was originally titled as the Event screen. The term *episode* replaced *event* after we decided to distinguish the occurrence that a heritage artefact joined and was thus often small-scale relating to time and place from the more conventional meanings of event, for example, the senses 3a, 3c and 12a in the Oxford English Dictionary (event, 2018).

<sup>72</sup> <https://developer.android.com/guide/topics/ui/notifiers/toasts>

<sup>73</sup> <https://material.io/components/lists#usage>

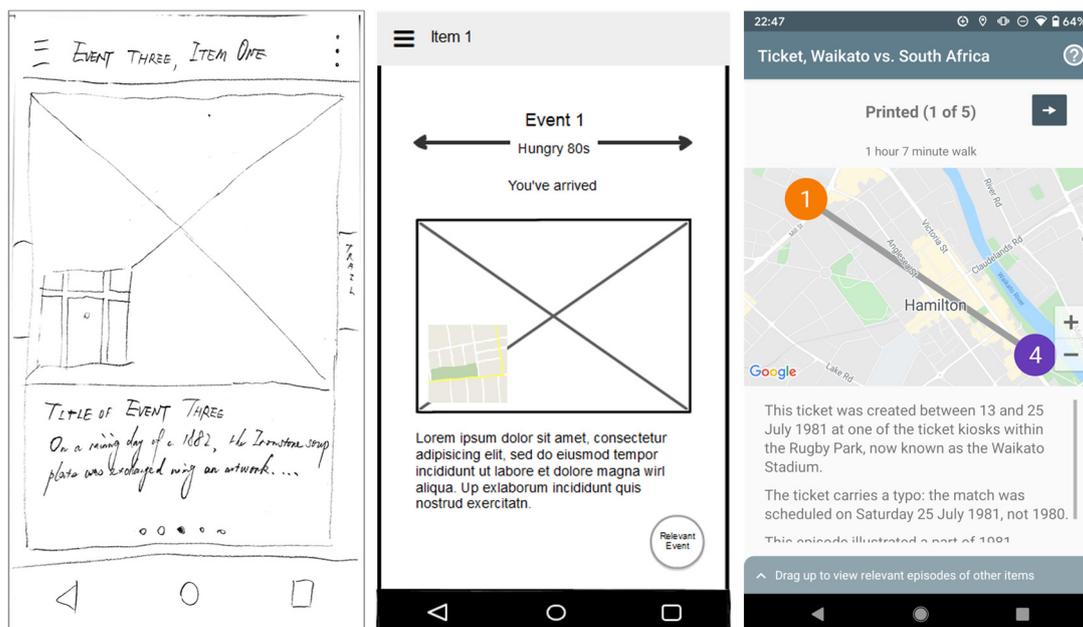


Figure 6.11 Episode screen during different phases of prototyping

Unlike the two previous screens, a considerable number of changes was made to the Episode screen throughout the prototyping process (see Figure 6.11). Table 6.4 specifies the components or widgets contained in the four parts of the screen—*Toolbar*, *Main Navigation*, *Main Body* and *Relevance* in the PP3, wireframe and high-fidelity prototype (abbreviated as *Hi-Fi* in the table). Table 6.5 on the other hand, illustrates the interaction details and metadata

Table 6.4 Components/widgets on Episode screen during different phases of prototyping

	PP3	Wireframe	Hi-Fi
Toolbar	<ul style="list-style-type: none"> <li>• Left: Hamburger menu button</li> <li>• Centre: Event/episode and item names</li> <li>• Right: Vertical ellipsis button</li> </ul>	<ul style="list-style-type: none"> <li>• Left: Hamburger menu button</li> <li>• Centre: Item name</li> </ul>	<ul style="list-style-type: none"> <li>• Left: Item name</li> <li>• Right: Question mark button</li> </ul>
Main Navigation	<ul style="list-style-type: none"> <li>• Swipe-based slide or CardView with dots indicator as main body</li> </ul>	<ul style="list-style-type: none"> <li>• Left &amp; Right: Previous and next button</li> <li>• Centre: Event/episode and period names</li> </ul>	<ul style="list-style-type: none"> <li>• Left &amp; Right: Previous and next button</li> <li>• Centre: Episode name and sequence number</li> </ul>
Main Body	<ul style="list-style-type: none"> <li>• Top: Scene image with mini map</li> <li>• Bottom: Episode description</li> <li>• Back: Visual cue of item trail</li> </ul>	<ul style="list-style-type: none"> <li>• Top: Walking distance message</li> <li>• Centre: Scene image with mini map</li> <li>• Bottom: Episode description</li> </ul>	<ul style="list-style-type: none"> <li>• Top: Walking distance message</li> <li>• Centre: MapView</li> <li>• Bottom: Episode description</li> </ul>
Episode Relevance	N/A	<ul style="list-style-type: none"> <li>• Floating action button</li> </ul>	<ul style="list-style-type: none"> <li>• Persistent bottom sheet with RecyclerView</li> </ul>

Table 6.5 Interaction details and metadata field values used in new information presentations on Episode screen

Interaction Number	Input	Output	Metadata Field Value Used	
			Sample	Other
1	Tap an episode row on ListView, Item screen	Episode screen	<ul style="list-style-type: none"> <li>• Place name/toponym</li> <li>• Name/toponym of relevant place</li> <li>• Artefact name</li> <li>• Person name</li> <li>• Person role</li> <li>• Time</li> <li>• Additional note/Miscellaneous</li> </ul>	<ul style="list-style-type: none"> <li>• Episode name</li> <li>• Ordinal number of the episode</li> <li>• Number of episodes of the item</li> <li>• Place GPS coordinates</li> <li>• Relevant place GPS coordinates</li> <li>• Mobile phone GPS coordinates</li> <li>• Number of episodes occurred in a place</li> <li>• Wider event name</li> </ul>
2	Tap a circle with a number great than 1 on top on item trail map	Circular chart & quick summary of place	<ul style="list-style-type: none"> <li>• Place name/toponym</li> <li>• Name/toponym of relevant place</li> </ul>	<ul style="list-style-type: none"> <li>• Number of episodes of the item occurred in other places</li> <li>• Episode name</li> </ul>
3	Tap a chart division on item trail map	Enlarged chart division & quick summary of episode	<ul style="list-style-type: none"> <li>• Time</li> </ul>	<ul style="list-style-type: none"> <li>• Ordinal number of the episode</li> <li>• Short form of artefact name</li> </ul>
4*	Drag up persistent bottom sheet	Relevant episode ViewHolder	<ul style="list-style-type: none"> <li>• Name/toponym of relevant place</li> </ul>	<ul style="list-style-type: none"> <li>• Short form of artefact name</li> <li>• Wider event name</li> </ul>

\* The values of the metadata fields shown in the row of Interaction 4 were processed in advance (i.e., before any new episode information was outputted). A user would be able to see the presentation of these values after expanding the persistent bottom sheet.

field values employed to present new information on the screen of the high-fidelity prototype (cf. Episode column in Table 6.1).

For the Toolbar, PP3 kept the global hamburger menu button on the left, the name of an event/episode followed by the name of an item at the centre and a vertical ellipsis button on the right. The wireframe dropped the event/episode name and the vertical ellipsis button. The former was included in the main navigation facility, the latter was removed because it was considered as a nonessential for an early-stage prototype. In a similar manner to Section 6.1.4, the hamburger menu button was subsequently withdrawn from and a question mark button for opening the help information on a CardView was added to the high-fidelity prototype (see Figure 6.12).

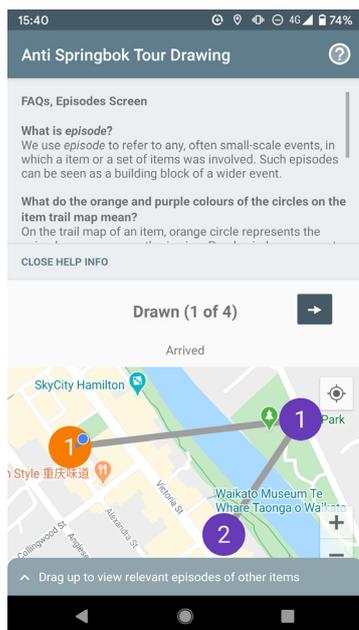


Figure 6.12 CardView widget (help information) opened, Episode screen

The main navigation facility of the screen was set to be slide or card swiping-based in PP3. Retaining the support to swipe gestures, a more prominent arrow button-based one incorporating the event/episode and period names was created during wireframing. The high-fidelity prototype inherited the essence of the latter and came with some adjustments (also see Interaction 1 in Table 6.5):

- The episode name was accompanied by the ordinal number
- The period name was excluded because it was not a part of the minimum form of the biographical metadata
- The swipe gestures were disabled due to the potential conflict with manipulating any elements horizontally in the MapView<sup>74</sup>, which was in the main body of the screen.

A user could tap the left and right arrow buttons to go through each episode of an item. Upon such taps, the information of the new episode would be shown with a one-second long fade-in effect, which was made following the feedback collected from the pilot evaluations to hint change of content.

The design of the main body as shown in PP3 featured a card-based layout on top of a horizontal element representing the notion of item trail. The layout would combine a

<sup>74</sup> <https://developers.google.com/android/reference/com/google/android/gms/maps/MapView>

contextual image that had an overlaid mini map at the bottom left illustrating the place, in which the episode occurred, followed by a textual description and a dots indicator. The wireframe withdrew the card-based layout and its associated elements such as the horizontal element at the back and the dots indicator, though integrated the walking distance message that first appeared on the Item screen into the main body. Two further changes were made while building the high-fidelity prototype:

- An item trail map replaced the contextual image
- If an episode had any relevant counterparts, one line was added to the end of the episode description to indicate that the episode manifested a wider event.

For the first change, we determined that the requirement on the degree of the content connections between an episode and the contextual image—the digitised and publicly accessible heritage photographs in particular—was too high to meet. One example was that the connection between the Printed episode of the ticket and a photograph of crowds outside the Rugby Park<sup>75</sup>—the present-day Waikato Stadium was the closest we could find but was considered not strong enough, predominantly due to the scarcity of the episode and photograph metadata. Therefore, the idea of visualising item trails was explored as an alternative. Realising we could do little with a map of a small size as it was in PP3 and the wireframe, a MapView consequently took over the position of the context image on the screen and accommodated the item trail map.

On the map we had the polyline<sup>76</sup>-represented trail drawn to connect the circle-represented places that an item stayed (see Interaction 1 in Table 6.5 and the right of Figure 6.11). If the location of a user, namely the GPS coordinates of their phone was within the bounds of the map, a blue icon that represented the whereabouts of the user would also appear (see Figure 6.12). The number of the episodes that an item attended in each place was set out on the circle. For instance, 4 meant that the rugby match ticket joined in four episodes at the Waikato Museum Te Whare Taonga o Waikato. The dual colour-coded design was introduced for making a distinction between the place where the shown episode occurred (i.e., in orange) and the others (i.e., in purple) on the item trail. Therefore, the Printed episode that was displayed in the right of Figure 6.11 took place at an orange circle-designated Waikato Stadium, the purple circle-designated museum set the stage for the other four episodes along the trail of the ticket.

<sup>75</sup> <https://heritage.hamiltonlibraries.co.nz/objects/1795/outside-rugby-park>

<sup>76</sup> <https://developers.google.com/maps/documentation/android-sdk/shapes#polylines>

A user could explore a trail via tapping the circles, which served as another approach to navigate through the episodes of an item. Tapping a circle with a 1 on the top would direct the user to view the episode that occurred in the circle-represented place. Similar to the output to tapping an arrow button, the information of the new episode would be presented with the fade-in effect that signalled content change. As a part of the episode information, the colour of the tapped circle would become orange whilst the previously orange one turned purple. If the user tapped a circle with a number that was greater than 1, a circular chart that was created using the MPAndroidChart library<sup>77</sup> would be shown to enumerate the episodes an item attended in the place (see Interaction 2 in Table 6.5 and Figure 6.13). The outer ring-shaped area of the chart was evenly divided by the number of the episodes, which was shown with the name of the place on the inner circle (e.g., *4 episodes at Waikato Museum* in Figure 6.13). Each division of the outer area represented an episode via displaying its name and all episodes were presented following a chronological order and in a clockwise direction (e.g., *Donated*—the first episode attended by the ticket at the museum—at the top left of the chart in Figure 6.13).

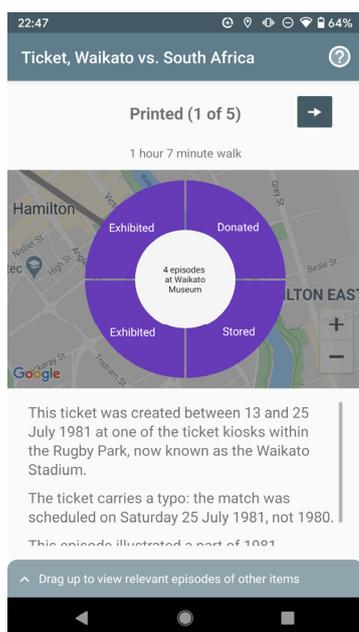


Figure 6.13 Episode chart opened, Episode screen

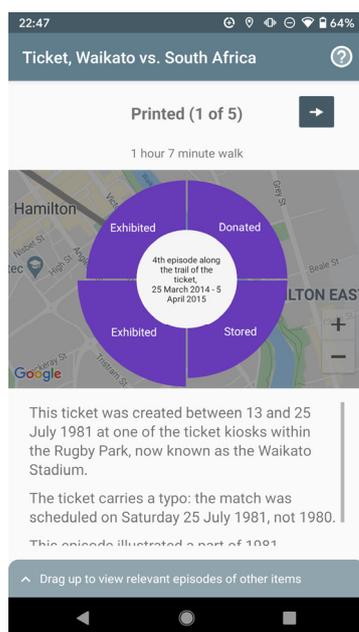


Figure 6.14 A chart division tapped, Episode screen

Upon a tap on any episode-representing division, the division would be enlarged, while the ordinal number of the episode and the time would be given on the inner circle of the chart (e.g., *4th episode along the trail of the ticket, 25 March 2014 – 5 April 2015* as shown in Figure

<sup>77</sup> <https://github.com/PhilJay/MPAndroidChart>

6.14, also see Interaction 3 in Table 6.5). If the user tapped the enlarged division one more time, the corresponding episode information would fade in and gradually become clear (e.g., the user would see the corresponding episode information after tapping the *Exhibited* division on the chart as shown in Figure 6.14). When landed on a screen of a particular episode that shared its stage with another or more episodes attended by the same item, the user would see the corresponding circle and division of the chart were highlighted in orange (see Figure 6.15 and Figure 6.16).

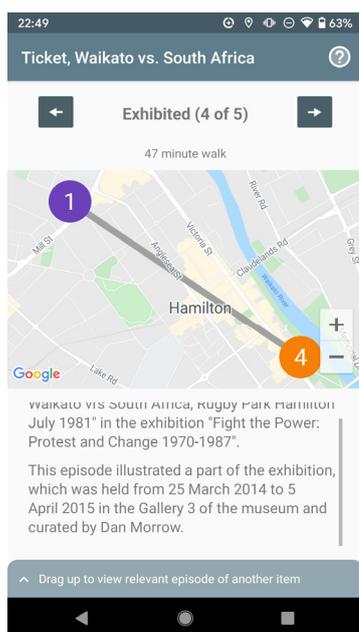


Figure 6.15 Orange circle set stage for multiple episodes, Episode screen

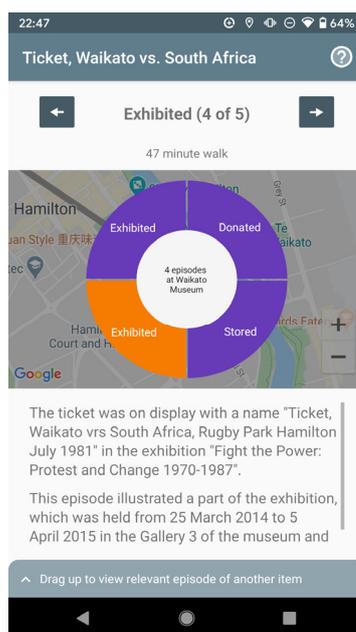


Figure 6.16 An episode was shown with its chart division in orange, Episode screen

The description of an episode was a synthesis of the biographical metadata values (see Interaction 1 in Table 6.5). An additional line of text signifying the relationship between an episode and a wider event was presented at the end of the description, for the episodes that were mutually relevant. For example, the line was *This episode illustrated a part of 1981 Springbok Tour in Hamilton*<sup>78</sup> for the Printed episode of the ticket, Drawn episode of the drawing and Taken episode of the photograph.

Putting the relevance between the episodes on view was not considered during the creation of PP3. A floating action button (FAB)<sup>79</sup> was then drawn at the bottom right of the

<sup>78</sup> See <https://nzhistory.govt.nz/culture/1981-springbok-tour>, <https://nzhistory.govt.nz/media/video/game-cancelled-in-hamilton>, and [https://en.wikipedia.org/wiki/1981\\_South\\_Africa\\_rugby\\_union\\_tour\\_of\\_New\\_Zealand\\_and\\_the\\_United\\_States#Hamilton:\\_Game\\_cancelled](https://en.wikipedia.org/wiki/1981_South_Africa_rugby_union_tour_of_New_Zealand_and_the_United_States#Hamilton:_Game_cancelled) for more details about the 1981 Springbok Tour in Hamilton.

<sup>79</sup> <https://material.io/components/buttons-floating-action-button>

wireframe and intended to be the entry point for a user to switch between the episodes that were mutually relevant, though attended by different items. However, the Material Design guidance suggested that FAB should represent “the primary action of a screen” and “no more than six options” can be included in a speed dial (Material Design, n.d.). Another potential flip side of employing FAB and speed dial was that the space for labelling each relevant episode would be insufficient. As a result, a RecyclerView<sup>80</sup>-embedded persistent bottom sheet<sup>81</sup> was implemented instead for unveiling the episode relevance in the high-fidelity prototype (see Figure 6.17). Given the relatively short height of the bottom sheet, the RecyclerView would need to be scrolled horizontally.

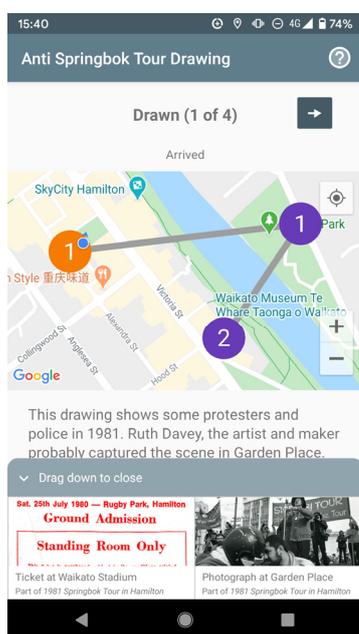


Figure 6.17 Persistent bottom sheet expanded, Episode screen

The top bar of the persistent bottom sheet was in Blue Gray 300, which was lighter than the colour of the arrow buttons (i.e., Blue Gray 700, #455A64 in hexadecimal format). The Blue Gray variations implied the difference between the two functionalities—switching between two mutually relevant episodes of two separate items and viewing the episodes of one item. After the pilot evaluations, the top corners were changed into round-shaped form to improve the discoverability of the gateway to accessing relevant episodes (see the other bottom sheet in Section 6.1.4).

<sup>80</sup> <https://developer.android.com/reference/androidx/recyclerview/widget/RecyclerView>

<sup>81</sup> <https://material.io/components/sheets-bottom#standard-bottom-sheet>

The persistent bottom sheet was by default minimised when a user landed on the Episode screen. The *expand* icon and the textual prompt—*Drag up to view relevant episode of another item/episodes of other items* on the top bar (as shown in the right of Figure 6.11, and Figure 6.12, Figure 6.13, Figure 6.14, Figure 6.15 and Figure 6.16) offered the user an indication on the existence of the functionality and how to commence viewing. The *hide* icon and the other prompt—*Drag down to close* (as shown in Figure 6.17), on the other hand was the other pointer to inform the user about manipulating the bottom sheet.

Each card-resembling ViewHolder<sup>82</sup> widget housed the information of a relevant episode. Following a top-down sequence, the item image, the shorter name of the item and the name of place, as well as the name of the wider event were demonstrated (see Interaction 4 in Table 6.5). Shown in Figure 6.17, the ticket image, *Ticket at Waikato Stadium* and *Part of 1981 Springbok Tour in Hamilton* were presented in the first ViewHolder. *1981 Springbok Tour in Hamilton* was italicised for stressing the notion of wider event. If the user tapped a ViewHolder, the information of the relevant episode under another item would gradually appear. The bottom sheet would be hidden whilst the item image and other selected metadata element values of the previous episode would be in turn taken by and lay out on a ViewHolder.

## 6.2 Evaluation

The primary purpose of the mobile prototype evaluation was to assess the effectiveness of the object-centric, or to be more specific, the object biography-centric interactions under a walking tour mode. The evaluation was disrupted by the COVID-19 pandemic that emerged on 28 February 2020 in New Zealand. The recruitment of pilot participants was postponed until 15 May due to the national lockdown imposed by the New Zealand Government and the wider impact of the pandemic on social interactions.

Three pilot sessions were performed in June to examine the validity of the study protocol and whether any minor changes of the prototype were required. As a result, the feedback received from the pilot sessions—each with a participant from the Department of Computer Science, the University of Waikato—helped in making before running the main sessions of the evaluation (see Section 6.1 for more details). By 25 July, eleven participants were recruited and evaluated the prototype.

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<sup>82</sup> <https://developer.android.com/reference/androidx/recyclerview/widget/RecyclerView.ViewHolder>

### 6.2.1 Participants

Two requirements were set to enable recruiting from the potential end-users of similar applications with prior experiences in:

- Visiting cultural heritage sites or institutions, and
- Using Android mobile phones.

Two tourism-related establishments were approached to confirm if participant recruitment advertisement could be posted at the receptions on 5 March 2020. Realising working with travellers would not promptly become feasible, we communicated with eleven potential participants via personal contact, sent emails to a student list and a cultural heritage-related organisation in Hamilton since 23 June.

### 6.2.2 Data Collection Method

We adapted the data collection method previously practised for acquiring metadata and prototyping in-situ (see Section 4.1.2) to cater for the evaluation. Specifically, we blended a semi-structured interview with observation of the interactions with the prototype and non-verbal expressions, and body-storming techniques.

As per the metadata we obtained from the Waikato Museum Te Whare Taonga o Waikato, the participants were invited to choose one pair of locations from the following two:

- Waikato Stadium (i.e., at Gate 1 on Tristram Street) and Garden Place (i.e., in front of the Central Library)
- Garden Place and Waikato Museum (i.e., in front of the museum).

The participants also got to decide which location to start—abbreviated hereafter as *first location* (see Figure 4.1)—and continue with—abbreviated hereafter as *second location* (see Figure 4.1). The choices were made in advance of their separate evaluation sessions.

The main sessions were performed on non-rainy days. One session usually cost up to one hour and comprised of three parts—*being at the first location*, *walk* and *being at the second location* (see the evaluation protocol in Appendix D). The researcher met each participant at the first location, gave a brief introduction of the evaluation, requested necessary consents and the demographic information from the participant (see Appendix D). Then the researcher presented a recording device to the participant and started audio and video recording (also see Section 6.2.3).

At the first location, the ice-breaking question was about the experiences of the participant in using any sorts of tour guide—technology or human—when visiting a cultural heritage site or institution. The participant was then given several minutes and encouraged to thoroughly explore the prototype, tell the researcher once they finished and shared their first impression. The subsequent task requested the participant to look for another episode that was relevant to the episode of an item that occurred at the first location (see Figure 6.1). A sticky note with the task written down on it was also presented as a reminder (also see Section 6.2.3). The next question centred around gathering thoughts about the design of the item trail map on the Episode Screen.

For those who were still confused with the content of the prototype, more explanations were given after gaining their responses to Q4. A copy of 206-word long introduction of 1981 Springbok Tour in Hamilton with selected directly quotations from two NZHistory entries<sup>83</sup> was also presented to the participants where appropriate.

Before moving the second location, a question exploring whether anything on the way was captured as interesting and relevant to the travel of a particular item was asked. The participant received the corresponding sticky note and could make a response immediately, during the walk or on their arrival at the second location.

Upon the arrival at the second place, the other task asked the participant to look for one or two specific episodes that were in some way related to the given episode in the first task (see Figure 6.1). The researcher then sought two episodes, an interesting one and an uninteresting one from the participant. The last question invited the sharing of the overall experience and anything that was left out but noticed or wanted to have in the prototype.

Two sessions were partially performed in Chinese for ensuring the effectiveness of communication with participants where English was their second language.

### 6.2.3 *Material and Apparatus*

The participants used the proof-of-concept prototype on a 4G network-enabled Google Pixel mobile phone that featured a 5-inch display with 1080\*1920-pixel resolution and an Android 10 operating system. Although the likelihood of battery draining was low, the researcher brought a mobile power bank with a 7,100-milliampere hour and 5-volt nameplate capacity as a reserve.

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<sup>83</sup> <https://nzhistory.govt.nz/culture/1981-springbok-tour>, <https://nzhistory.govt.nz/media/video/game-cancelled-in-hamilton>

The researcher took a clipboard holding the printed copies of the Participant Information Sheet and Consent Form, Demographic Form and evaluation protocol for all sessions. Starting from the second session, a copy of the introduction of 1981 Springbok Tour in Hamilton was also included. The sticky notes—each bearing a written task (i.e., the Q3, Q en route and Q5, see Appendix D)—were prepared after confirming the starting and ending places of a session.

The audio and video recording equipment successfully used in the previous metadata acquisition and prototyping study (see Section 4.1.3) was reused. The researcher wore a head-mounted action camera with a hat, as well as an audio recorder with a lapel microphone and a belt-pack transmitter (see the left on Figure 4.12). The participant had a lapel microphone-plugged receiver with them (see the right on Figure 4.12). Three fully charged batteries for the audio recorder were prepared. However, running two sessions in one day with less than a two-hour interval caused incomplete recordings, as the original battery that could last for more than 55 minutes needed two hours to charge.

#### 6.2.4 Preliminary Results

Among three female and eight male participants, three were academic or research staff members (P1, P3 and P9), seven were postgraduate students (P2, P4, P6, P7, P8, P10 and P11) and one was a librarian (P5). Table 6.6 offers three additional pieces of demographic information of the participants—whether they were local, age range and duration of living in Hamilton—and the routes each participant and the researcher took in the evaluation session.

Five participants (P3, P4, P5, P8 and P9) saw themselves as local, whereas the other six (P1, P2, P6, P7, P10 and P11) were non-locals. The age range was: two were in their twenties (P4 and P8), another two were in their thirties (P7 and P10), four participants were between forty and forty-nine years old (P2, P6, P9 and P11) and three more were in their fifties (P1, P3 and P5). Further, four participants (P2, P7, P10 and P11) spent two years or less in Hamilton, six participants lived averagely 22.3 years in the city (P1, P3, P4, P5, P8 and P9) with the

Table 6.6 Additional demographic information of and route taken by each participant

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11
Local	No	No	Yes	Yes	Yes	No	No	Yes	Yes	No	No
Age											
Range											
22 – 29				•				•			
30 – 39							•			•	
40 – 49		•				•			•		•
50 – 59	•		•		•						
Years in Hamilton	17	2	27	22	25	10	0.5	23	20	1	1.4
Route											
GP – WM	•				•	•					•
WM – GP				•				•		•	
GP – WS							•				
WS – GP		•	•						•		

shortest and longest being 17 and 27 years. 10 years of local residence placed the case of P6 somewhere in the middle of the spectrum.

Four participants (P1, P5, P6 and P11) took the Garden Place – Waikato Museum route (abbreviated as *GP – WM* in Table 6.6) and another three (P4, P8 and P10) chose the same route but in opposite sequence of visit (abbreviated as *WM – GP* in Table 6.6). Three participants (P2, P3 and P9) selected the Waikato Stadium – Garden Place route (abbreviated as *WS – GP* in Table 6.6). They drove a car and travelled to a location that was within 10-minutes walking distance to the stadium with the researcher to secure the inclusion of the intervening walk. P7 decided to walk with the researcher from Garden Place to the Waikato Stadium (abbreviated as *GP – WS* in Table 6.6).

The demographic information was collected and combined with the route choices for the purposes of:

- Ensuring all available walking routes and a variety of potential users of cultural heritage-related applications were covered
- Identifying any underrepresented potential user groups and recruiting corresponding participants until the collected data reached saturation.

The preliminary results showed that we received a positive feedback as to the acceptance of interacting with biography-enhanced objects whilst encountered some issues. Three interrelated themes stood out from the data we collected from the eleven main sessions:

- Perceiving biography-enhanced artefact-centric interaction
- Assessing metadata quality
- Communicating users' mental models.

*Perceiving biography-enhanced artefact-centric interaction.* The interaction presented a learning curve in various degrees to the participants—from being somewhat lost to quickly adapted themselves to this alternative approach. The reflection of P7 at the end of their session was representative: “... this app is more like snowboarding. It’s a little bit of steep learning curve in the beginning, but once you get accustomed to it, it starts to make sense why the design is done that way. I’d probably still argue some could’ve been done differently, but it starts to make sense.” One step further, some participants considered alternative ways of presenting object biography. For instance, P4 suggested *stage* as “a better word for episode, for this stage in its life [and] drag up to view relevant stage of another item. ... [I]f I travelled to Taupō, I wouldn’t say that was the episode of my life, through which I was in Taupō, I

would say that was a stage in my life. ... [If] I was in Taupo for a few days, I probably wouldn't call it a stage of my life, but I wouldn't use the word episode."

*Assessing metadata quality.* The participants identified room for improving the quality of the sample metadata through offering their feedback on multiple occasions. Firstly, P6 nominated an uninteresting item: "I'm not sure [if the vending box for Waikato Times (i.e., O4 in Table 5.2) is interesting to view]. This box is like something in ... museums that we can see everywhere ... I can't see anything why, just installed in 1890 and store in [the] museum now. So, is it the first? ... I [don't know] the historical value for [this item]." Secondly, P5 recognised the incompleteness of the sample metadata and its potential impact on the target users: "I think it depends on the purpose of your app, ... For museum staff, [it] would be useful to know [the Anti Springbok Tour drawing] actually has been moved to the house of David Fowler. For the members of the public, I'm not sure if they need to know that. ... [T]his information here is more about the provenance of the item and how it got to the museum." Thirdly, P3 offered a clue for a missing metadata field value (see Figure 6.18): "See ... that far corner over there, that's where they had the ticket stands, so that's probably where [the 1981 Springbok Tour ticket] was printed. It's been like rebuilt a couple of times, but that's where it used to be."

*Communicating users' mental models.* The participants' mental models were communicated as to some design choices at a higher level and user interface widget behaviours. The earlier quoted thoughts of P7 on their experience showed an update to their

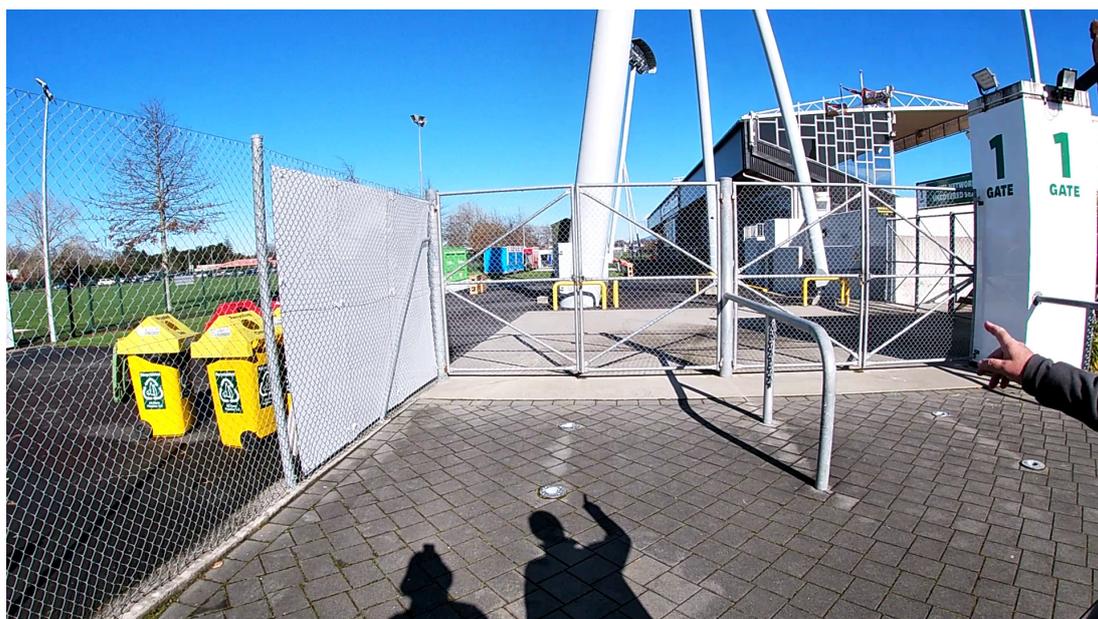


Figure 6.18 Pointing out the location of the previous ticket stands on the way to Garden Place from the Waikato Stadium

mental model based on a period of using the prototype. The mental model update was also supported among others, by the case of P8: "... [O]nce I got my head around, the interaction was like click this to get this, [was] pretty easy to navigate ...". For some crucial design choices, for example switching between relevant episodes using the persistent bottom sheet on the Episode screen, P9 indicated a mental model mismatch: "... [W]hen you click on [an episode ViewHolder] and now you got this event of the item, but you can't see the item, so that's annoying." The images enabled the users to *see the items*, the attempts of enlarging the current fixed item images by the participants such as P10 and P11 were observed. "It would be better if [the ImageView] could be dragged and an enlarged image could [be displayed by taken] the entire space of the screen. ... Wanting to see enlarged images is a personal tendency of mine", said P10.

### 6.3 Discussion

COVID-19 caused the postponement of the prototype evaluations to the Hamilton winter with more rain, wind and colder temperatures. The participants and researcher had to reschedule several evaluation sessions.

The social consequences of the COVID-19 pandemic also impacted participant recruitment resulting in a smaller-scale evaluation and may have altered the participant demographics. No overseas tourists were available and the composition of participants included more males who attended higher education. For this reason, the collected data showed a variation that departed from the impression that study participants cannot suggest what they want, instead they can soon realise what they do not when using a prototype (Rogers, Sharp, & Preece, 2011, p. 390). Some feedback including suggestions and arguments as shown in the preliminary results (see Section 6.2.4) reflected that the participants had specialised in certain fields of computer science, cultural heritage information or in rare cases, both. Despite the fact that they were identified as the potential users of cultural heritage-related applications, more evaluation sessions are needed to gather more diverse views, whilst the collected data could also be thoroughly coded. At the time of writing, the codes were mainly created deductively.

#### 6.3.1 *Acquiring Metadata from More Stakeholders*

Object biography is competent in conveying different moments in the lifespan of an artefact in a non-linear fashion (Gosden & Marshall, 1999; Joy, 2009). Accessioned by heritage institutions does not mean the death of items. On the contrary, they started their social life

in museums (Alberti, 2005; Tythacott, 2012; Friberg & Huvila, 2019). In practice, the prototype was the first attempt that utilised a minimum number of object biography metadata elements to enable artefact-centric interactions in the wider environment. From the preliminary results, we could see that the limited quantity of metadata elements combined with missing values sometimes impaired the perceived quality of the object biographies such as that of the vending box (see Section 6.2.4).

The values of the in-museum episodes we collected from the previous studies exemplified that heritage items continued joining in and exiting from “spheres of relationships” (Joy, 2009) since they were being considered for donations or accessions:

- A visitor speaking to P4 of the first study (i.e., object biography metadata acquisition, see Section 3.2.4) on the conservation of the illuminated manuscripts
- P7 of the second study (i.e., metadata acquisition and prototyping, see Section 4.2.2) acquiring the stuffed lion before the close of the local Lioness Club and discussing its value with others
- The participant of the third study (i.e., sample metadata acquisition, see Section 5.2.2) inferring how the content of the Anti-Springbok Tour Drawing was identified.

The samples extracted from the museum collections database served as a starting point of acquiring object biography metadata and did not include the type of instances listed above. The perceived quality of the detail-lacking metadata and the very non-linear nature of object biography (Joy, 2009) together called for alternative acquisition approaches for working with other stakeholders to complement the one we employed, and hence to contribute to describing the interactions of the “social objects” (Simon, 2010). These stakeholders may include among others, the creators (Coughlan, et al., 2015), previous owners, donors and caretakers of the items, memory institution patrons and visitors (Coughlan, et al., 2015), as well as subject matter enthusiasts and experts (Dijkshoorn, 2019). Extra ethical considerations, resources and cares in elucidating the use of shared information may be needed in order to address the potential dilemma between sharing and guarding the object biography-related personal and family history (Tasker & Liew, 2020).

### 6.3.2 *Presenting Biographical Intersections*

A finding of the first study was the intersections of the interlinked biographies were often found as interesting (see Section 3.2.4). Although the main purpose was to verify whether object biography-centric interactions could work, one possible reason for the varied

perceived qualities of item metadata was a lack of the intersected biographies that matched the mental models of the participants. The reason could also explain why certain items, in particular the photograph of the Springbok Tour Protest was chosen instead when the participants were asked to choose an episode that was deemed interesting: compared to the detail-lacking metadata, the item images encapsulated more contextual information.

The preliminary results demonstrated the perceived interestingness of biographical intersections, or in the participants' term—*context*. For instance, the context in the eyes of P4 and P5 can be the biographical intersections between objects and:

- Events—the rugby game that was scheduled on 25 July 1981 and the Springbok tour in general
- Persons—Eva Rickard<sup>84</sup> and Ruth Davey
- Landscapes (see Figure 6.19)—the added traffic lights on Victoria Street, Hamilton and the original decorations remained on the buildings elsewhere.

The version of the prototype employed in the evaluation sessions offered episode relevance and indicated the existence of two wider events—the 1981 Springbok Tour in Hamilton and the “Fight the Power” exhibition held by the Waikato Museum Te Whare Taonga o Waikato. Other metadata values such as those at the intersection between object



Figure 6.19 Talking about the potential uses of the on-trail contextual information on the way to Garden Place from the Waikato Museum

<sup>84</sup> <https://teara.govt.nz/en/biographies/6r4/rickard-tuaiwa-hautai-kereopa>

and landscape biographies exhibited their potential when they were used in walking tours (Cushing & Cowan, 2017)—the particular form taken by the present prototype.

Making the prototype conform to the mental models of potential users (Nielsen, 2010) as to making biographical intersections available would be guiding the future iterations. The potential inclusion of the heritage photographs collected by the local LAMs to illustrate such intersected biographies could be examined. On the other hand, enabling the potential users to effectively adapt their mental models (Nielsen, 2010) would lead the way for designing biographical intersection presentations that centres around and supports the visitor-artefact interaction.

## 6.4 Summary

In this chapter, we described the design and evaluation processes of a proof-of-concept Android application prototype that provided an alternative way of interacting with biography-enhanced artefacts beyond the memory institution walls. Compared to other object biography-related studies that usually conveyed conceptual and theoretical findings (Humphries & Smith, 2014; Colburn, 2016; Clarke & Frederick, 2012; Friberg & Huvila, 2019), our approach was more practical as to applying the notion to improve visitor-artefact interactions.

The prototype, as distinct from multimedia guides or other mobile applications such as *The Metropolitan Museum of Art*<sup>85</sup> app that were made for indoor use only and backed by more traditional visit or artefact-centric perspectives, offered an object biography focus. A clear focus such as the implemented object biography one in our case also set the prototype apart from the related digital heritage applications for outdoor use. Some enhanced by AR, these applications (Jeater, 2012; Cushing & Cowan, 2017; Fenu & Pittarello, 2018; McGookin, et al., 2019; Jones, Theodosis, & Lykourentzou, 2019) enabled visitors to travel between a time point in the past and the present time with yet a seemingly shifting and thus blurry focus—be it a person, an event, a scene or a digital surrogate of an item. In addition, unlike the research output of some other digital heritage applications that also took the form of a walking tour (Jeater, 2012; Locatelli, Giannachi, & Sinker, 2014; Park & Peng, 2016; McGookin, et al., 2019), we described the interaction design and the corresponding processing of the sample metadata one step at a time.

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<sup>85</sup> The app was no longer accessible on 30 July 2020 via the following link: <https://play.google.com/store/apps/details?id=org.metmuseum.android.met>

From the preliminary results of the main evaluation sessions, we believe this object biography-centric prototype offered its potential users with a novel interactive experience. Although a learning curve was presented, the participants were able to grasp and manipulate the object biographies through the user interface.

## 7. Discussion

The evaluation of ItemTrails marked the completion of the primary research activities in this PhD project. The studies were successful in conveying a novel interactive experience to potential end-users of digital heritage applications. By using object biography as the conceptual framework, the utility and potential of the interaction and biographical metadata of objects featured in ItemTrails need to be examined. Such examination can help reflecting what we learned from designing and performing the primary research activities and addressing the research questions. In addition, to what extent the use of the adapted research methods delivered adequate results is worth considering. Mitigating the influences of the constraints, notably by the logistical concerns and communications with the key informant when performing object biography metadata sample acquisition is of our interest. Discussing the contributions is needed to communicate the value of the research.

This chapter is divided into five sections. In Section 7.1, we position our study results into the contexts of interaction with artefacts and the metadata of artefacts. We also extend our consideration of object biography as a conceptual framework (see Section 2.3.3). Section 7.2 addresses the three Research Questions that were presented in Section 1.2 and guided the four studies. Section 7.3 accounts the effectiveness of the adapted research methods used in each study. Section 7.4 reflects on the limitations identified in both the primary and secondary research activities. Section 7.5 summarises the contributions of the work.

### 7.1 Research in Context

We first place ItemTrails in context with a selection of 13 digital heritage applications and prototypes to discuss what we gained from designing artefact-centric interaction supported by object biographies. Table 7.1, Table 7.2 and Table 7.3 show ItemTrails and the 13 selected applications with a focus on their *interaction* and underlying descriptive *metadata*.

The *interaction* stands for interaction with descriptive metadata of artefacts, primarily via visual (including textual) stimuli using Android- or iOS<sup>86</sup>-running handheld devices, in particular mobile phones. The exceptions are *Gaze-Guided Narratives* that runs on an eye tracker and a Bluetooth headphone to offer auditory information (Kwok, Kiefer, Schinazi, Adams, & Raubal, 2019), the smart glasses version of *MAR guide* and *SensiMAR* (Marto, Melo, Gonçalves, & Bessa, 2021). We observe some of the selected applications focus on places,

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<sup>86</sup> <https://developer.apple.com/ios/>

persons or even events instead of artefacts and such information foci may seem self-explanatory. By deeming the basis of the foci—physical man-made things as heritage objects (see Section 2.3.3), we can conclude that the 13 selected applications allow users to interact with artefacts outside physical LAMs. The applications were selected to display a wide coverage of the studies and examples that employed descriptive metadata of artefacts:

- Five concentrating on artefacts such as paintings, rock inscriptions, buildings and building complexes: *Streetmuseum Londinium* (Jeater, 2012), *Rock art* (Galani, Mazel, Maxwell, & Sharpe, 2013), *ArtMaps* (Coughlan, et al., 2015), *Gaze-Guided Narratives* (Kwok, Kiefer, Schinazi, Adams, & Raubal, 2019) and *Hwaseong Fortress app* (Koo, Kim, Kim, Kim, & Cha, 2019)
- One seeing artefacts as representations of persons: *Svevo Tour* (Fenu & Pittarello, 2018)
- Seven integrating artefacts into places: *Walk1916* (Cushing & Cowan, 2017), *CrossCult Pilot 4* (Jones, Theodosios, & Lykourentzou, 2019), *Explore* (McGookin, et al., 2019), *MAR guide* (Litvak & Kuflik, 2020), *SGTrails* (Yew, Deshpande, Precians, Cheng, & Do, 2020), *MillSecret* (Tzima, Styliaras, & Bassounas, 2021) and *SensiMAR* (Marto, Melo, Gonçalves, & Bessa, 2021).

Table 7.1 Comparison of the reported interaction patterns and underlying metadata of ItemTrails and 13 selected digital heritage applications (Part 1)

<b>Interaction</b>	<i>ItemTrails</i>	<i>Sreethmuseum Londinium</i> (Jeater, 2012)	<i>Rock art</i> (Galani, Mazel, Maxwell, & Sharpe, 2013)	<i>ArtMaps</i> (Coughlan, et al., 2015)	<i>Gaze-Guided Narratives</i> (Kwok, Kiefer, Schinazi, Adams, & Raubal, 2019)	<i>Hwaseong Fortress app</i> (Koo, Kim, Kim, Kim, & Cha, 2019)
Conceptualising artefacts as	Artefacts	Artefacts	Artefacts	Artefacts	Artefacts	Artefacts
Biography-enhanced artefact-centric	Yes	Partial	Partial	Partial	Partial	Partial
In direct places	Yes	Yes	Yes	Yes	Yes	Yes
In relevant places	Yes	No	No	No	No	No
In unrelated places	Yes	Yes	No	Yes	No	Unknown
Hybrid paradigms	Yes	Unknown	Explicit only	Suggested	Yes	Explicit only
Integrated with related activities	No	No	No	No	No	No
User-generated biographical metadata	No	No	No	Partial	No	No
<b>Metadata</b> Object biography-centric	Yes	Unknown	Unknown	Unknown	Unknown	Unknown
Event-centric	No	Unknown	Unknown	Unknown	Unknown	Unknown
Object-centric	No	Unknown	Unknown	Suggested	Unknown	Unknown
Custom	No	Unknown	Suggested	Suggested	Unknown	Unknown

Table 7.2 Comparison of the reported interaction patterns and underlying metadata of ItemTrails and 13 selected digital heritage applications (Part 2)

	<i>ItemTrails</i>	<i>Svevo Tour</i> (Fenu & Pittarello, 2018)	<i>Walk1916</i> (Cushing & Cowan, 2017)	<i>CrossCult Pilot 4</i> (Jones, Theodosis, & Lykourntzou, 2019)	<i>Explore</i> (McCookin, et al., 2019)	<i>MAR guide</i> (Litvak & Kuflik, 2020)	
<b>Interaction</b>	Conceptualising artefacts as	Artefacts	Representations of persons	Representations of places	Representations of places	Representations of places	Representations of places
	Biography-enhanced artefact-centric	Yes	No	No	No	Partial	No
	In direct places	Yes	Yes	Yes	Yes	Yes	Yes
	In relevant places	Yes	No	No	No	No	No
	In unrelated places	Yes	Unknown	Unknown	Unknown	Yes	Unknown
	Hybrid paradigms	Yes	Explicit only	Yes	Yes	Yes	Yes
	Integrated with related activities	No	No	Yes	No	Yes	No
	User-generated biographical metadata	No	No	No	Partial	No	No
<b>Metadata</b>	Object biography-centric	Yes	Unknown	Unknown	Unknown	Unknown	Unknown
	Event-centric	No	Unknown	Suggested	Unknown	Unknown	Unknown
	Object-centric	No	Suggested	Unknown	Unknown	Unknown	Unknown
	Custom	No	Suggested	Suggested	Unknown	Suggested	Suggested

Table 7.3 Comparison of the reported interaction patterns and underlying metadata of ItemTrails and 13 selected digital heritage applications (Part 3)

	<i>ItemTrails</i>	<i>SGTrails</i> (Yew, Deshpande, Precians, Cheng, & Do, 2020)	<i>MillServer</i> (Tzima, Styliaras, & Bassounas, 2021)	<i>SensimAR</i> (Marto, Melo, Gonçalves, & Bessa, 2021)
<b>Interaction</b>	Conceptualising artefacts as	Artefacts	Representations of places	Representations of places
	Biography-enhanced artefact-centric	Yes	No	No
	In direct places	Yes	Yes	Yes
	In relevant places	Yes	No	No
	In unrelated places	Yes	Unknown	No
	Hybrid paradigms	Yes	Explicit only	Explicit only
	Integrated with related activities	No	No	Yes
	User-generated biographical metadata	No	Partial	No
<b>Metadata</b>	Object biography-centric	Yes	Unknown	Unknown
	Event-centric	No	Unknown	Unknown
	Object-centric	No	Unknown	Unknown
	Custom	No	Suggested	Suggested

### 7.1.1 Interaction in Context

For the first row—*conceptualising artefacts as*—under the interaction category, three types of conceptualisations—artefacts, persons and places—are recorded (as described under Section 7.1). How artefacts were conceptualised influenced the way of perceiving and interacting with the ‘thingness’ presented by the applications, be it an artefact, a person or a place. In ItemTrails, we experimented conveying the notion of object biography and two of the four qualities of the notion—life stages and ways of gaining meanings (see Sections 2.3.2, 6.1, 6.1.5 and 6.1.6) to users. ItemTrails took this *biography-enhanced artefact-centric* approach

to guide users to meet the descriptive metadata of objects in multiple places. In each encounter, users get to know what had been ‘experienced’ by one or more artefacts at a particular life stage. Artefacts gained meanings from both episodes (e.g., the Printed episode of the Ticket, Waikato vs. South Africa or simply, the creation of the ticket, see Section 6.1.6) and wider events (e.g., 1981 Springbok Tour in Hamilton). The places were categorised into two kinds—those of *direct* and *relevant* (see Section 5.1.1). The existence of relevant places could add another layer for representing geographical scales of shared meanings to reinforce their significance, while establishing more places in wider environments for accessing artefacts.

In comparison, all the artefact type and a place type applications presented the spatio-temporal metadata that related to the depicted scene of an artwork (Jeater, 2012; Coughlan, et al., 2015) or the creation (Galani, Mazel, Maxwell, & Sharpe, 2013; Kwok, Kiefer, Schinazi, Adams, & Raubal, 2019; Koo, Kim, Kim, Kim, & Cha, 2019) and repurpose (McGookin, et al., 2019) of an inscription, building or building complex. We consider such inclusion of spatio-temporal metadata to be a *partial* implementation that enabled users to interact with *biography-enhanced* artefacts. While staying relevant to biographical narratives of persons or places, the remaining seven applications did not take an *artefact-centric* approach. All the 13 applications chose to facilitate interactions *in direct places*, ItemTrails was the only one that presented *relevant places*.

In addition to direct and relevant places, users could use ItemTrails *in unrelated places* such as somewhere that was not yet documented in object biography metadata or a home environment. Streetmuseum Londinium, ArtMaps and Explore similarly allowed user interactions that could at least be made at unrelated spots in a designated area (Jeater, 2012; Coughlan, et al., 2015; McGookin, et al., 2019). Four of the selected applications solely supported on-site interactions by providing users with temporal, spatial and thematic information about one building in relation to a previously viewed counterpart (Kwok, Kiefer, Schinazi, Adams, & Raubal, 2019) or more immersive multi-sensory experiences (Tzima, Styliaras, & Bassounas, 2021; Marto, Melo, Gonçalves, & Bessa, 2021). For the other six applications, whether off-site interactions were enabled was not reported.

ItemTrails employed geofencing (see Section 6.1.4) to offer a *hybrid interaction paradigm* (i.e., both explicit and implicit interaction paradigms) to users to choose which artefact to ‘meet’. The hybrid interaction paradigm was also the design choice for Gazed-Guided Narratives, Walk1916, CrossCult Pilot 4, Explore and MAR guide. Rock art, Hwaseong Fortress app, Svevo Tour, SGTrails, MillSecret and SensiMAR incorporated explicit

interactions. The reasons for some could be the potential clash between implicit interactions and the respective research objectives (e.g., findability of the rock art (Galani, Mazel, Maxwell, & Sharpe, 2013) and memorability of the game content (Tzima, Styliaras, & Bassounas, 2021)).

Meeting the last two interaction criteria—*integrated with related activities* and *user-generated biographical metadata* could help creating new experiences based on the other two qualities of object biography—intersection with human biographies and multiple voices (see Section 2.3.2). Walk1916, Explore and MillSecret were designed or found to be *integrable to related activities* such as exercising (Cushing & Cowan, 2017) and visiting a place for recreational purposes (McGookin, et al., 2019; Tzima, Styliaras, & Bassounas, 2021). Besides integrations with information-intensive works (e.g., searching information while writing (Twidale, Gruzd, & Nichols, 2008)), such integrations between relatively lightweight information interactions and leisure activities could be helpful for ItemTrails for exporting artefacts to everyday lives of visitors. ArtMaps, CrossCult Pilot 4 and SGTrails partially supported *users to generate biographical metadata*. Obtaining and studying crowdsourced metadata of artefacts and places was part of the reasons that ArtMaps and CrossCult Pilot 4 were developed (Coughlan, et al., 2015; Jones, Theodosis, & Lykourantzou, 2019). The user comments, namely the free-text metadata in SGTrails, were designated for enabling social interactions and used for understanding experiences (Yew, Deshpande, Precians, Cheng, & Do, 2020). Both could be deemed as a foundation of representing intersections between biographies of artefacts and users, as well as featuring polyvocal narratives.

### 7.1.2 Descriptive Metadata in Context

As shown in Table 7.1, Table 7.2 and Table 7.3, little information regarding the underlying descriptive metadata and its structures in particular, was documented for the selected applications. Eight of the 13 applications were assessed to be built on *custom* descriptive metadata of artefacts. The ArtMaps project started from generating geographical coordinates based on the literal values that populated the place metadata fields of less than 33% of the 70,000 artworks at Tate Britain (Coughlan, et al., 2015). The Svevo Tour team had a goal of “making more material” about both the real persons and fictional characters in the world of Svevo available (Fenu & Pittarello, 2018). In the cases of Walk1916 and Explore, the researchers reported that they employed digital images, geographical coordinates, text descriptions and audio and video assets (Cushing & Cowan, 2017; McGookin, et al., 2019). These descriptions may indicate that there was insufficient or no machine-readable

structured descriptive metadata available, regardless of the metadata structure being *object biography*-, *event*- or *object-centric*.

On the other hand, ItemTrails was built on structured and object biography-centric descriptive metadata. Despite being incomplete (i.e., the same metadata scarcity problem that potentially challenged the researchers who created the selected applications), the metadata served as the basis of a novel interactive experience as perceived by users (see Section 6.2.4). Such experiences could be enriched by intersections between object and human biographies, which could in turn pave the way for representing multiple voices (e.g., the meanings made by museum goers via walking in the shoes of people who interacted with displayed objects, see Section 3.2.4). The studies that were relating to providing object biography-centric descriptive metadata with more linkage via artefact-person intersection could be beneficial to achieving the envisaged experience enrichment.

We observed that the descriptive metadata of objects or persons in the studies cited in the following two paragraphs was being expanded and more connections were being established on top of the tie between artefacts and persons from both ends. On the artefact side, the outcomes of ArtMaps went beyond crowdsourced geotags for artworks and indicated a potential of engaging people to interact with “the spatial footprints of artworks” (Coughlan, et al., 2015). The Early Medieval cemeteries in Austria and Czech were modelled in compliance with CIDOC CRM following a four-level hierarchy—*burial site* (as *E18 Physical Object*), *grave* (as *E18 Physical Object*), *human remains* (as *E20 Biological Object*) and *finds* (as *E22 Man-Made Object*) (Eichert, 2021). *Person* (as *E21 Person*) was connected to *burial site* and *grave* via *place* (as *E53 Place*).

On the person side, the descriptive metadata (that included spatio-temporal and genre information) of approximately 2,000 photographs taken by Charles W. Cushman was used to enhance the biographical metadata of the amateur photographer (Mayr, et al., 2019). A visualised narrative of Dante Alighieri’s life<sup>87</sup>, which featured various objects such as illuminated manuscripts, the fresco *La Divina Commedia di Dante* by Domenico di Michelino and the tomb of the poet, was created on the processed free-text biography and the metadata imported from Wikidata<sup>88</sup> (Metilli, Bartalesi, & Meghini, 2019). The prosopographical metadata of the Finnish World War II casualties was derived from death record (i.e., part of person biography and inadequate to form life narratives) and cemetery (i.e., artefact)

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<sup>87</sup> <https://dlnarratives.eu/timeline/dante.html>

<sup>88</sup> <https://www.wikidata.org>

metadata (Ikkala, et al., 2017). Such prosopographical metadata could help in interpreting artefacts when biographical metadata of individual persons remains unknown.

### 7.1.3 *Object Biography as Conceptual Framework*

We extend the third approach of using object biography as a conceptual framework, which was initially proposed in Section 2.3.3, to convert the life stories of artefacts into descriptive metadata. Starting from the first metadata acquisition study in Chapter 3 and throughout this thesis, object biography as a conceptual framework was used primarily in three ways:

- A tool for designing descriptive metadata acquisition methods and making sense of existing and acquired metadata
- A tool for informing artefact-centric interaction design and examining related digital heritage applications
- A structure for acquired metadata.

In this section, we discuss the first two uses of this conceptual framework—and leave the last one, related to Research Question 2, to Section 7.2.2.

*A tool for designing descriptive metadata acquisition methods and making sense of existing and acquired metadata.* We collected unstructured, then semi-structured, biographical metadata of artefacts from the first and second metadata acquisition studies (see Chapters 3 and 4) and the third metadata sample study (see Chapter 5). By interviewing key informants in their physical LAMs, unstructured metadata were collected centring around the idea of the journeys artefacts travelled—specifically, direct and relevant place and time values, as well as participant-object and participant-institution audience stories in the first study. Likewise, unstructured metadata from artefact-place stories were given in-situ by key informants for three roles—an international traveller, a different person that participants could think of and a commuter—played by the researcher in the second study. Both sets of the unstructured metadata delivered instances of biographical facets of artefacts, which guided us to form a conceptualisation of object biography metadata. The unstructured metadata also confirmed that object biographies closely tied to other types of biographies, especially those of persons, as well as of places and other objects via persons.

Semi-structured metadata were collected from a staff member at the Waikato Museum Te Whare Taonga o Waikato in the tabular form of a condensed object biography metadata structure. This condensed structure incorporated ten metadata fields—artefact name, other artefact used, manifestation of exchange value, person name, person role, time, place

name/toponym, location and extent, name/toponym of relevant place and additional note/miscellaneous across artefact life stages. The semi-structured metadata showed fine-grained values as to artefact name, time and place information, particularly starting from artefact accession, though considerably less so before accession stage.

*A tool for informing artefact-centric interaction design and examining related digital heritage applications.* For building ItemTrails on top of the machine-readable version of the semi-structured metadata, we employed a design concept that interactions with (almost animistic) artefacts should be the focus while those with persons and places (i.e., object biography metadata values) should be downplayed. The prototype was perceived as conveying a novel experience although the learning curve appeared to be steep for some participants in a one-hour study. Informed by the studies introduced in Section 2.3.3 that conceptualise physical man-made things as artefacts, we also compared ItemTrails with 13 selected digital heritage applications. Conceptually via an object biography lens, we interpreted the information foci of some of the selected applications as artefact-represented persons and places (see Table 7.2 and Table 7.3). However, at least for some of the applications that tended to have a less articulated information focus (e.g., Hwaseong Fortress app and Walk1916, both focussed on artefacts and places), their designs on top of potentially customised metadata delivered a less integrated and consistent interactive experience.

## 7.2 Addressing the Research Questions

The three research questions presented in Section 1.2 guided the search of an intersected biographical metadata-based interactive experience and thus the design and execution of the four research activities presented in Chapters 3 to 6 (see Table 7.4). ItemTrails, which was informed by the qualities of object biography, consequently enabled artefact interactions beyond the LAM walls. We will address the three questions by discussing what we learned throughout the research process and use five artefacts that were presented in Chapters 2 and 5 to illustrate our views:

- Grappling hook (EO1, see Section 2.2.1)
- Grain jar, anonymous, c. -206 - c. 220 (EO2, see Section 2.2.1)
- Lacquer plate with pattern of children exercising with *gun* the staff weapon (EO3, see Section 2.3.2)
- Statue of Guan Yu (EO4, see Section 2.3.2)
- Ticket, Waikato vs. South Africa (coded below as EO5, see Section 5.2.1).

Table 7.4 Four studies and their associated research questions

Study Number	Study Name & Chapter	RQ1	RQ2	RQ3
1	Acquiring object biography metadata (Chapter 3)	Yes	Yes	
2	Acquiring place-centric object biography metadata (Chapter 4)		Yes	Yes
3	Acquiring object biography metadata samples (Chapter 5)	Yes	Yes	
4	Designing and evaluating object biography application prototype (Chapter 6)	Yes	Yes	Yes

### 7.2.1 *To what degree is existing descriptive metadata suitable for creating novel artefact-centric interactions beyond the walls of memory institutions?*

The current descriptive metadata of typical artefacts is not sufficient on its own for enabling biography-enhanced artefact-centric interactions outside physical LAMs. We reached this conclusion with little surprise, given a background that such descriptive metadata documented partial life stories at particular spatio-temporal points and was not created for being reusable in context-aware applications (e.g., see Section 2.2.1 for the descriptive metadata of EO1 and EO2, and Figure 7.1 for the descriptive metadata of EO3 and EO4 used for exhibition purposes<sup>89</sup>). The required work of further structuring and acquiring descriptive metadata of artefacts should address two primary deficiencies:

- Lacking necessary metadata fields
- Lacking details to populate metadata fields.

*Lacking necessary metadata fields.* More metadata fields should be included to collectively represent object biographies, in which artefacts should be connected to persons, and to places and other artefacts via persons. Such an object biography metadata model could be made in a tabular form as we did in Chapter 5 or based on existing metadata schemas. For example, multiple names for one artefact need to be properly represented. Artefacts could gain multiple names from different persons in respective social spheres. The metadata of EO4

<sup>89</sup> The photos of the descriptive metadata of EO3 and EO4 were originally posted by the screen names タカユキ (Takayuki) and さっこ (Sakko) on:  
[https://twitter.com/Fr\\_3Stakayuki/status/1150282758385614849/photo/1](https://twitter.com/Fr_3Stakayuki/status/1150282758385614849/photo/1);  
<https://twitter.com/2119funk/status/1164864344821100545/photo/2>

(see Figure 7.1) described the artefact differently in Japanese and Korean<sup>90</sup>, English<sup>91</sup> and Chinese<sup>92</sup>, which suggested a curatorial choice. During and after the donation of EO5, the ticket was given descriptive names with some variations for cataloguing and exhibition purposes (see Table 5.3). This generalisable phenomenon differed from what can commonly be seen in existing descriptive metadata—one artefact name represented by a Uniform Resource Identifier (URI) and used throughout (e.g., the metadata of EO1 and EO2 in Section 2.2.1).

*Lacking details to populate metadata fields.* One recurring theme of the existing descriptive metadata was the literal values that populated metadata fields and conveyed rich information, did not have alternative machine-readable representations (see the finding in Section 3.2.3). EO1 and EO2 (see Section 2.2.1 for the metadata) as subjects were linked to free-text-populated objects by CIDOC CRM and Dublin Core predicates *P3 has note* and *description*, respectively. The texts contained information concerning time, place, event, person and value, none of which were otherwise represented. The metadata values of EO5 (see Table 5.3) conveyed less details of the life stories occurred before its accession than those that took place in museum afterwards. This lack of details could be addressed by involving more stakeholders in metadata acquisition initiatives (Coughlan, et al., 2015; Dijkshoorn, 2019; Tasker & Liew, 2020) and deriving values from intersected biographical metadata of persons or prosopographical metadata of groups of people (cf. the approaches taken by Mayr et al. (2019), Metilli, Bartalesi and Meghini (2019) and Ikkala et al. (2017)).

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<sup>90</sup> Statue of Guan Yu—関羽像 and 관우상

<sup>91</sup> Only contained the name of the person portrayed—Guan Yu

<sup>92</sup> Statue of Lord Guan—关公像

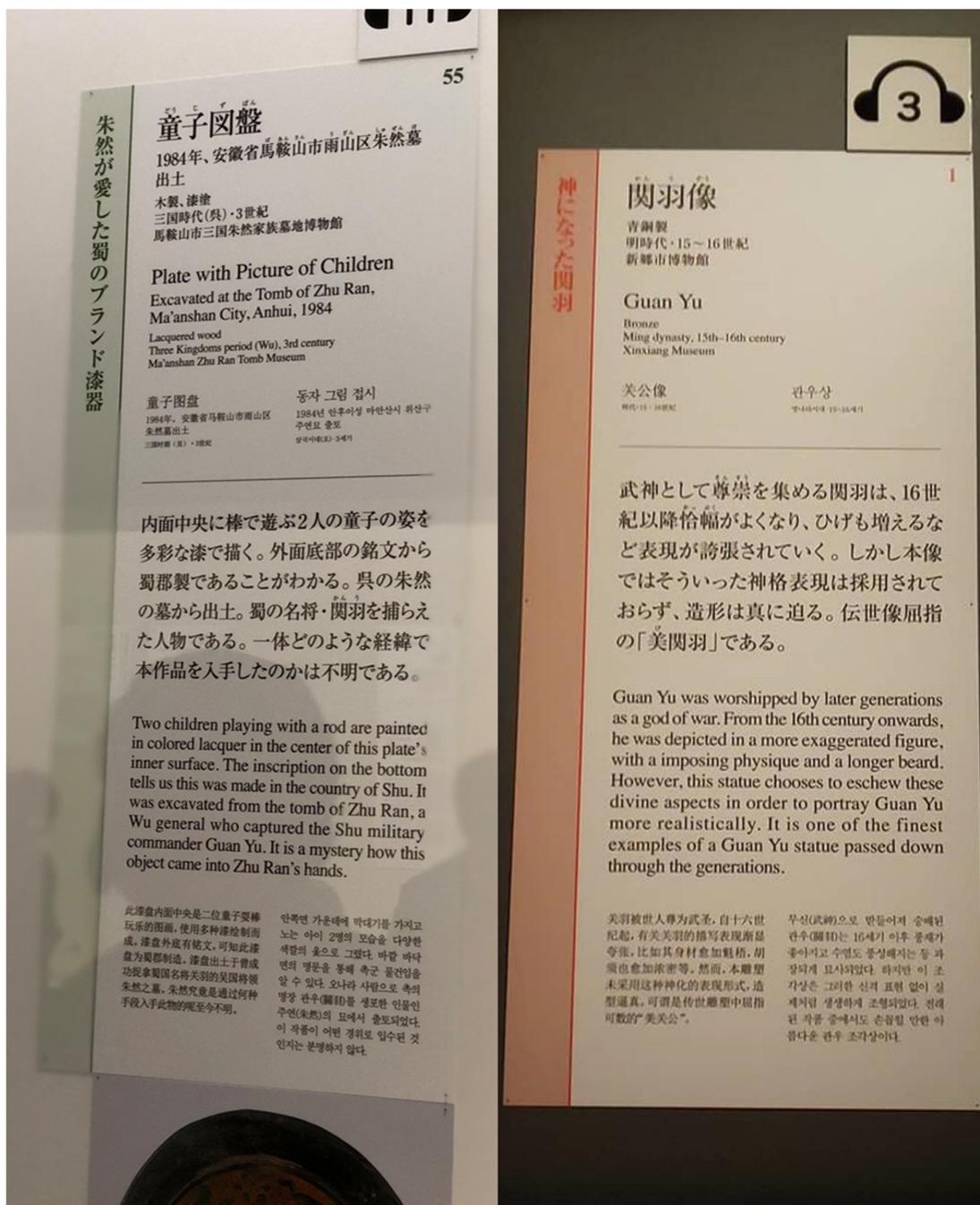


Figure 7.1 Quadrilingual metadata (in Japanese, English, Chinese and Korean) of the lacquer plate with pattern of children exercising with *gun* the staff weapon (EO3) and the statue of Guan Yu (EO4) displayed in the Tokyo National Museum, 2019. Photographs cropped for readability. Photograph courtesy of the screen names タカユキ (Takayuki) and さっこ (Sakko)

## 7.2.2 Can we use object biography as a framework to document cultural heritage artefacts?

Object biography can be used as a conceptual tool for documenting artefacts. This is the last one of the three approaches (described as *a structure of acquired metadata* in Section 7.1.3)

to applying object biography as the conceptual framework in this thesis. Unlike the archaeological and museological investigations that applied the notion to create free-text biographies for artefacts, we started off biographically representing descriptive metadata of artefacts for novel interactions from a computer science perspective. We illustrate the utility and potential of the conceptual tool by extending our discussion in the following two aspects of enhancing the descriptive metadata of artefacts (see Section 7.2.1):

- Incorporating necessary metadata fields
- Incorporating details to populate metadata fields.

*Incorporating necessary metadata fields.* In our biographically structured version of the descriptive metadata (see Table 5.3 to Table 5.7), the added metadata fields such as artefact name, other artefact used, manifestation of exchange value, person name and place name/toponym that constituted each row of the table jointly represented a life story space. The values of such necessary metadata fields may be shared by other types of biographical metadata. For example, an obvious connection between EO1 and EO5 is the 1981 Springbok rugby tour. The connection could be unfolded among other entities, the properly represented names of the involved persons and places. However, the related values were not derived from the free-text description of EO1 (see Section 2.2.1, e.g., the Biko Squad and Eden Park). Despite two CIDOC CRM-represented life stories—the production and the accession<sup>93</sup>, the stories during the tour were documented in a triple as the grappling hook refers to the 1981 Spring Tour, using the Auckland Museum Base Ontology<sup>94</sup> (Auckland Museum Tāmaki Paenga Hira, 2018). For EO5, there were no details obtained for the stories during the tour, though the staff member at the Waikato Museum Te Whare Taonga o Waikato filled in a message—“Creation was at ticket kiosks within Rugby Park, exact location of kiosks unknown”—as an additional note next to the place cells (see Table 5.3). According to this note, one participant who evaluated ItemTrails pointed out a probable location of the ticket stands at the Waikato Stadium (previously known as the Rugby Park) in Hamilton (see Section 6.2.4 and Figure 6.18).

*Incorporating details to populate metadata fields.* As illustrated by EO1 and EO5, missing details were often found across artefact, person, time and place, the four parental categories of our added metadata fields (see Table 5.1), in addition to literal values not being properly

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<sup>93</sup> The production can be read as: the grappling hook was made by a man named Hugh R. Grenfell in a one-year timespan of 1981 in Auckland. The accession can be read as: the grappling hook was gifted by Hugh R. Grenfell to the Auckland Museum Tāmaki Paenga Hira on 1 May 2018.

<sup>94</sup> <https://api.aucklandmuseum.com/#ontologies>

represented. This issue was also exemplified by the unavailability of machine-readable structured descriptive metadata for creating digital heritage applications as discussed earlier in Section 7.1.2. Friberg and Huvila (2019) stated that the frequently seen curatorial problems included:

- Relying on exchanging collection information socially than using formal documentation and database
- Lacking continuity in conserving and studying collections
- Failing to support collection management with resources.

We argue that we could use object biography to represent artefacts more formally with more metadata field values that were previously absent. While visitors of the touring exhibition of the Three Kingdoms might be able to learn some reasons that why EO3 and EO4 could be related to each other by reading the labels, such relatedness could be extended to EO2 and more formally documented in biographical metadata. Zhu Ran—a person name in the metadata of EO3—joined in the capture of Guan Yu—a person name in the metadata of EO4—in 220 CE (Chen S. , n.d.-d). Given the object-person intersections, the two artefacts can be documented as related via the biographical metadata of the persons. Guan Yu, who captured Yu Jin<sup>95</sup>, his subordinates and tens of thousands of Wei<sup>96</sup> soldiers in 219 CE, claimed a lack of ration of food and took grain from the Xiang Pass<sup>97</sup> that belonged to his then-alliance—the forces of Wu (Chen S. , n.d.-c). According to this historical record, EO2 could be related to EO4 via the connections among the prosopographical metadata of grain jar and granary back to the time, the granary in the Xiang Pass, relevant personnel who retrieved the grain and Guan Yu. Given the complexity of the network of biographical (and prosopographical) metadata of objects, persons and places, incorporating necessary metadata fields and details to populate such fields would be mutually informed in practice.

### 7.2.3 *What are useful concepts to create novel artefact-centric interactions beyond the walls of memory institutions?*

Based on the central idea of biography—object-person intersection (Gosden & Marshall, 1999), we consider that any object could ‘intersect’ its biography with those of one or more persons and places. This biographical intersection of objects, persons and places is a core concept that supports the creation of artefact-centric interactions outside physical LAMs. The

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<sup>95</sup> in Simplified Chinese: 于禁

<sup>96</sup> in Simplified Chinese: 魏

<sup>97</sup> in Simplified Chinese: 湘关

concept offers design implications at both *metadata* and *interaction* levels (these two terms were described in Section 7.1).

Creating and maintaining biographical metadata was primarily discussed in Sections 7.2.1 and 7.2.2. Biographical intersection could be a principle that guides more formal representation of objects via incorporating relevant metadata fields and their values shared by intersected biographies of artefacts, persons and places. In the case of EO3 for example, the collective name of the lacquerware craftsmen (as the value of the creator) would link the biographical metadata of EO3 (object) to those of Zhu Ran (person) and Shu Commandery (place).

ItemTrails offered one way that integrated life stages and ways of gaining meanings (two of the four qualities of object biography), for users to interact with biographical metadata in an outdoor environment (see Section 7.1.1). While the preliminary evaluation results verified that the prototype conveyed a novel interactive experience, such experience could be augmented by presenting biographical intersection of objects, persons and places, as well as multiple voices to users (see Section 6.3.2). Petrelli et al. (2017) demonstrated presenting multiple voices that were customised by curators and produced using actors to complement factual descriptions in a museum exhibition. This biographical intersection would open up new perspectives and opportunities for users to view and communicate digital heritage information in wider environments.

A starting point could be viewing the intersection between the biographical metadata of EO5 and that of the original owner of EO5 via utilising the geo-location data of the Waikato Stadium (i.e., a metadata field value shared by the intersected biographies). In this scenario (as in many others), a digital tool-assisted meaning making process would mean that a user could intersect their own biographical metadata with those of objects, persons and/or places to create new metadata values, and thus obtain their own digital heritage-related autobiography (see Section 7.1.2). The newly created metadata values could represent direct interactions with biographical metadata of objects (e.g., using the geo-location data of an object to visit a place, shown in *Streetmuseum Londinium* (Jeater, 2012), *Walk1916* (Cushing & Cowan, 2017) and *SGTrails* (Yew, Deshpande, Precians, Cheng, & Do, 2020)), or meanings made on the biographical intersection of objects, persons and places (see Section 6.3.2). For biographical metadata of objects in particular, the newly created metadata values would also represent the voice of the user in a structured form.

We gained an understanding that the experience of interacting with biographical metadata of artefacts is considerably dependent on user interface layouts and elements from evaluating ItemTrails. This finding echoed an observation made by Ikkala et al. (2017) when discussing the needs of general audiences when interacting with digital heritage LOD: the usefulness of a digital heritage application is very dependent on whether user interfaces are easy to manage.

### 7.3 Research Methods

We performed four studies for acquiring the descriptive metadata of the selected artefacts and seeking feedback on the experiences of using ItemTrails to address the research questions (see the relationships between each study and research question in Table 7.4). The novelty of this project meant that there were no established conceptual frameworks and research methods. Using object biography as the conceptual framework, we adapted research methods from combining existing qualitative research techniques (Rogers, Sharp, & Preece, 2011) and positioning them in new contexts. In this section, we will briefly discuss the effectiveness of the research methods employed in the four studies, two of which were performed indoors and the other two were placed into wider physical contexts:

- Semi-structured interview supplemented with board game elements
- Survey supplemented with semi-structured interview
- Bodystorming-inspired semi-structured interview.

*Semi-structured interview supplemented with board game elements.* This research method was designed for acquiring the biographical descriptive metadata of two to four selected objects from key informants and developing an initial understanding of the metadata (see Section 3.1). The board game elements were incorporated in tangible user interaction design (Cesaria, Cucinelli, De Prezzo, & Spada, 2020) or employed as a tool to inform location-based application design (Jones & Papangelis, 2020) in the digital heritage field. The addition of board game elements (i.e., printed maps, board game pieces, sticky page markers and notes, as well as cardboard pieces) to the research method assisted the key informants to supply a rich number of metadata field values, which can also be verbally clarified without delay by referring to the completed journey of an object.

*Survey supplemented with semi-structured interview.* The sparse and detail-lacking metadata that existed prior to performing the first study (see Table 7.4 and Section 3.2) suggested a need for a research method for acquiring biographical descriptive metadata of

several selected objects from key informants and learning the qualities of such metadata (see Section 5.1). The acquired metadata field values (see Table 5.3 to Table 5.7) were the outcome of labour-intensive work, which required considerably more time and effort to accomplish, compared with initial metadata acquisition. The outcome reflected that the annotated spreadsheets shared three key elements with questionnaires—understandability, interpretability and easiness for completion (Adams & Cox, 2008), which should be carefully managed (see discussions in Sections 7.4 and 8.1).

*Bodystorming-inspired semi-structured interview.* This research method was originally designed for acquiring biographical descriptive metadata of several objects in-situ and bodystorming how object stories can be told with the assistance of ‘magical powers’ (i.e., imagined functionalities) (see Section 4.1). We later adapted the method to evaluate ItemTrails, which incorporated both usability measurement tasks and bodystorming-inspired conversations (see Section 6.2.2). By referring to the results, including more fine-grained metadata and interpretations of the imagined functionalities (see Sections 4.2 and 6.2.4), we consider involving both heritage enthusiasts and experts and potential end-users of digital heritage applications in a bodystorming-inspired iterative design process a success. The “idea of ‘being there’ and living with data in embodied ways” (Oulasvirta, Kurvinen, & Kankainen, 2003) contributed to the design for a novel interactive experience offered by the context-aware ItemTrails.

These research methods were used to address the three research questions. For example, collecting the existing metadata of the selected artefacts (see the generalised technique in the work of Yin (2016, p. 155)) was performed as an integrated part of board game element-featured and bodystorming-inspired semi-structured interviews. The research methods seem effective for developing the digital heritage applications on top of biographical metadata of objects for a more engaging experience.

## 7.4 Limitations

Whilst designing and executing the primary and secondary research, we identified three main types of limitations:

- Participants, artefacts and places
- Object biography metadata samples
- Selection of other digital heritage applications.

*Participants, artefacts and places.* The primary research performed and reported in this thesis were set in the context of smaller museums in New Zealand. Recruiting key informants (for the first three studies) and potential end-users of digital heritage applications (for the evaluation of ItemTrails) was challenging. The recruiting approaches such as snowball sampling, calling and visiting to invite participation of potential key informants were all used and turned out to be time-consuming. Extending the participant recruitment to heritage enthusiasts and experts who were not working in LAMs was particularly difficult. As a result, the first three studies feature predominantly the voices from one group of key informants—LAM professionals in the Waikato Region. For evaluating ItemTrails, most participants were staff and students from the University of Waikato. The inclusion of overseas travellers would be ideal, which was impossible to organise in 2020 and the first quarter of 2021 due to the pandemic-driven closure of the New Zealand border. Consequently, the diversity of participants across the studies was limited.

Although we attempted to seek wider coverage of artefact and place variations, this was necessarily constrained by the context of engagement with small New Zealand museums. The selected artefacts and places conveyed the biographical metadata that reflected the stories of smaller settlements with a time span from the era of the New Zealand Wars to 1980s. Studies in settings with longer and richer histories would enable issues of scale (in terms of numbers of artefacts and events) to be explored.

*Object biography metadata samples.* Following the discussion of the research method in Section 7.3, acquiring metadata samples from one museum staff member was determined by considering the time limit, anticipated workload, difficulty of recruiting more participants and logistical concerns of performing the prototype evaluation. An alternative plan that would involve one more key informant to critique the metadata field values completed by the museum staff member was designed prior to the commencement of the study but was not chosen due to resource constraints. The study, as a contracted work, was then conducted in collaboration with the staff member of the Waikato Museum Te Whare Taonga o Waikato, whose organisational responsibilities were the most relevant. Incorporating metadata supplied by one domain expert can demonstrate the qualities of object biography to some extent (e.g., one historian supplied biographical metadata of Dante Alighieri (Metilli, Bartalesi, & Meghini, 2019)). However, the misunderstanding of the customisable event fields in the spreadsheets was not prevented using our approach—asking the key informant generic questions (e.g., are there any queries about what we need for each grid?). The understandability, interpretability and ease of completing the spreadsheets should be

improved by having an informal communication session with key informants to walk through the spreadsheets and requirements. If time allows, a potentially better approach would be communicating with the museum to identify other potential key informants (e.g., former employees or other types of cultural heritage stakeholders with knowledge of the chosen artefacts). Some participants questioned the less engaging in-museum life stories of objects (i.e., factual and detail-lacking, see Section 6.2.4) when evaluating ItemTrails. The involvement of former LAM employees might be able to mitigate this issue via enriching biographical metadata of objects to showcase their in-museum lives.

*Selection of other digital heritage applications.* A majority of the digital heritage applications presented in Table 7.1 to Table 7.3 did not disclose their underlying metadata. Because of our interest in exporting artefacts to wider environments, all the applications were designed to be used outdoors and many of them were AR-enabled. On the other hand, virtual reality (VR) applications, especially those being experienced in physical LAMs could be deemed as relevant—providing an opportunity for users to interact with artefacts at certain life stages that may be difficult to experience in-situ. These applications were chosen from the academic publications that were related to the domain of inquiry and many of them were published in the last five years. We could extend coverage to applications that were more market-oriented (e.g., the applications featured in the work of Basaraba et al. (2019)).

## 7.5 Contributions

Whilst further studies (see Section 8.1) are called for addressing these limitations, the main contributions of the research are:

- Learned existing metadata is insufficient for creating novel interactions with artefacts in wider environments
- Adapted object biography as a conceptual framework for performing the four research activities presented in this thesis
- Adapted existing qualitative data collection techniques for acquiring metadata (Zhao, Twidale, & Nichols, 2018)
- Created the first object biography-centric mobile application as a proof-of-concept
- Validated biographical intersection as a useful design concept.

The core idea of the thesis is to move artefact interaction touchpoints into the wider environment beyond the physical limits of memory institutions. As a consequence, interactions with artefacts can become longer, more engaging and with greater potential to grow over time. However, in order to achieve these interactions, it is necessary to expend considerable effort in reframing metadata from a typical descriptive catalogue entry to be object biography-centric.

One main reason for suggesting the reframing is that we learned the existing metadata is lacking both biography-enabling data fields and details to populate such fields (see Chapters 3 and 5 and Sections 7.1.2 and 7.2.1). We adapted the notion of object biography as a conceptual framework to design metadata acquisition methods, make sense of existing and acquired metadata, structure acquired metadata and inform artefact-centric interaction design (see Chapters 3, 4, 5 and 6 and Sections 7.1.3 and 7.2.2). The metadata acquisition methods were based on two existing qualitative data collection techniques—in-depth interview and bodystorming (see Chapters 3, 4 and 5 and Section 7.3). Biographical descriptive metadata of a variety of the selected real-world artefacts were gathered from key informants both in physical LAM and outdoor environments, and a condensed metadata structure in a tabular form was created (see Chapters 3, 4 and 5). We created ItemTrails—the first object biography-centric mobile application prototype—that employed the biographical descriptive metadata of four selected local artefacts to facilitate artefact-centric interactions both explicitly and implicitly in direct, relevant and unrelated places (see Chapter 6). Object biography as a conceptual framework can also be applied to examining related digital heritage applications to set a context for ItemTrails (see Section 7.1). In evaluating the prototype, we validated biographical intersection as a useful concept, which showed the utility and potential in creating biographical descriptive metadata and meaningful interactions with artefacts (see Section 7.2.3).

## 8. Conclusion

Based on two research gaps, artefact-centric interactions in wider physical environments and descriptive metadata support for such interactions, we investigated one approach to enable ‘meeting’ biography-enhanced objects in the places they have been. By using object biography as the conceptual framework, we acquired the biographical metadata of a selection of artefacts both indoors and in ‘the wild’ to explore their qualities and obtain the samples in a tabular structure. We developed and evaluated the first mobile application prototype that provides users with an opportunity to interact with object biography metadata. The preliminary results of the evaluation indicate that potential users can engage interactions with heritage items after an initial period of conceptual familiarisation.

This thesis, to the best of our knowledge, presented the first research that employed object biography as its central principle to form a new basis for person-artefact interactions that go beyond the physical limits of LAMs. The main contributions are discussed in Section 7.5: in summary, we learned that:

- The current existing descriptive metadata of artefacts lack necessary metadata fields and details to populate such fields to be reusable and useful in context-aware applications
- Object biography can be used as a conceptual framework to design descriptive metadata acquisition methods, inform artefact-centric interaction design, as well as enhance and structure the description of artefacts
- The biographical intersection of objects, persons and places is a core concept to support designing for the artefact-centric interactive experience outside physical LAMs.

### 8.1 Future Work

The research activities in this thesis are limited by their scale and focus (see Section 7.4). We propose the following items as future work including some natural extensions of the limitations:

- Explore additional approaches for presenting biographical intersections in the interface of heritage applications: the current prototype explored one limited display of the intersection concept (i.e. object-object intersection).

- Explore approaches for representing biographical intersections and apply user profiles in heritage applications: the current prototype was limited by the incompleteness of the metadata. User profiles, which could provide another category of intersection, were not implemented in the prototype.
- Improve the learnability of object biography and biographical intersection conveyed in the prototype: based on participant feedback, then alternative methods to convey object biography concepts could be explored. These methods should also be used with more diverse participants as the underlying concepts should be accessible to all potential users.
- Improve the adapted research method for acquiring biographical metadata values of a small number of objects. As noted in Section 7.4, the quality and quantity of metadata would be improved through the engagement of more LAM professionals than in this study.
- Explore alternative methods for acquiring biographical metadata (i.e., fields and values) from multiple sources including stakeholders of cultural heritage. In addition to greater professional engagement the multiple voices aspect of object biography could be enhanced by greater involvement of multiple stakeholders. Implementation of the multiple voices concept has significant implications for both the user interface and the metadata structure.
- Formalise biographical metadata structure. The current prototype is based on a limited tabular metadata structure which does not fully embody the LOD approach.
- Offer virtual experience to address accessibility concerns in the prototype. There are opportunities to explore object-centric interactions via remote experiences (i.e. not physically located at the relevant place). In addition, VR and AR technologies potentially allow alternative experiences to the current prototype.

ItemTrails is currently developed on four incomplete sets of sample metadata. For further studying the biographical approach, exploring ways of presenting biographical intersections of object, persons and places on the user interface (i.e., graphical and auditory) could be taken into account. Presenting such intersections means employing the structured metadata that represents person and place biographies. Applying user profiles (e.g., previous user patterns) would enable users to intersect their personal biography with those of objects, other persons and places. The complexity of such metadata and the interactions which it

supports would need to be carefully managed and presented. By doing so, more scenarios such as cycling and drive tours, pre-visit and in-trip planning could be supported. Real-world deployment would require high levels of learnability and accessibility. The learnability of the user interface elements and interaction patterns that convey the notions of object biography ('experienced' by the almost animistic artefacts) and biographical intersection could be refined or redesigned. Designing for a virtual interactive experience that addresses accessibility concerns (e.g., for situations where travel is not practicable) should also be examined.

The adapted research method for acquiring biographical metadata values of a small number of objects could be refined in two key ways: improved communication prior to using the survey instrument and involving more voices to describe and fill in gaps in life stories of artefacts. The research method may bring in a practical value for digital heritage applications that rely on deriving metadata from archived free-text descriptions. Future work could explore alternative approaches (i.e., both qualitative and quantitative) of inviting object biography contributions that contain both metadata fields and values from multiple sources including cultural heritage stakeholders. The alternative metadata acquisition methods would assist obtaining narratives such as "I met my wife in the café displayed on this picture in Amsterdam in 1959" (van Hooland, Rodríguez, & Boydens, 2011), which can be found at biographical intersections. The potential stakeholder-contributed metadata would differ from those gathered in other crowdsourcing or nichesourcing projects that are centred on a more traditional understanding of provenance.

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## **Appendix A. Material for Acquiring Object Biography Metadata**

This appendix contains the material that was prepared for conducting the exploratory study described in Chapter 3.

A1, A2, A3, A4, A5 and A6 were submitted to support the first application to the Human Research Ethics Committee, Faculty of Computing and Mathematical Sciences of the University. A7 was consequently received, dated 31 October 2017.

A8 and A9—the protocols of the first and second pilot sessions—were adapted from A5 and A3.

A10, A11, A12, A13, A14 and A15 were then submitted to support the second application that reflected the revisions made—highlighted in yellow—after the pilot sessions to the Human Research Ethics Committee. A16 was consequently received, dated 15 December 2017.

A17 recorded the process of conducting the two pilot sessions and revising study protocols.

# A1: Preliminary Ethics Application Form

Faculty of Computing and Mathematical Sciences

## FCMS Preliminary Ethics Application Form for Usability Studies, Surveys and Related Personal Data Gathering



Please note that older versions of Adobe Reader may not enable completed forms to be saved.

Please complete all sections of this form.

### General Applicant Details

Applicant's name: Can Zhao

Department:  Computer Science  
 Mathematics  
 Statistics  
 Other:

Email address: cz93@students.waikato.ac.nz

Phone number:

(Best number for contact during standard working hours)

Staff

Student

Supervisor's name: Dr David Nichols

Dissertation / thesis research

Code code: COMP900

Course assignment / project

Other:

Other:

**General Research Activity Details**

Short, descriptive title: A study to explore heritage resource information  
(<10 words)

Activity outline: The study aims at exploring the heritage resource information that a) the local galleries, libraries, archives and museums (GLAM) professionals presented and would consider presenting to visitors and patrons and, b) the local heritage experts could provide. The research method is interview.

In a paragraph describe the activity this application relates to, methods to be used, outcomes hoped for, and how it fits with a broader project (if applicable). The expected outcome is an understanding of the following from the perspective of the local GLAM professionals and heritage experts: a) identifying information of heterogeneous heritage resources that visitors and patrons could find interesting and might revisit and, b) presenting such information via geo-locations. This exploratory study forms a part of one of my PhD project milestones focussing on deriving a Linked Open Data (LOD) model primarily from the CIDOC Conceptual Reference Model (CIDOC CRM) and its compatible models to manipulate heritage resource data.

Approximate start date: October 2017

Expected activity duration involving subjects: 60 minutes for each interview session  
(i.e. excluding later analysis)

Expected overall completion date: September 2018  
(including analysis and reporting)

**Planned Approach** Field-based usability study Laboratory-based usability study Survey / Questionnaire Personal information / Data gathering

Other: The researcher plans to conduct semi-structured interviews. The venue should be a place with access to, a) for GLAM professionals, each institution's object records or, b) for heritage experts, each participant's archive. Before each interview, the researcher will confirm with the participant about the selection of 2 to 4 heritage items and/or sites that the interview will be centred around. During each interview, the researcher will ask a series of pre-defined questions and might follow up for more details. The participant will also perform a geo-location marking activity. The researcher will then analyse the data and report the results. For ensuring anonymity, the researcher will confirm with the participants to see if they are okay with the inclusion of information that might lead to identification (e.g. their quotes) before publishing the results (also see the response to "How can you ensure the anonymity of participants?" on p. 9).

## Faculty of Computing and Mathematical Sciences

- Data gathering from subject:  Computer activity, through software  
 AV recordings  
 Biometric data  
 Experimenter will monitor manually  
 Other:

Data gathering details: The researcher will record video and audio of each interview. The researcher will also manually record some keywords from the participants' responses for asking follow-up questions and maybe accelerating data analysis process. Therefore the researcher will gather the participants' verbal, gestural and facial expressions, as well as the written data created in performing the geo-location marking activity.

**Participants**Approximate number  
of participants:

- <5  
 6-10  
 11-20  
 21-50  
 >50

 There are specific requirements for choosing participants

Notes on numbers and requirements: The participants should be GLAM professionals or heritage experts with in-depth knowledge about the selected heritage resources and/or experience of communicating with their institution's visitors/patrons.

Recruitment method:

Personal contact  
 Advertisement

Online / Email

Other:

## Faculty of Computing and Mathematical Sciences

Will participants provide specific informed consent for their involvement in this study?

Yes  No

Signed paper form

Electronic form

How will participants be provided the necessary information about this study?

(See Participant Information Sheet)

Signed paper form

Electronically pushed

Electronically pulled

Other:

Will you have direct personal engagement with all participants?

Yes  No

Will participants' personal identification details (e.g. name, address, phone number, email, computer IP address or other personal ID) be recorded?

Yes  No

Details: For the recruitment purposes, the researcher may record the names, work email addresses and possibly work phone numbers of the potential participants.

Is there any compulsion and/or will participants/subjects receive any incentives for their involvement?

Yes  No

## Faculty of Computing and Mathematical Sciences

Can you ensure that an individual participant can withdraw after completing the activity but before the data is analysed and reported?  Yes  No

Does your study involve any contrived deception, for example withholding some relevant information from participants for the purpose of the study?  Yes  No

Is there a possibility that participants may incur, or have greater risk of, physical, psychological, social, economic or cultural harm as a result of being involved in this study?  Yes  No

**Reporting and Publication of Results**

How will the outcomes  
will be reported?

Published journal or conference paper

Thesis or dissertation

Limited circulation research report

Published working paper or research report

Course assignment

Popular press

Other:

Is it likely that individual participants could be identified from the published results?

Yes

No

How can you ensure the  
anonymity of participants?

The researcher will anonymise the participants as P1 to Pn in the published results. Due to the factors such as the selected item and/or sites for the study, the nature of work in the heritage field, etc., the participants might still get identified. The researcher will give the participants the right of refusal for including any information before publishing any results (also see p. 4).

Will the data obtained from the experiment will be made available publicly (e.g. through a public database)?

Yes

No

**Storage of Results**

Length of time data  
will be retained:

- Data will not be retained following the study
- <1 year
- 1-5 years
- >5 years

The gathered data  
will be stored in:

- Not applicable
- Faculty archive (safe)
- Computer archive – offline back up
- Computer archive – online or cloud
- Personal office
- Other:

Date: 09/10/2017  
(Required format: dd/mm/yyyy)

## **A2: Participant Information Sheet and Consent Form**

### *Participant Information Sheet*

Ethics Committee, Faculty of Computing and Mathematical Sciences, University of Waikato

### **Project Title**

*A study to explore heritage resource information*

### **Purpose**

This interview is conducted as partial requirement for the degree of Doctor of Philosophy at the University of Waikato.

### **What is this research project about?**

The study aims at exploring the heritage resource information that a) the local galleries, libraries, archives and museums (GLAM) professionals presented and would consider presenting to visitors and patrons and, b) the local heritage experts could provide.

### **What will you have to do and how long will it take?**

The researcher will want to interview you about how you identify heritage resource information that visitors and patrons could find interesting and might revisit. Part of this interview will involve watching you as you mark the geo-locations of each selected heritage resource on map. This interview should take no longer than *60 minutes*. The researcher may ask for relevant documents or sources accessible for this research. If you give consent, the audio and video of the interview may be recorded, and photos may be taken of your geo-location marking activity. You will be asked to give consent prior to the interview and may be asked to also give consent at a later stage.

### **What will happen to the information collected?**

The information collected will be used by the researcher to write research publications including the doctoral thesis. Only the researcher and supervisor will be privy to the notes, photos and recordings from the interview. Some of your responses might be quoted and a small number of the geo-location marking photos might be used in the publications. As these types of information might lead to identification due to the factors such as the selected item and/or sites for the study, the nature of work in the heritage field, etc., you will be contacted for confirming whether you agree to have such information included in any publications. You will not be named in the publications and every effort will be made to disguise your identity. The researcher will keep the notes, photos and recordings before the completion of the PhD and then archive the anonymised recording transcriptions, but will treat them with the strictest confidentiality.

### **Declaration to participants**

If you take part in the study, you have the right to:

- Refuse to answer any particular question and to withdraw from the study before 30 September 2018. If you wish to withdraw, contact the researcher, Can Zhao (cz93@students.waikato.ac.nz). You do not need to give any reasons for withdrawing from the study.
- Ask any further questions about the study that occurs to you during your participation.
- Be given access to a summary of findings from the study when it is concluded.

### **Who's responsible?**

If you have any questions or concerns about the project, either now or in the future, please feel free to contact either:

Researcher:

*Can Zhao*

*Department of Computer Science*

*University of Waikato*

*Private Bag 3105*

*Hamilton, New Zealand*

*Email: [cz93@students.waikato.ac.nz](mailto:cz93@students.waikato.ac.nz)*

Supervisor:

*Dr David Nichols*

*Department of Computer Science*

*University of Waikato*

*Private Bag 3105*

*Hamilton, New Zealand*

*Email: [david.nichols@waikato.ac.nz](mailto:david.nichols@waikato.ac.nz)*

*Research Consent Form*

Ethics Committee, Faculty of Computing and Mathematical Sciences, University of Waikato

***A study to explore heritage resource information***

**Consent Form for Participants**

I have read the **Participant Information Sheet** for this study and have had the details of the study explained to me. My questions about the study have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I also understand that I am free to withdraw from the study before **30 September 2018** or to decline to answer any particular questions in the study. I understand I can withdraw any information I have provided up until the researcher has commenced analysis on my data. I agree to provide information to the researchers under the conditions of confidentiality set out on the **Participant Information Sheet**.

I agree to participate in this study under the conditions set out in the **Participant Information Sheet**.

Signed: \_\_\_\_\_

Name: \_\_\_\_\_

Date: \_\_\_\_\_

**Additional Consent as Required**

I agree / do not agree to the use of audio and video recording of my responses.

If I agree to audio and video recording, then I understand that I may review the recording within three days of the interview and may withdraw the audio and video recording from the study. A withdrawn audio and video recording will be deleted.

I agree / do not agree to the use of photographs of me and/or artefacts present during the interview.

If I agree to photographs being taken, then I understand that I may review them at the end of the interview and withdraw any photograph from the study. Withdrawn photographs will be deleted.

Signed: \_\_\_\_\_

Name: \_\_\_\_\_

Date: \_\_\_\_\_

## Contact information:

## Researcher:

*Can Zhao*

*Department of Computer Science*

*University of Waikato*

*Private Bag 3105*

*Hamilton, New Zealand*

*Email: cz93@students.waikato.ac.nz*

## Supervisor:

*Dr David Nichols*

*Department of Computer Science*

*University of Waikato*

*Private Bag 3105*

*Hamilton, New Zealand*

*Email: david.nichols@waikato.ac.nz*

## A3: Provisional Protocol for Interviewing a Museum Curator

Participant ID:

- 2 items selected by the researcher:
  - 1. *Captain Hamilton's Sword*
  - 2. *Pearson's Carbolic Sand Soap*
- 1 to 2 items selected by the participant:
  - The items should match the following criteria as many as possible. Whether or not the selected items are directly related to 1 and/or 2 is at the discretion of the participant:
    - Studied
    - Related (i.e., if the participant selects 2 items, the items should be related)
    - Presented in their works
    - Varied in terms of classification (i.e., all the items selected by both the researcher and the participant should be varied)
    - Travelled internationally
  - Request the participant to provide the reasons of selecting the items and their basic information (i.e., what would be considered sufficient for their physical labels in an exhibition context).
  - Confirm the selection of items with the participant before the interview.
- Give and present the information of *Participant Information Sheet* and *Consent Form* to the participant. Request for their consent.

1. Could you tell us your duties as a Curator of Social History?

Note:

- Present 1, 2 and the items on a laptop/tablet or a printed piece of card/paper on cardboard.

2. What, if any, have you worked on or been working on that involves any or any combinations of 1, 2 and the items?

Note:

3. Could you show us the source of the information presented relating to any or any combinations of 1, 2 and the items in your works?

- Follow up any mentions or absence of *object record*, *archive*, *system* and *metadata*

Note:

- Remind the participant: Since we are discussing [3 or 4] items here, you could use [the term in the language of participant (e.g. object record, archive or system)] at any time.

4. Could you show us the information presented relating to any or any combinations of 1, 2 and the items in your works?

- If necessary, stimulate the participant with examples (e.g. the book - *Te Haerenga The Journey*, the exhibition - *A City Takes Shape - Glimpses of early Hamilton* held from December 2015 to February 2017)

Note:

5. From a professional perspective, what are the information of 1, 2 and the items that visitors could find interesting, both presented and not presented in your works?

- Follow up for why

- Follow up for why on any mentions of *interesting information that were not presented*
- Follow up any mentions or absence of *relatedness* and *approach/strategy of presenting information* (e.g. via *label, tour, book*, etc.)
- Follow up any mentions or absence of *related intangible heritage*
  - If necessary, clarify *intangible (cultural) heritage*: includes traditions or living expressions inherited from our ancestors and passed on to our descendants, such as oral traditions, performing arts, social practices, rituals, festive events, knowledge and practices concerning nature and the universe or the knowledge and skills to produce traditional crafts.
- If necessary, stimulate the participant with the photo of the plaque of the sculpture of Captain Hamilton, enquire the donation of Captain Hamilton's sword (by his family to the city in 1956, then transferred to the museum)
- If necessary, stimulate the participant with the photo of the the collection page of Captain Hamilton's British China War Medal, enquire the transfer of Captain Hamilton's British China War medal to museum (in 1973)

Note:

6. For the information of 1, 2 and the items presented in your works, what message have you wanted the visitors to take away with them?
- If necessary, clarify *take away*: to enable revisit to or use of the information in post-visit phase
  - Follow up for why
  - Follow up for how museum staff facilitates the visitors to take away any message
  - Follow up for any known results and why

Note:

7. What are the queries and feedback, if any, you have received from the visitors on 1, 2 and the items?
- Follow up any mentions or absence of the curator's/museum's *response*
  - Follow up for any known results of the communications and why

Note:

8. Let's perform an activity:
- Present the activity information on a laptop/tablet or a printed piece of card/paper on cardboard.
    - Please mark all the geo-locations of 1, 2 and the items that you could think of on this map.
    - Please distinguish two types of geo-locations:
      - Direct geo-locations: the places an item has *been*, and *when*;
      - Relevant geo-locations: other places that are *relevant* to an item, and if possible, *when*.
    - Please also write down, if possible, the remainder of the information to each geo-location (e.g. Captain Hamilton's sword was *made* by Ollivier and Brown, Sackville Street, London. *Edward Pearson left* a sample soap at the Waikato Times office on 26 May 1882.).
  - Take photos of the map when the participant completes the activity.

Note:

9. What would be another work that covers the information of 1, 2 and the items?
- Follow up for why on any mentions of *not possible* due to the fact that 1, 2 and the items are not directly related.

Note:

10. Leaving aside all the pragmatic issues, would you consider using item information made available by other galleries, libraries, archives and museums (GLAMs) or loaning items from other GLAMs relating to [any or any combinations of] 1, 2 and the items for [the name of the work given by the participant]?

Note:

11. How would you present the information of [any or any combinations of] 1, 2, the items and the other GLAMs' items in [the name of the work given by the participant]?

- Follow up any mentions or absence of *relatedness* and *approach/strategy of presenting information* (e.g. via *label, tour, book*, etc.)

Note:

12. For the information of [any or any combinations of] 1, 2, the items and the other GLAMs' items in [the name of the work given by the participant], what message would you want the visitors to take away with them?

- Follow up for why
- Follow up for how museum staff facilitates visitors to take away any message

Note:

13. Let's get back to the map. Could you add a new note/marker/pin to the geo-locations, of which the information are considered necessary for [the name of the work given by the participant]?

Note:

## A4: Provisional Protocol for Interviewing Other Curators and Librarians

Participant ID:

- 2 to 3 items selected by the participant:
    - The items should match the following criteria as many as possible:
      - Studied
      - Related
      - Presented in their works
      - Varied in terms of classification
      - Travelled internationally
    - Request the participant to provide the reasons of selecting the items and their basic information (i.e., what would be considered sufficient for their physical labels in an exhibition context).
    - Confirm the selection of items with the participant before the interview.
    - If necessary, the researcher should go and see the items in the context of any works they are incorporated into before the interview.
  - Give and present the information of *Participant Information Sheet* and *Consent Form* to the participant. Request for their consent.
1. Could you tell us your duties as a [the participant's role at their institution]?  
 Note:
    - Present the items on a laptop/tablet or a printed piece of card/paper on cardboard.
  2. What, if any, have you worked on or been working on that involves the items?  
 Note:
    - Remind the participant: Since we are discussing [2 to 3] items here, you could use [the term in the language of participant (e.g. object record, archive or system)] at any time.
  3. Could you show us the source of the information presented relating to the items in your works?
    - Follow up any mentions or absence of *object record, archive, system* and *metadata*
 Note:
    - Remind the participant: Since we are discussing [2 to 3] items here, you could use [the term in the language of participant (e.g. object record, archive or system)] at any time.
  4. Could you show us the information presented relating to the items in your works?
    - If necessary, stimulate the participant with examples
 Note:
    - Remind the participant: Since we are discussing [2 to 3] items here, you could use [the term in the language of participant (e.g. object record, archive or system)] at any time.
  5. From a professional perspective, what are the information of the items that [visitors or patrons] could find interesting, both presented and not presented in your works?
    - Follow up for why
    - Follow up for why on any mentions of *interesting information that were not presented*
    - Follow up any mentions or absence of *relatedness* and *approach/strategy of presenting information* (e.g. via *label, tour, book*, etc.)
    - Follow up any mentions or absence of *related intangible heritage*
      - If necessary, clarify *intangible (cultural) heritage*: includes traditions or living expressions inherited from our ancestors and passed on to our descendants, such as oral traditions, performing arts, social practices,

rituals, festive events, knowledge and practices concerning nature and the universe or the knowledge and skills to produce traditional crafts.

Note:

6. For the information of **the items** presented in your works, what message have you wanted the [visitors or patrons] to take away with them?
- If necessary, clarify *take away*: to enable revisit to or use of the information in post-visit phase
  - Follow up for why
  - Follow up for how museum or library staff facilitates the [visitors or patrons] to take away any message
  - Follow up for any known results and why

Note:

7. What are the queries and feedback, if any, you have received from the [visitors or patrons] on **the items**?
- Follow up any mentions or absence of the curator's/museum's *response*
  - Follow up for any known results of the communications and why

Note:

8. Let's perform an activity:
- Present the activity information on a laptop/tablet or a printed piece of card/paper on cardboard.
    - Please mark all the geo-locations of **the items** that you could think of on this map.
    - Please distinguish two types of geo-locations:
      - Direct geo-locations: the places an item has *been*, and *when*;
      - Relevant geo-locations: other places that are *relevant* to an item, and if possible, *when*.
    - Please also write down, if possible, the remainder of the information to each geo-location.

Note:

9. What would be another work that covers the information of **the items**?
- Follow up for why on any mentions of *not possible* due to the fact that **the items** are not directly related.

Note:

10. Leaving aside all the pragmatic issues, would you consider using item information made available by other galleries, libraries, archives and museums (GLAMs) or loaning items from other GLAMs relating to [any or any combinations of] **the items** for [the name of the work given by the participant]?

Note:

11. How would you present the information of **the item(s)** and the other GLAMs' items in [the name of the work given by the participant]?
- Follow up any mentions or absence of *relatedness* and *approach/strategy of presenting information* (e.g. via *label*, *tour*, *book*, etc.)

Note:

12. For the information of the item(s) and the other GLAMs' items in [the name of the work given by the participant], what message would you want the [visitors or patrons] to take away with them?

- Follow up for why
- Follow up for how museum staff facilitates [visitors or patrons] to take away any message

Note:

13. Let's get back to the map. Could you add a new note/marker/pin to the geo-locations, of which the information are considered necessary for [the name of the work given by the participant]?

Note:

## A5: Provisional Protocol for Interviewing Heritage Experts

Participant ID:

- 2 to 3 items and/or sites selected by the participant:
  - The items and/or sites should match the following criteria as many as possible:
    - Studied
    - Related
    - Presented in their outcomes
    - Varied in terms of classification
    - Travelled internationally (for any selected sites, this would mean there are other places *relevant* to them)
  - Request the participant to provide the reasons of selecting the items and/or sites and their basic information (i.e., what would be considered sufficient for their physical labels in an exhibition context).
  - Confirm the selection of items and/or sites with the participant before the interview.
  - If necessary, the researcher should go and see the items in the context of any works they are incorporated into before the interview.
- Give and present the information of *Participant Information Sheet* and *Consent Form* to the participant. Request for their consent.

1. Could you tell us your experience centred on heritage items and/or sites?

Note:

- Present the items and/or sites on a laptop/tablet or a printed piece of card/paper on cardboard.

2. What, if any, have you studied or been studying that involves the items and/or sites?

Note:

3. Could you show us the outcomes of your studies relating to the items and/or sites?

- Follow up any mentions or absence of *the information of the item(s) and/or site(s)*

Note:

- Remind the participant: Since we are discussing [2 to 3] items and/or sites here, you could use [the term in the language of participant (e.g. object record, note, document or archive)] at any time.

4. From an expert perspective, what are the information of the items and/or sites that visitors and/or readers could find interesting, both presented and not presented in your outcomes?

- Follow up for why
- Follow up any mentions or absence of *relatedness* and *approach/strategy of presenting information* (e.g. via *label, tour, book*, etc.)
- Follow up any mentions or absence of *related intangible heritage*.
  - If necessary, clarify *intangible (cultural) heritage*: includes traditions or living expressions inherited from our ancestors and passed on to our descendants, such as oral traditions, performing arts, social practices, rituals, festive events, knowledge and practices concerning nature and the universe or the knowledge and skills to produce traditional crafts.

Note:

5. NOTE - this question may not apply to all the participants (e.g. those with no experience in presenting information to and communicating with visitors and/or readers)

For the information of the items and/or sites presented to the visitors and/or readers, what message have you wanted them to take away?

- If necessary, clarify *take away*: to enable revisit to or use of the information in post-visit phase
- Follow up for why
- Follow up for how heritage experts facilitate the visitors and/or readers to take away any message
- Follow up for any known results and why

Note:

6. NOTE - this question may not apply to all the participants (e.g. those with no experience in presenting information to and communicating with visitors and/or readers)

What are the queries and feedback, if any, you have received from the visitors and/or readers on the items and/or sites?

- Follow up any mentions or absence of heritage expert's/organisation's *response*
- Follow up for any known results of the communications and why

Note:

7. Let's perform an activity:

- Please mark all the geo-locations of the items and/or sites that you could think of on this map.
- Please distinguish two types of geo-locations:
  - Direct geo-locations: the places an item has *been*, and *when*;
  - Relevant geo-locations: other places that are *relevant* to an item/site, and if possible, *when*.
- Please also write down, if possible, the remainder of the information to each geo-location.

Note:

8. NOTE - this question may not apply to all the participants (e.g. those with no experience in presenting information to visitors and/or readers)

What would be a work that covers the information of the items and/or sites?

Note:

9. NOTE - this question may only apply to the participants who were chosen to respond to Q8  
Leaving aside all the pragmatic issues, would you consider using information of items made available by galleries, libraries, archives and museums (GLAMs) relating to the items and/or sites for [the name of the work given by the participant]?

Note:

10. NOTE - this question may only apply to the participants who were chosen to respond to Q8  
How would you present the information of the items and/or sites and the other GLAMs' items in [the name of the work given by the participant]?

- Follow up any mentions or absence of *relatedness* and *approach/strategy of presenting information* (e.g. via *label, tour, book*, etc.)

Note:

11. NOTE - this question may only apply to the participants who were chosen to respond to Q8

For the information of the items and/or sites and the other GLAMs' items in [the name of the work given by the participant], what message would you want the visitors and/or readers to take away with them?

- Follow up for why
- Follow up for how heritage experts facilitate the visitors and/or readers to take away any message

Note:

12. NOTE - this question may only apply to the participants who were chosen to respond to Q8  
Let's get back to the map. Could you add a new note/marker/pin to the geo-locations, of which the information are considered necessary for [the name of the work given by the participant]?

Note:

## A6: Participant Information Form

<i>ID</i>	<i>Name</i>	<i>Profession &amp; Institution</i>	<i>Time</i>	<i>Venue</i>	<i>Note</i>
P1					
P2					
P3					
P4					
P5					
P6					
P7					
P8					
P9					
P10					

## A7: Approval Letter to First Ethics Application

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31 October 2017

Can Zhao

C/- Department of Computer Science  
**THE UNIVERSITY OF WAIKATO**

Dear Can

### **Request for approval to conduct a user study with human participants**

On the basis of the information you have provided on the FCMS Preliminary Ethics Application Form relating to your COMP 900 research "A study to explore heritage resource information" the Committee has given you approval to proceed with your proposed study.

We wish you well with your research.



**Mark Apperley**  
Human Research Ethics Committee  
Faculty of Computing and Mathematical Sciences

## A8: Protocol for the First Pilot Session

Participant ID:

- Give and present the information of *Participant Information Sheet* and *Consent Form* to the participant. Request for their consent.
1. Could you tell us your experience centred on academic visit/travelling for your academic work?
 

*Note:*
  2. What was the outcome of your academic visits?
    - Follow up any mentions or absence of *the information of the outcome(s)/the item(s)*

*Note:*

    - Remind the participant: Since our discussion might relate to multiple outcomes/items, you could use the PC or any note on hand at any time.
  3. Let's perform an activity:
    - Present the activity information on a laptop/tablet or a printed piece of card/paper on cardboard.
      - Please mark maximum 10 places that you could think of on these maps, you could choose any maps that match your experience.
      - Please distinguish two types of geo-locations:
        - Direct geo-locations: maximum 5 places you have *been*, and *when*;
        - Relevant geo-locations: other places that you plan/would like to go, each is *relevant* to minimum one place you have been.
      - Please also write down, if possible, the remainder of the information to each geo-location (e.g. purposes, other people you have met, etc.).

*Note:*

    - Take photos of the map when the participant completes the activity.
  4. What were the visits that you found interesting, could be the entirety or any part of it?
    - Follow up for why
    - Follow up any mentions or absence of *relatedness*

*Note:*
  5. Have you shared the particular experiences with other people? Any other visit experiences that you shared with other people?
    - Follow up for why
    - Follow up for any *interesting responses* and why

*Note:*
  6. What would be a collection of yours that covers the information you presented on the map(s)?
 

*Note:*
  7. Leaving aside all the pragmatic issues, would you consider using related information of any outcome made available by relevant institutions or organisations (e.g. official record, keynote

speech on Youtube, etc.) for your (particular) collection/[the name of the collection given by the participant]?

Note:

8. How would you present the information you presented on the maps and the related information of any outcome made available by relevant institutions or organisations in your (particular) collection/[the name of the collection given by the participant]?

- Follow up any mentions or absence of *relatedness* and *approach/strategy of presenting information* (e.g. via *label, tour, book*, etc.)

Note:

9. OPTIONAL - For the information presented in your (particular) collection/[the name of the collection given by the participant], which part would you want to share with other people?

- Follow up for why

Note:

## A9: Protocol for the Second Pilot Session

Participant ID:

- 2 artefacts selected by the participant.
    - The artefacts should match the following criteria:
      - Travelled internationally
      - Varied in terms of classification (the respective classifications of the artefacts are at the participant's discretion)
      - Related (i.e., 1) they are related to each other in a way and, 2) they are related to the participant's interest or work)
      - Enquired or received feedback (e.g., other people showed their interest in the artefacts, or asked questions about them)
    - Request the participant to provide the reasons of selecting the artefacts as per the criteria and their basic information (a museum exhibit label-level amount of metadata would be sufficient).
    - Confirm the selection of items with the participant before the interview.
  - Put the maps facing up.
  - Introduce the study in a casual manner.
  - Request the participant before the interview: since our discussion will centre around the selected artefacts, please get the relevant information on hand. If it is necessary, please log into the computer and relevant system. You could use the information at any time during the interview.
  - Give and present the information of *Participant Information Sheet* and *Consent Form* to the participant. Request for their consent.
1. Could you tell us how did you meet/create these two artefacts?  
 Note:
    - Present the brief information of the artefacts on a piece of paper.
  2. Which, if any, part of your daily life have the artefacts involved in?  
 Note:
    - Present the activity information on a piece of paper.
      - Please mark all the geo-locations relating to each of the artefacts, you could choose any maps available here.
      - Please distinguish two types of geo-locations if both of them apply:
        - Direct geo-locations: the places an artefact has *been*, and *when*;
        - Relevant geo-locations: other places that are *relevant* to an artefact, and if applicable, *when*.
      - Please also write down, if possible, the *context* associated with each geo-location.
    - Before performing the activity, notify the participant that I need to make some change to the camera's position and its focal length.
    - Upon completion and before the participant's interpretation, follow up: what is your understanding of *context*?
    - Follow up any mentions or absence of gap in biographies: what do we know in between [geo-location A] and [geo-location B]?

Note: *context* -

- After the interpretation, take photos of the map(s) and notes. Return the camera and its setting to the previous conditions.

4. (I suppose there were some people got to see the artefacts) How did the people who got to see the artefacts (they) meet them (the artefacts)? Would you bring up any information relating to the artefacts to the people (them), or would the people (they) ask for information relating to the artefacts, or a mix of both?

Note:

5. From the owner's perspective, what are the information of the artefacts that other people could find interesting, both brought up previously and not yet?

- Follow up the "about"/subject of each piece of the interested information (e.g. context, intangible heritage\*, etc.)

\* Traditions or living expressions inherited from our ancestors and passed on to our descendants, such as oral traditions, performing arts, social practices, rituals, festive events, knowledge and practices concerning nature and the universe or the knowledge and skills to produce traditional crafts.

- Follow up any mentions or absence of *relatedness*
- Follow up any mentions or absence of *interesting information that were not brought up previously*
- Follow up for why

1.			
about	relatedness	b.u.	why
2.			
3.			
4.			
5.			

--	--	--	--

Any other relevant information presented to the people who got to see the artefacts?

- Follow up any mentions or absence of *context*: are these information considered as *context*? / could this be counted as *context*?
- Follow up any mentions or absence of *relatedness*

Note:

7. For the information of the artefacts brought up previously, any message have you wanted the people who got to see the artefacts to take away with them?

- If necessary, clarify *take away*: to enable use of the information in post-visit phase
- Follow up for why
- Follow up for how, if any the participant facilitates the people to take away any message
- Follow up for any known results and why

Note:

8. What are the feedback, if any, you have received from the people who got to see the artefacts?

- Follow up any mentions or absence of the participant's *response*
- Follow up for any known results of the communications and why

Note:

# A10: Revised Preliminary Ethics Application Form

Faculty of Computing and Mathematical Sciences

## FCMS Preliminary Ethics Application Form for Usability Studies, Surveys and Related Personal Data Gathering



Please note that older versions of Adobe Reader may not enable completed forms to be saved.

Please complete all sections of this form.

### General Applicant Details

Applicant's name: Can Zhao

Department:  Computer Science  
 Mathematics  
 Statistics  
 Other:

Email address: cz93@students.waikato.ac.nz

Phone number:

(Best number for contact during standard working hours)

**Applicant Status**

Staff

Student

Supervisor's name: Dr David Nichols

Dissertation / thesis research

Code code: COMP900

Course assignment / project

Other:

Other:

**General Research Activity Details**

Short, descriptive title: A study to explore heritage resource information  
(<10 words)

Activity outline: The study aims at exploring the heritage resource information that a) the local galleries, libraries, archives and museums (GLAM) professionals, b) the local heritage experts and c) enthusiastic amateurs presented and would consider presenting or could provide to visitors, patrons, readers, etc. The research method is interview.

In a paragraph describe the activity this application relates to, methods to be used, outcomes hoped for, and how it fits with a broader project (if applicable). The expected outcome is an understanding of the following from the perspective of the local GLAM professionals, heritage experts and enthusiastic amateurs: a) identifying information of heterogeneous heritage resources that visitors and patrons could find interesting and might revisit and, b) presenting such information via geo-locations.

This exploratory study forms a part of one of my PhD project milestones focussing on deriving a Linked Open Data (LOD) model from the relevant metadata schemas or ontologies (e.g. CIDOC Conceptual Reference Model (CIDOC CRM)) to manipulate heritage resource data.

Approximate start date: January 2018

Expected activity duration involving subjects: 60 minutes for each interview session  
(i.e. excluding later analysis)

Expected overall completion date: September 2018  
(including analysis and reporting)

**Planned Approach** Field-based usability study Laboratory-based usability study Survey / Questionnaire Personal information / Data gathering

Other: The researcher plans to conduct semi-structured interviews. The venue should be a place with access to, a) for GLAM professionals, each institution's object records or, b) for heritage experts and enthusiastic amateurs, each participant's archive. Before each interview, the researcher will confirm with the participant about the selection of 2 to 4 heritage items and/or sites that the interview will be centred around. During each interview, the researcher will ask a series of pre-defined questions and might follow up for more details. The participant will also perform a geo-location marking activity. The researcher will then analyse the data and report the results. For ensuring anonymity, the researcher will confirm with the participants to see if they are okay with the inclusion of information that might lead to identification (e.g. their quotes) before publishing the results (also see the response to "How can you ensure the anonymity of participants?" on p. 9).

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- Data gathering from subject:  Computer activity, through software
- AV recordings
- Biometric data
- Experimenter will monitor manually
- Other:

Data gathering details: The researcher will record video and audio of each interview. The researcher will also manually record some keywords from the participants' responses for asking follow-up questions and maybe accelerating data analysis process. Therefore the researcher will gather the participants' verbal, gestural and facial expressions, as well as the written data created in performing the geo-location marking activity.

**Participants**Approximate number  
of participants:

- <5  
 6-10  
 11-20  
 21-50  
 >50

 There are specific requirements for choosing participants

Notes on numbers and requirements: The participants should be GLAM professionals, heritage experts and enthusiastic amateurs with in-depth knowledge about the selected heritage resources and/or experience of communicating with visitors, patrons, readers, etc.

Recruitment method:

Personal contact  
 Advertisement

 Online / Email Other:

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Will participants provide specific informed consent for their involvement in this study?

Yes  No

Signed paper form

Electronic form

How will participants be provided the necessary information about this study?

Signed paper form

Electronically pushed

Electronically pulled

(See Participant Information Sheet)

Other:

Will you have direct personal engagement with all participants?

Yes  No

Will participants' personal identification details (e.g. name, address, phone number, email, computer IP address or other personal ID) be recorded?

Yes  No

Details: For the recruitment purposes, the researcher may record the names, work email addresses and possibly work phone numbers of the potential participants.

Is there any compulsion and/or will participants/subjects receive any incentives for their involvement?

Yes  No

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Can you ensure that an individual participant can withdraw after completing the activity but before the data is analysed and reported?  Yes  No

Does your study involve any contrived deception, for example withholding some relevant information from participants for the purpose of the study?  Yes  No

Is there a possibility that participants may incur, or have greater risk of, physical, psychological, social, economic or cultural harm as a result of being involved in this study?  Yes  No

**Reporting and Publication of Results**

How will the outcomes  
will be reported?

Published journal or conference paper

Thesis or dissertation

Limited circulation research report

Published working paper or research report

Course assignment

Popular press

Other:

Is it likely that individual participants could be identified from the published  
results?

Yes

No

How can you ensure the  
anonymity of participants?

The researcher will anonymise the participants as P1 to Pn in the published  
results. Due to the factors such as the selected item and/or sites for the study, the  
nature of work in the heritage field, etc., the participants might still get identified.  
The researcher will give the participants the right of refusal for including any  
information before publishing any results (also see p. 4).

Will the data obtained from the experiment will be made available publicly  
(e.g. through a public database)?

Yes

No

**Storage of Results**

Length of time data  
will be retained:

- Data will not be retained following the study
- <1 year
- 1-5 years
- >5 years

The gathered data  
will be stored in:

- Not applicable
- Faculty archive (safe)
- Computer archive – offline back up
- Computer archive – online or cloud
- Personal office
- Other:

Date: 08/12/2017

(Required format: dd/mm/yyyy)

# A11: Revised Participant Information Sheet and Consent Form

## *Participant Information Sheet*

Ethics Committee, Faculty of Computing and Mathematical Sciences, University of Waikato

### **Project Title**

*A study to explore heritage resource information*

### **Purpose**

This interview is conducted as partial requirement for the degree of Doctor of Philosophy at the University of Waikato.

### **What is this research project about?**

The study aims at exploring the heritage resource information that a) the local galleries, libraries, archives and museums (GLAM) professionals, b) the local heritage experts and c) enthusiastic amateurs presented and would consider presenting or could provide to visitors, patrons, readers, etc.

### **What will you have to do and how long will it take?**

The researcher will want to interview you about how you identify heritage resource information that visitors, patrons, readers, etc. could find interesting and might revisit. Part of this interview will involve watching you as you mark the geo-locations of each selected heritage resource on map. This interview should take no longer than *60 minutes*. The researcher may ask for relevant documents or sources accessible for this research. If you give consent, the audio and video of the interview may be recorded, and photos may be taken of your geo-location marking activity. You will be asked to give consent prior to the interview and may be asked to also give consent at a later stage.

### **What will happen to the information collected?**

The information collected will be used by the researcher to write research publications including the doctoral thesis. Only the researcher and supervisor will be privy to the notes, photos and recordings from the interview. Some of your responses might be quoted and a small number of the geo-location marking photos might be used in the publications. As these types of information might lead to identification due to the factors such as the selected item and/or sites for the study, the nature of work in the heritage field, etc., you will be contacted for confirming whether you agree to have such information included in any publications. You will not be named in the publications and every effort will be made to disguise your identity. The researcher will keep the notes, photos and recordings before the completion of the PhD and then archive the anonymised recording transcriptions, but will treat them with the strictest confidentiality.

### **Declaration to participants**

If you take part in the study, you have the right to:

- Refuse to answer any question and to withdraw from the study before 30 September 2018. If you wish to withdraw, contact the researcher, Can Zhao (cz93@students.waikato.ac.nz). You do not need to give any reasons for withdrawing from the study.
- Ask any further questions about the study that occurs to you during your participation.
- Be given access to a summary of findings from the study when it is concluded.

### **Who's responsible?**

If you have any questions or concerns about the project, either now or in the future, please feel free to contact either:

**Researcher:**

*Can Zhao  
Department of Computer Science  
University of Waikato  
Private Bag 3105  
Hamilton, New Zealand  
Email: cz93@students.waikato.ac.nz*

**Supervisor:**

*Dr David Nichols  
Department of Computer Science  
University of Waikato  
Private Bag 3105  
Hamilton, New Zealand  
Email: david.nichols@waikato.ac.nz*

*Research Consent Form*

Ethics Committee, Faculty of Computing and Mathematical Sciences, University of Waikato

***A study to explore heritage resource information*****Consent Form for Participants**

I have read the **Participant Information Sheet** for this study and have had the details of the study explained to me. My questions about the study have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I also understand that I am free to withdraw from the study before **30 September 2018** or to decline to answer any question in the study. I understand I can withdraw any information I have provided up until the researcher has commenced analysis on my data. I agree to provide information to the researchers under the conditions of confidentiality set out on the **Participant Information Sheet**.

I agree to participate in this study under the conditions set out in the **Participant Information Sheet**.

Signed: \_\_\_\_\_

Name: \_\_\_\_\_

Date: \_\_\_\_\_

**Additional Consent as Required**

I agree / do not agree to the use of audio and video recording of my responses.

If I agree to audio and video recording, then I understand that I may review the recording within three days of the interview and may withdraw the audio and video recording from the study. Withdrawn audio and video recordings will be deleted.

I agree / do not agree to the use of photographs of me and/or artefacts present during the interview.

If I agree to photographs being taken, then I understand that I may review them at the end of the interview and withdraw any photograph from the study. Withdrawn photographs will be deleted.

Signed: \_\_\_\_\_

Name: \_\_\_\_\_

Date: \_\_\_\_\_

## Contact information:

## Researcher:

*Can Zhao*

*Department of Computer Science*

*University of Waikato*

*Private Bag 3105*

*Hamilton, New Zealand*

*Email: cz93@students.waikato.ac.nz*

## Supervisor:

*Dr David Nichols*

*Department of Computer Science*

*University of Waikato*

*Private Bag 3105*

*Hamilton, New Zealand*

*Email: david.nichols@waikato.ac.nz*

## A12: Revised Protocol for Interviewing a Museum Curator

Participant ID:

- 2 items selected by the researcher:
    - 1. *Captain Hamilton's Sword* (Museum Accession No.: 1973/39/1.1-3)
    - 2. *Pearson's Carbolic Sand Soap* (Museum Accession No.: 1979/29/3)
  - 1 to 2 items selected by the participant:
    - The items should match the following criteria as many as possible:
      - Studied
      - Related (i.e., if the participant selects 2 items, the items should be related to each other or at least 1 item should be related to either 1 or 2. If the participant selects 1 item, the item should be related to either 1 or 2. The interpretation of *relatedness* is at the participant's discretion)
      - Presented in their works
      - Enquired or received feedback
      - Varied in terms of *classification* (i.e., all the items should be varied, each item's *classification* is at the participant's discretion)
      - Travelled internationally
    - Request the participant to provide the reasons for selecting the items as per the criteria and the metadata/record of each item including 1 and 2 selected by the researcher.
    - Confirm the selection of items with the participant before the interview.
  - Introduce the study in a casual manner.
  - Request the participant before the interview: since our discussion will centre around 1, 2 and the items, please get the information used for presenting any of these items (in your works) on hand. If necessary, please log into the relevant system. You could use the information at any time during the interview.
  - Give and present the information of *Participant Information Sheet* and *Consent Form* to the participant. Request for their consent.
1. Could you tell us your duties as a Curator of Social History?
 

Note:

    - Present the brief information of 1, 2 and the items on a piece of paper.
  2. What have you worked on or been working on that involves any or any combinations of 1, 2 and the items?
 

Note:
  3. Besides the object record/metadata we have requested, are there any other information sources (bibliography) used for presenting any or any combinations of 1, 2 and the items in your works?
    - Follow up any mentions or absence of *object record*, *archive*, *system* and *metadata*

Note:
  4. Let's perform an activity:
    - Present the activity information on a piece of paper.
      - Please mark all the geo-locations relating to 1, 2 and the items that you could think of on any or multiple maps available here.
      - Please distinguish two types of geo-locations:
        - Direct geo-locations: the places an item has *been*, and *when*;

- Relevant geo-locations: other places that are *relevant* to an item, and if applicable, *when*.
- Please also write down, if possible, the *context* associated with each geo-location.

- Before performing the activity, notify the participant that I need to make some change to the camera's position and its focal length.
- Upon completion and before the participant's interpretation, follow up: what is your understanding of *context*?
- Follow up any mentions or absence of gap in biographies: what do we know in between [geo-location A] and [geo-location B]?

Note:

- After the interpretation, take photos of the map(s)

5. Could you show us the information presented relating to any or any combinations of 1, 2 and the items in your works?

- Follow up any mentions or absence of *context*: are there any (other) information considered as *context*? / could you show us the information considered as *context*? / could this be counted as *context*?
- If necessary, stimulate the participant with examples (e.g. the book - *Te Haerenga The Journey*, the exhibition - *A City Takes Shape - Glimpses of early Hamilton* held from December 2015 to February 2017)

Note:

6. From a professional perspective, what are the information of 1, 2 and the items that visitors could find interesting, both presented and not presented in your works?

- Follow up any mentions or absence of *relatedness & approach/strategy of presenting information* (e.g. via *label, tour, book*, etc.)
- Follow up any mentions or absence of *interesting information that were not presented & why*
- Follow up for why
- If necessary, stimulate the participant with the photo of the plaque of the sculpture of Captain Hamilton, enquire the donation of Captain Hamilton's sword (by his family to the city in 1954?/1956?, then transferred to the museum)

Note:

7. For the information of 1, 2 and the items presented in your works, what message have you wanted the visitors to take away with them?

- If necessary, clarify *take away*: to enable revisit to or use of the information in post-visit phase
- Follow up for why
- Follow up for how museum staff facilitates the visitors to take away any message
- Follow up for any known results and why

Note:

8. What are the queries and feedback, if any, you have received from the visitors on 1, 2 and the items?

- Follow up any mentions or absence of the curator's/museum's *response*
- Follow up for any known results of the communications and why

Note:

9. What would be another work that covers the information of any combination of 1, 2 and the items?

- Follow up for why

Note:

10. Leaving aside all the pragmatic issues, would you consider using item information made available by other galleries, libraries, archives and museums (GLAMs) or loaning items from other GLAMs relating to [any or any combinations of 1, 2 and the items for [the name of the work given by the participant]]?

- Follow up for examples

Note:

11. How would you present the information of [the combination of 1, 2, the items] and from other GLAMs in [the name of the work given by the participant]?

- Follow up any mentions or absence of *relatedness* and *approach/strategy of presenting information* (e.g. via *label, tour, book*, etc.)

Note:

12. For the information (of [the combination of 1, 2 and the items] and from other GLAMs) in [the name of the work given by the participant], what message would you want the visitors to take away with them?

- Follow up for why
- Follow up for how museum staff facilitates visitors to take away any message

Note:

## A13: Revised Protocol for Interviewing Other Curators and Librarians

Participant ID:

- 2 to 3 items selected by the participant:
    - The items should match the following criteria as many as possible:
      - Studied
      - Related (the interpretation of *relatedness* is at the participant's discretion)
      - Presented in their works
      - Enquired or received feedback
      - Varied in terms of *classification* (i.e., all the items should be varied, each item's *classification* is at the participant's discretion)
      - Travelled internationally
    - Request the participant to provide the reasons for selecting the items as per the criteria and the metadata/record of each item.
    - If necessary, the researcher should go and see the items in the context of any works they are incorporated into before the interview.
    - Confirm the selection of items with the participant before the interview.
  - Introduce the study in a casual manner.
  - Request the participant before the interview: since our discussion will centre around the items, please get the information used for presenting any of these items (in your works) on hand. If necessary, please log into the relevant system. You could use the information at any time during the interview.
  - Give and present the information of *Participant Information Sheet* and *Consent Form* to the participant. Request for their consent.
1. Could you tell us your duties as a [the participant's role at their institution]?
- Note:
- Present the brief information of the items on a piece of paper.
2. What have you worked on or been working on that involves the items?
- Note:
3. Besides the object record/metadata we have requested, are there any other information sources (bibliography) used for presenting the items in your works?
    - Follow up any mentions or absence of *object record*, *archive*, *system* and *metadata*
- Note:
4. Let's perform an activity:
    - Present the activity information on a piece of paper.
      - Please mark all the geo-locations relating to each item that you could think of on any or multiple maps available here.
      - Please distinguish two types of geo-locations:
        - Direct geo-locations: the places an item has *been*, and *when*;
        - Relevant geo-locations: other places that are *relevant* to an item, and if applicable, *when*.
      - Please also write down, if possible, the context associated with each geo-location.

- Before performing the activity, notify the participant that I need to make some change to the camera's position and its focal length.
- Upon completion and before the participant's interpretation, follow up: what is your understanding of *context*?
- Follow up any mentions or absence of gap in biographies: what do we know in between [geo-location A] and [geo-location B]?

Note:

- After the interpretation, take photos of the map(s) and notes. Return the camera and its setting to the previous conditions.

5. Could you show us the information presented relating to the items in your works?
  - Follow up any mentions or absence of *context*: are there any (other) information considered as *context*? / could you show us the information considered as *context*? / could this be counted as *context*?
  - If necessary, stimulate the participant with examples

Note:

6. From a professional perspective, what are the information of the items that [visitors or patrons] could find interesting, both presented and not presented in your works?
  - Follow up any mentions or absence of *relatedness & approach/strategy of presenting information* (e.g. via *label, tour, book*, etc.)
  - Follow up any mentions or absence of *interesting information that were not presented & why*
  - Follow up for why

Note:

7. For the information of the items presented in your works, what message have you wanted the [visitors or patrons] to take away with them?
  - If necessary, clarify *take away*: to enable revisit to or use of the information in post-visit phase
  - Follow up for why
  - Follow up for how museum or library staff facilitates the [visitors or patrons] to take away any message
  - Follow up for any known results and why

Note:

8. What are the queries and feedback, if any, you have received from the [visitors or patrons] on the items?
  - Follow up any mentions or absence of the [curator's or librarian's] / [museum's or library's] *response*
  - Follow up for any known results of the communications and why

Note:

9. What would be another work that covers the information of any combinations of the items?
  - Follow up for *why*

Note:

10. Leaving aside all the pragmatic issues, would you consider using item information made available by other galleries, libraries, archives and museums (GLAMs) or loaning items from other

GLAMs relating to [any or any combinations of] the items for [the name of the work given by the participant]?

- Follow up for examples

Note:

11. How would you present the information of the combination of [the items] and from other GLAMs in [the name of the work given by the participant]?

- Follow up any mentions or absence of *relatedness* and *approach/strategy of presenting information* (e.g. via *label, tour, book*, etc.)

Note:

12. For the information (of the combination of [the items] and from other GLAMs) in [the name of the work given by the participant], what message would you want the [visitors or patrons] to take away with them?

- Follow up for why
- Follow up for how [museum or library] staff facilitates [visitors or patrons] to take away any message

Note:

## A14: Revised Protocol for Interviewing Heritage Experts

Participant ID:

- 2 to 3 items and/or sites selected by the participant:
    - The items and/or sites should match the following criteria as many as possible:
      - Studied
      - Related (the interpretation of *relatedness* is at the participant's discretion)
      - Presented in their outcomes
      - Enquired or received feedback (e.g., other people showed their interest in the items, or asked questions about them)
      - Varied in terms of *classification* (i.e., all the items should be varied, each item's *classification* is at the participant's discretion)
      - Travelled internationally (for any selected sites, this would mean there are other items and/or places *relevant* to them)
    - Request the participant to provide the reasons for selecting the items as per the criteria and the metadata/record of each item.
    - If necessary, the researcher should go and see the items in the context of any works they are incorporated into before the interview.
    - Confirm the selection of items with the participant before the interview.
  - Introduce the study in a casual manner.
  - Request the participant before the interview: since our discussion will centre around the items and/or sites, please get the information used for presenting any of these items (in your works) on hand. If necessary, please log into the relevant system. You could use the information at any time during the interview.
  - Give and present the information of *Participant Information Sheet* and *Consent Form* to the participant. Request for their consent.
1. Could you tell us your experience centred on heritage items and/or sites?
 

Note:

    - Present the brief information of the items and/or sites on a piece of paper.
  2. What have you studied or been studying that involves the items and/or sites? What are the outcomes?
 

Note:
  3. Besides the object record/metadata we have requested, are there any other information sources (bibliography) used for presenting the items and/or sites in your outcomes?
    - Follow up any mentions or absence of *object record*, *archive*, *system* and *metadata*

Note:
  4. Let's perform an activity:
    - Present the activity information on a piece of paper.
      - Please mark all the geo-locations relating to each of the items and/or sites that you could think of on any or multiple maps available here.
      - Please distinguish two types of geo-locations:
        - Direct geo-locations: the places an item/component of a site has *been*, and *when*;
        - Relevant geo-locations: other places that are *relevant* to an item/site, and if *applicable*, *when*.
      - Please also write down, if possible, the *context* associated with each geo-location.

- Before performing the activity, notify the participant that I need to make some change to the camera's position and its focal length.
- Upon completion and before the participant's interpretation, follow up: what is your understanding of *context*?
- Follow up any mentions or absence of gap in biographies: what do we know in between [geo-location A] and [geo-location B]?

Note:

- After the interpretation, take photos of the map(s) and notes. Return the camera and its setting to the previous conditions.

5. Could you show us the information presented relating to the items and/or sites in your outcomes?

- Follow up any mentions or absence of *context*: are there any (other) information considered as *context*? / could you show us the information considered as *context*? / could this be counted as *context*?
- If necessary, stimulate the participant with examples

Note:

6. From an expert perspective, what are the information of the items and/or sites that [visitors or readers] could find interesting, both presented and not presented in your works?

- Follow up any mentions or absence of *relatedness & approach/strategy of presenting information* (e.g. via *label, tour, book*, etc.)
- Follow up any mentions or absence of *interesting information that were not presented & why*
- Follow up for why

Note:

7. For the information of the items and/or sites presented in your outcomes, what message have you wanted the [visitors or readers] to take away with them?

- If necessary, clarify *take away*: to enable revisit to or use of the information in post-visit phase
- Follow up for why
- Follow up for how the heritage experts facilitate the [visitors or readers] to take away any message
- Follow up for any known results and why

Note:

8. What are the queries and feedback, if any, you have received from the [visitors or readers] on the items and/or sites?

- Follow up any mentions or absence of the [participant's and/or relevant staff's] *response*
- Follow up for any known results of the communications and why

Note:

9. NOTE - this question may not apply to all the participants  
What would be another work of yours that covers the information of the items and/or sites?

- Follow up for why

Note:

10. NOTE - this question may only apply to the participants who were chosen to respond to Q9  
Leaving aside all the pragmatic issues, would you consider using information of items made available by galleries, libraries, archives and museums (GLAMs) relating to [any or any combinations of] the items and/or sites for [the name of the work given by the participant]?  
- Follow up for examples

Note:

11. NOTE - this question may only apply to the participants who were chosen to respond to Q9  
How would you present the information of the combination of [the items and/or sites] and the other GLAMs' items in [the name of the work given by the participant]?  
- Follow up any mentions or absence of *relatedness* and *approach/strategy of presenting information* (e.g. via *label, tour, book*, etc.)

Note:

12. NOTE - this question may only apply to the participants who were chosen to respond to Q9  
For the information (of the combination of [the items and/or sites] and from other GLAMs) in [the name of the work given by the participant], what message would you want the [visitors or readers] to take away with them?  
- Follow up for why  
- Follow up for how heritage experts facilitate the [visitors or readers] to take away any message

Note:

## A15: Protocol for Interviewing Enthusiastic Amateurs

Participant ID:

- 2 to 3 items and/or sites selected by the participant:
  - The items and/or sites should match the following criteria as many as possible:
    - Studied
    - Related (the interpretation of *relatedness* is at the participant's discretion)
    - Enquired or received feedback (e.g., other people showed their interest in the items, or asked questions about them)
    - Varied in terms of *classification* (i.e., all the items should be varied, each item's *classification* is at the participant's discretion)
    - Travelled internationally (for any selected sites, this would mean there are other items and/or places *relevant* to them)
  - Request the participant to provide the reasons for selecting the items as per the criteria and the metadata/record of each item.
  - If necessary, the researcher should go and see the items in the context of any works they are incorporated into before the interview.
  - Confirm the selection of items with the participant before the interview.
- Introduce the study in a casual manner.
- Request the participant before the interview: since our discussion will centre around the items and/or sites, please get the information used for presenting any of these items (in your works) on hand. If necessary, please log into the relevant system. You could use the information at any time during the interview.
- Give and present the information of *Participant Information Sheet* and *Consent Form* to the participant. Request for their consent.

1. Could you tell us how did you meet/create the items and/or sites?

Note:

- Present the brief information of the items and/or sites on a piece of paper.

2. Which, if any, part of your daily life have the items and/or sites involved in?

Note:

3. Let's perform an activity:

- Present the activity information on a piece of paper.
  - Please mark all the geo-locations relating to each of the items and/or sites, you could choose any maps available here.
  - Please distinguish two types of geo-locations:
    - Direct geo-locations: the places an item has *been*, and *when*;
    - Relevant geo-locations: other places that are *relevant* to an item/site, and if applicable, *when*.
  - Please also write down, if possible, the *context* associated with each geo-location.
- Before performing the activity, notify the participant that I need to make some change to the camera's position and its focal length.
- Upon completion and before the participant's interpretation, follow up: what is your understanding of *context*?
- Follow up any mentions or absence of gap in biographies: what do we know in between [geo-location A] and [geo-location B]?

Note:

- After the interpretation, take photos of the map(s) and notes. Return the camera and its setting to the previous conditions.

4. (I suppose there were some people got to see the items and/or sites) How did the people who got to see the items and/or sites (they) meet them (the items and/or sites)? Would you bring up any information relating to the items and/or sites to the people (them), or would the people (they) ask for information relating to the items and/or sites, or a mix of both?

- Follow up any mentions or absence of *context*: are there any (other) information considered as *context*? / could this be counted as *context*?

Note:

5. From the owner's perspective, what are the information of the items and/or sites that other people could find interesting, both brought up previously and not yet?

- Follow up any mentions or absence of *relatedness*
- Follow up any mentions or absence of *interesting information that were not brought up previously*
- Follow up for why

Note:

6. Any other relevant information presented to the people who got to see the items and/or sites?

- Follow up any mentions or absence of *relatedness*

Note:

7. For the information of the items and/or sites brought up previously, any message have you wanted the people who got to see the items and/or sites to take away with them?

- If necessary, clarify *take away*: to enable use of the information in post-visit phase
- Follow up for why
- Follow up for how, if any, the participant facilitates the people to take away any message
- Follow up for any known results and why

Note:

8. What are the queries and feedback, if any, you have received from the people who got to see the items and/or sites?

- Follow up any mentions or absence of the participant's *response*
- Follow up for any known results of the communications and why

Note:

## A16: Approval Letter to Second Ethics Application

Faculty of Computing and  
Mathematical Sciences  
*Rorohiko me ngā Pūtaiao Pāngarau*  
The University of Waikato  
Private Bag 3105  
Hamilton  
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15 December 2017

Can Zhao

C/- Department of Computer Science  
**THE UNIVERSITY OF WAIKATO**

Dear Can

### **Request for approval to conduct a user study with human participants**

On the basis of the information you have provided on the revised FCMS Preliminary Ethics Application Form relating to your COMP 900 research "A study to explore heritage resource information" and in your email of December 13th 2017 regarding these changes from your first pilot study, the Committee has given you approval to proceed with your proposed study.

We wish you well with your research.



**Mark Apperley**  
Human Research Ethics Committee  
Faculty of Computing and Mathematical Sciences

## A17: Pilot Sessions and Study Protocol Revisions

### Revised pilot protocols

Figure 1 illustrates the revision of the study protocols throughout the research design phase. Steps 1 and 2 of Figure 1 represent that the protocols used in the pilot sessions (see A8: Protocol for the First Pilot Session

and A9: Protocol for the Second Pilot Session

) were derived from, and kept as close as possible with their respective counterparts for interviewing heritage experts (see A5: Provisional Protocol for Interviewing Heritage Experts

) and a museum curator (see A3: Provisional Protocol for Interviewing a Museum Curator

).

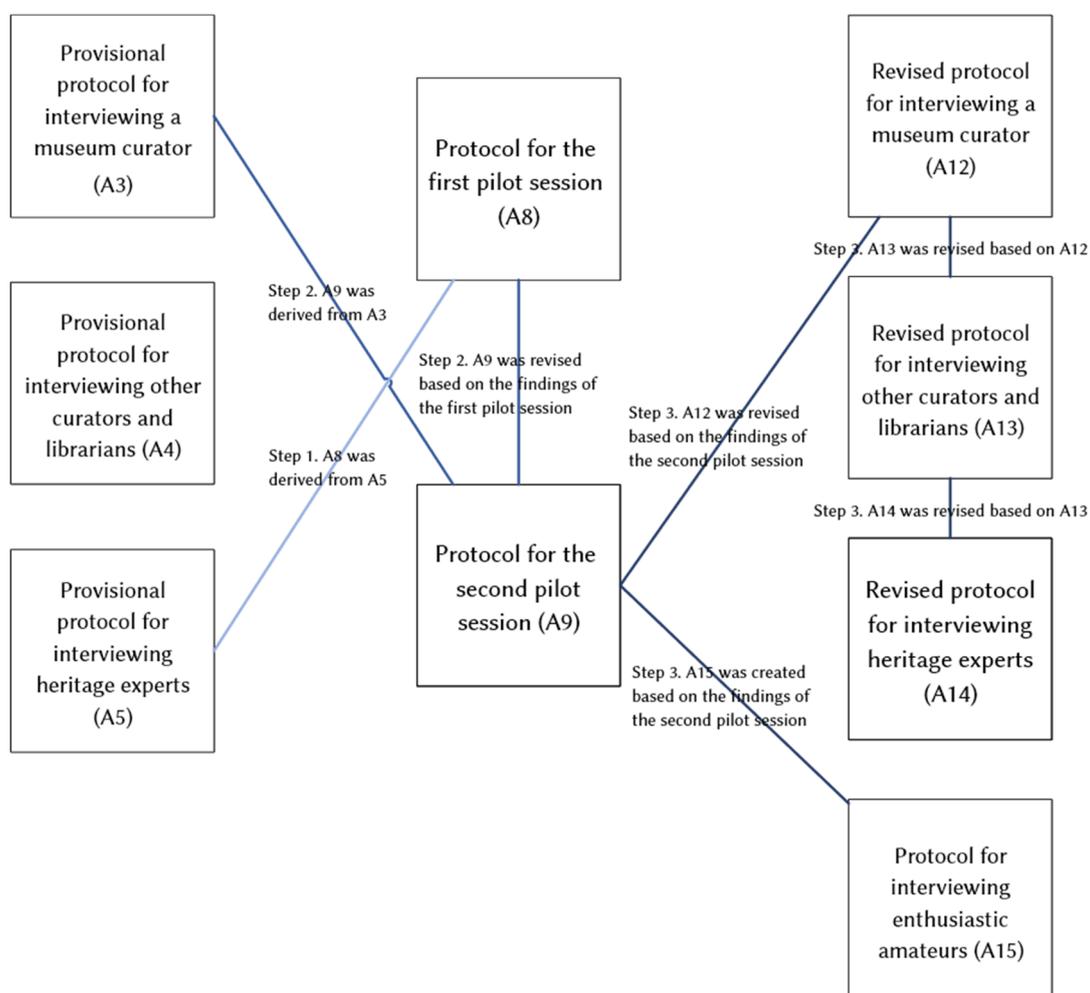


Figure 1 Study protocol revisions during the research design phase

The questions were adapted with a focus on academic visit for the first session and personally collected artefact for the second. Specifically, the questions of the first session were human biography-based because of the vagueness of the term *object* in the context of academic visit. Built on the findings, the second used questions focussing on object biography. Table 1 encapsulates the revisions made before conducting each session (shown as Steps 1 and 2 in Figure 1) in detail according to the four categories including sequence, recontextualisation and combination, addition and removal; specific questions and uses.

Table 1 Questions revised from provisional protocols and used in pilot sessions

Category	Revision	Used in First Pilot	Used in Second Pilot
Sequence	Q7 of A5 and Q8 of A3 moved	Q3 of A6	Q3 of A7
Recontextualisation and combination	Q5 and Q6 of A5 revised and combined	Q5 of A6	
	Q1, Q2, Q3 and Q4 of A3 revised and reorganised		Q1, Q2 and Q4 of A7
Addition	New Q6 added		New Q6 of A7
Removal	Q12 of A5 removed	Exclusion of equivalent questions	
	Q9, Q10, Q11, Q12 and Q13 of A3 removed		Exclusion of equivalent questions

The revision of question sequence was employed in both sessions—the activity probing into all the locations relating to the selected heritage objects/sites with contextual information (i.e., Question 7 of A5 and Question 8 of A3) was moved earlier—after the first two ice-breaking questions.

For the category of recontextualisation and combination, Questions 5 and 6 of A5 asking for the information that an expert wanted visitors to take away and whether there were any visitor query or feedback were recontextualised and combined. The new Question 5 of A8 studied the academic visit experience shared with other people. Given the participant's experience and a focus on specific heritage artefact information (cf. I1 in Table 2), Questions 1, 2, 3 and 4 of A3 enquiring a curator's duties, the works that involve the selected heritage objects and specific object information were taken and revised for the second session. Questions 1, 2 and 4 of A9 dealt with how the participant met the artefacts, their current involvement in the participant's daily life and how other people got to see them.

A new Question 6 searching for more relevant information presented to other people who met the selected objects was added in A9. Some original questions were considered or proved to be irrelevant. Question 12 of A5 probing into more location information relating

to an imaginary work on the selected heritage objects/sites was removed from A8. Questions 9, 10, 11, 12 and 13 of A3 seeking information relating to an imaginary work involving the artefacts were removed from A9 because of the result—an unnatural assumption on the linkage—gained from asking the corresponding questions in the first session (see I4 in Table 2).

### **Pilot Session Procedure**

The aim of the study and PhD research were given after the participants sat down and adjust themselves into a fit state. Reminders on getting any additional information of the selected artefacts readily available and logging into the lab computer and relevant systems if necessary were also delivered in the second session. The Participant Information Sheet and Research Consent Form (see A2) were then handed to the participants. If they had no question, the consent of their participation in the study with audio and video recordings was obtained.

The participants were asked to respond to the questions and occasionally follow-ups listed in A8 and A9. For Question 3 in A9, a piece of paper with the printed instruction was presented to the second participant. Once the participants accomplished their location activities, the photos of the outcome were taken by using the still camera placed on the table (see Figure 3.2). Afterwards, the participants were asked to continue explaining their location activity works, as well as answering the remainder of the questions. Questions 7, 8 and 9 in A8 and Question 8 in A9 were skipped. Finally, a post-study debriefing interview was conducted.

### **Findings and changes**

The first and second pilot sessions lasted for 49 and 56 minutes with Questions 1 to 6 of A8 and 1 to 7 of A9 asked and answered respectively excluding the times taken by the pre-study briefings and post-study debriefing interviews. Four aspects that need revision were follow-up question and clarification, phrasing, unnatural assumption, as well as study procedure. With reference to these four aspects, Tables 2 and 3 summarise the issues found from each session, related questions and changes applied to the study—from the second pilot session and onwards.

The first participant started by asking whether Questions 1 and 2 were looking for general responses or specific examples (I1 in Table 2). Presenting short questions was a research design criterion, a follow-up clarification encouraging participants to offer their immediate thoughts was considered a change that could potentially make some short

questions to work more effectively. Yet such a note was not added to the protocols because despite the ice-breaking Questions 1, Question 2 in the subsequent sessions were all aimed at dealing with specific heritage artefact information that exhibit a considerable contrast to Question 2 in the first pilot session.

Although I2 in Table 2 was intended to leave some space for unrestrictedly expressing one's collected information of each location, the phrasing issue resulted in insufficient data gathered from the participant. The phrase was replaced by "the context associated with each geo-location" in the subsequent protocols—A9 and onwards, complemented by a follow-up question—"what is your understanding of context". Due to a technical oversight, the focal length remained unchanged during marking and labelling the locations (I5 in Table 2). The notes for taking actions were also added.

The issues I3 and I4 in Table 2 together revealed the assumed linkage between an imaginary work/collection of a scholar and their academic visit information was unnatural. As a result, Questions 7, 8 and 9 of A8 were skipped and the questions built on the linkage were removed from A9. Unlike LAM professionals and heritage experts, the second participant-represented enthusiastic amateurs may have a relatively limited experience in curating items, which may make the responses to the corresponding questions yielding little value.

The first participant suggested introducing the aim of the study and PhD research in a casual manner (I6 in Table 2), asking for logging into relevant systems (I7 in Table 2), showing the maps (I8 in Table 2) together with preparing pens and more maps (I9 and I10 in Table 2). The relevant changes were included in the pre-study briefing and Question 3 of A9.

Table 2 Issues from the pilot session 1

Category	Issue No.	Issue	Question No. in A8	Change in Pilot Session 2
Follow-up	I1	Responding in general or with specific examples	Q1, Q2	
Phrasing	I2	Understanding the phrase “the remainder of the information to each geo-location”	Q3	Changed into “the <i>context</i> associated with each geo-location” with a follow-up asking “what is your understanding of context”
Unnatural assumption	I3	Understanding the phrase “a work/collection that covers the information you presented on the maps”	Q6	Question removed
	I4	Responding to Questions 7, 8 and 9	Q7, Q8, Q9	Questions removed
Procedure	I5	Not changing camcorder’s focal length	Q3	Notes added on changing focal length before and after the activity
	I6	Feeling unease when listening to study and PhD research briefing	Pre-study briefing	Briefed in a casual manner
	I7	Spending time on system login when certain information is needed	Pre-study briefing	Prompted in advance
	I8	Seeing material (maps) with its back facing upwards	Pre-study briefing	Maps displayed
	I9	Seeing no pen on the table	Pre-study briefing	Five pens placed on the table
	I10	Getting an incomplete set of maps	Pre-study briefing	Four more maps prepared

The second pilot session ran more smoothly with the changes made from the first. By gathering all the free-flowing interpretation without interrupting the participant’s response to Question 3 of A9, determining potential gaps between the marked locations afterwards grew to be difficult and thus skipped (I11 in Table 3). As getting relevant data as much as possible is critical to the activity, “mark all the geo-locations” would be emphasised and any temporal gap would be explored by asking “what do we know in between two geo-locations”. Despite an appearance of the relevant notes in the protocol, changing the video camera’s focal length for recording the activity was again an issue (I14 in Table 3). Such an adjustment needs to be made for data analysis purposes even if a pause is caused.

Two follow-up questions assuming the participant has analysed or summarised specific heritage object information (I13 in Table 3) formed a part of Questions 5 and 6 of A9. The participant’s response to Question 5 was rich yet did not touch on the “about”/subject of each

piece of the information that would interest other people, which proved a direct follow-up to be inappropriate. A more effective approach can be referring back to the relevant data—the participant’s definition of context in particular—for insights. Besides, a tabular space for note-taking was not helpful. The first follow-up of Question 6 was repetitively looking for more presented heritage item information that was regarded as context by the participant. Both follow-up questions were removed from the protocols.

The participant suggested the understanding of geo-location would make a difference when answering Question 3 (I12 in Table 3). Following up to motivate participants to take a holistic view on the concept that goes beyond physical spot may bring in richer data.

Table 3 Issues from the pilot session 2

Category	Issue No.	Issue	Question No. in A9	Change in Revised Protocols
Follow-up	I11	Not getting all the geo-location information explored	Q3	To emphasise “please mark all the geo-locations” To follow up any temporal gap
	I12	Understanding geo-location	Q3	To follow up if geo-location narrowly understood as physical spot
Unnatural assumption	I13	Responding to follow-ups requiring analysis/summary	Q5, Q6	First follow-up question of Q5 of A9 removed First follow-up question of Q6 of A9 removed
Procedure	I14	Hesitation of changing camcorder’s focal length	Q3	To follow the notes even if a pause caused

To recapitulate, the pilot session findings contributed to the identification and mitigation of:

- Procedural issues that reflected inadequate planning and mis-prioritisation occurred in pre-study briefing and Question 3—the geo-location activity (i.e., I5 to I10 in Table 2, I14 in Table 3);
- Phrasing issue that suggested specifying keywords (e.g., context) in the geo-location activity was better than leaving too much space to a participant (i.e., I2 in Table 2);
- Issues that reflected follow-ups were missing from the geo-location activity (i.e., I11 and I12 in Table 3);
- Issues that may affect a particular group of participants because of their differed experience (i.e., I3 and I4 in Table 2, I13 in Table 3).

Accordingly, the findings above formed the foundation of the following changes:

- The revised *Participant Information Sheet* and *Consent Form* (see A11);
- The revised protocols for interviewing a museum curator (see A12), curators and librarians (see A13) and heritage experts (see A14), the revision process was shown as Step 3 in Figure 1;
- A newly added protocol of interviewing enthusiastic amateurs (see A15), the process was likewise shown as Step 3 in Figure 1.

All the changes were colour-coded in yellow in the respective appendices. To clarify the revision of the *Participant Information Sheet*, *Consent Form* and addition of the new protocol: a new group of the potential participants—enthusiastic amateurs—was included, given the data elicited from the second pilot session and the constraint of the limited participant pool. For the revisions of the remaining protocols, Table 4 elaborates the changes made comparing to their previous version as per the four categories including sequence, specification, addition and removal; specific content and applications to A12, A13, A14 and A15.

Table 4 Content revised from the pilot session protocols

Category	Revised Content	Applied to A12	Applied to A13	Applied to A14	Applied to A15
Sequence	New Q4 (revised from Q3 of A9)	✓	✓	✓	
Specification	New Q4 (revised from Q3 of A9)	✓	✓	✓	
Addition	New Q9, Q11, Q12	✓	✓	✓	
	Notes of heritage object selection, pre-study briefing and in-session action plan	✓	✓	✓	✓
	New Q3	✓	✓	✓	
Addition	New first follow-up of Q5 of A12, A13 and A14/Q4 of A15	✓	✓	✓	✓
	New follow-up of Q10	✓	✓	✓	
	Removal	Q13 of A3 and A4, Q12 of A5 removed	✓	✓	✓

Performing the location activity earlier in the pilot studies was a success, consequently the sequencing adaptation was kept (i.e., Questions 4 in A12, A13 and A14). Questions 4 also

had the phrase replacement (i.e., the context associated with each geo-location) and a new follow-up question (i.e., “what is your understanding of context”) following the identification of I2 in Table 2. Another specification was about making the grouping of the selected heritage artefacts explicit in Questions 9, 11 and 12 in A12, A13 and A14.

More notes on heritage artefact selection, pre-study briefing and in-session action plan during study were included. For instance, one more criterion of heritage artefact selection—enquired or received feedback—was incorporated into A12, A13, A14 and A15; so was a reminder requesting participants to get information relating to any selected objects prepared and log into relevant system. The note on operating camcorder during the geo-location activity was also revised and integrated into the protocols.

A new Question 3 was added in A12, A13 and A14 to seek more “information sources used for presenting” the selected objects in addition to the requested metadata. Besides, two follow-up questions were included as a part of Questions 5 as well as Questions 10 in A12, A13 and A14. In Questions 5, the follow-up deals with the mentions or absence of *context* in the data gathered from curators, librarians and heritage experts. In Questions 10, the follow-up asks for examples of using object information made by, or loaning any other objects from other LAMs relating to the selected objects for participants’ imaginary works. Lastly, the questions designed to gather more geo-location information relating to the imaginary works on the selected artefacts/sites (i.e., Questions 13 in A3 and A4, Question 12 in A5) were removed for the study sessions.

# **Appendix B. Material for Acquiring Place-Centric Object Biography Metadata**

This appendix contains the material that was prepared for conducting the study described in Chapter 4.

B1, B2, B3 and B4 were submitted to support the first application to the Human Research Ethics Committee, Faculty of Computing and Mathematical Sciences of the University. B5 was consequently received, dated 5 October 2018.

B6 was a formal request sent to the Human Research Ethics Committee following the completion of three pilot study sessions, for extending the expiration date of participant right to withdraw from 28 February 2019 to 28 February 2020, dated 5 March 2019.

B7 was a formal request sent to the Human Research Ethics Committee for adding another participant recruitment approach, dated 12 April 2019. The content of the participant recruitment poster is shown in B8. B9 was consequently received, dated 16 April 2019.

## **B1: Cover Sheet of Application for Approval under the Ethical Conduct in Human Research and Related Activities Regulations, Ethics Committee, Faculty of Computing and Mathematical Sciences, University of Waikato**

Name: Can Zhao

Department: Department of Computer Science

Email address: cz93@students.waikato.ac.nz

Phone number: \_\_\_\_\_

Mailing address: Department of Computer Science, University of Waikato, Private Bag 3105,

Hamilton, New Zealand

This is an application for approval of: (please tick as many as apply)

- Research project involving human participants
- Course/Paper which involves student projects that collect data from human participants
- Undergraduate student project which involves data collection from human participants
- Master's degree research
- PhD research
- PhD research proposal to move from Conditional to Full enrolment

Supervisor's name: (if applicable): David Nichols

Supervisor's approval (signature): \_\_\_\_\_

Project Title: In-situ heritage information acquisition and prototyping

Is this research associated with an external grant or funding?       Yes       No

Please specify: \_\_\_\_\_

I request approval for this research or related activity and attach all relevant documentation necessary for evaluation under the Ethical Conduct in Human Research and Related Activities Regulations.

I am applying under section 10 of the Ethical Conduct in Human Research and Related Activities Regulations Large Random Sample Surveys and Similar Research Methodology and consequently there is no consent form in this application.

I am applying under section 11 of the Ethical Conduct in Human Research and Related Activities Regulations Field Research and consequently there is no consent form in this application.

I have read and complied with the Ethical Conduct in Human Research and Related Activities Regulations.

Principal Investigator's signature:

\_\_\_\_\_

### **Ethics Committee Action**

Should this application be referred to another delegated University Ethics Committee?

Yes     No

Details: \_\_\_\_\_

Does this application also require approval from an external body (e.g. Northern Y Regional Ethics Committee)? See Appendix 5.

Yes     No

Details: \_\_\_\_\_

Approved

Convenor's signature

Approved with recommendations

Request modifications

Reviewer's signature

Approved with modifications

Reviewer's signature

Forward to University committee

Date: \_\_\_\_\_

Copy of approval letter to UNILink for research associated with external grants and contracts

## **B2: Application for Approval: Outline of Research or Related Activity, Human Research Ethics Committee, Faculty of Computing and Mathematical Sciences, University of Waikato**

*Note: add your project details to this document – do not delete any of the existing content*

### **Details of Proposed Activity**

#### **1. Identify the project**

##### 1.1 Title of Project

In-situ heritage information acquisition and prototyping

##### 1.2 Researcher(s) name and contact information

Can Zhao

Department of Computer Science

University of Waikato

Private Bag 3105

Hamilton, New Zealand

Email: [cz93@students.waikato.ac.nz](mailto:cz93@students.waikato.ac.nz)

##### 1.3 Supervisor's name and contact information (if relevant)

David Nichols

Department of Computer Science

University of Waikato

Private Bag 3105

Hamilton, New Zealand

Email: [david.nichols@waikato.ac.nz](mailto:david.nichols@waikato.ac.nz)

##### 1.4 Anticipated date to begin data collection

5 November 2018

- 1.5 Does your application involve issues of health or disability with human participants? If so, please refer to the guidelines as to whether your application needs to be submitted to the Northern Y Regional Ethics Committee.

No.

## 2. Describe the research or related activity

- 2.1 Briefly outline what the project is about including your goals and anticipated benefits. Include links with a research programme, if relevant.

The goals include to:

- Acquire heritage item metadata that relates to particular locations from the local a) libraries, archives and museums (LAM) professionals, b) heritage experts and c) enthusiastic amateurs.
- Explore possible ideas for designing interaction between heritage items and mobile application users.

The anticipated benefits include:

- An in-depth understanding of location-centred heritage item metadata. The two sets of the results (another set of the result was the more general heritage item metadata collected in lab condition from a previous study) together form a foundation for building a conceptual model of the researcher's PhD project.
- A Linked Open Data (LOD) model derived from the relevant metadata schemas or ontologies (e.g. CIDOC Conceptual Reference Model (CIDOC CRM)) to manipulate heritage item metadata.
- Some possible mobile application design directions under different circumstances. The pertinent data is collected when the participants are asked to use tangible models of different possible functionalities to narrate heritage item metadata to up to three target user groups.

- 2.2 Briefly outline your methods.

Each study session comprises two activities—metadata acquisition and prototyping. The researcher will conduct each session with a different participant at two chosen outdoor locations (by the participant and the researcher respectively) and during the walk from the first location to the second. The research method features a combination of semi-structured interview and bodystorming with tangible models of different possible functionalities that work as cues.

Recording equipment will be used in all study sessions. For selecting a recording solution for the sessions conducted with the local LAM professionals, heritage experts and enthusiastic amateurs, four options will be tested in the pilot studies:

- Option 1: an audio recorder with 1 wired (the researcher) and 1 wireless microphones (the participant), a wearable action camera (the researcher).

- Option 2: an audio recorder with 1 wired (the researcher) and 1 wireless microphones (the participant), a portable camcorder operated by another person in the research team (as identified in the sections 2.5 and 5.3).
- Option 3: an audio recorder with 1 wired (the researcher) and 1 wireless microphones (the participant), camera/mobile phone for photograph taking operated by the researcher.
- Option 4: an audio recorder with 1 wired (the researcher) and 1 wireless microphones (the participant) only.

2.3 Describe plans to give participants information about the goals of the research or related activity.

The plan of giving participants information about the goals of the research or related activity includes:

- Providing the *Participant Information Sheet* and *Consent Form* to the participants: This will be done twice. The first time will be right after every participant agreed to join in the study. The researcher will email the participants the *Participant Information Sheet* and *Consent Form* along with a request for selecting one heritage-related location and providing a short reason of the location selection. The other occasion will be at the beginning of each study session, a printed copy of the *Participant Information Sheet* and *Consent Form* will be given to the participant for their information and for gaining their consent.
- Answering any question made by the participants: From the time when the *Participant Information Sheet* is emailed to the participants to 28 February 2019 (a date which is currently assumed to be two months later than the day on which the last study session is completed), the researcher will be responsible to answer any question regarding the research and any other related activity.

2.4 Identify the expected outputs of this research or related activity (e.g., reports, publications, presentations).

Relevant chapters of the researcher's PhD thesis and possibly published conference or journal paper.

2.5 Identify who is likely to see or hear reports or presentations arising from this research or related activity.

The researcher's chief supervisor Associate Professor David Nichols, Professor Michael Twidale at the University of Illinois Urbana-Champaign (both involved in the design of this research) and the researcher's co-supervisors Associate Professor Sally Jo Cunningham and Professor David Bainbridge.

2.6 Identify the physical location(s) for the research or related activity, the group or community to which your potential participants belong, and any private data or documents you will seek to access. Describe how you have access to the site, participants and data/documents. Identify how you obtain(ed) permission from relevant authorities/gatekeepers if appropriate and any conditions associated with access.

The physical locations for each study session are likely to be two publicly accessible outdoor locales within walking distance of each other. These two locations are associated with particular heritage items, and therefore have rich stories to tell.

If we need to access a private locale (e.g. a particular heritage building) or any private data or documents, we will negotiate with the participant, obtain the relevant permission and make an update to this application separately.

The participants are likely from the local libraries, museums, historical societies and community trusts in the Waikato Region. The pilot study participants are likely from the Department of Computer Science at the University of Waikato. We will communicate with each participant via email.

### 3. Obtain participants' informed consent without coercion

3.1 Describe how you will select participants (e.g., special criteria or characteristics) and how many will be involved.

The participants will be recruited via personal contacts from the local libraries, museums, historical societies and community trusts. Snowball sampling may also be used.

The pilot study participants will be recruited locally from the Department of Computer Science.

Six to ten participants including those who will join in the pilot studies will be recruited.

3.2 State clearly whether this is an application under section 10 of the Ethical Conduct in Human Research and Related Activities Regulations: Large Random Sample Surveys.

No. As described in the sections 2.2 and 3.1, the proposed research will employ a combined qualitative research method and will likely involve six to ten participants.

3.3 Describe how you will invite them to participate.

The researcher will send the invitation to every potential participant via email.

3.4 Show how you provide prospective participants with all information relevant to their decision to participate. Attach your participant information sheet, cover letter, or introduction script. See document on informed consent for recommended content. Information should include, but is not limited to:

- what you will ask them to do;
- the context in which information sheets and consent sheets will be used. When (e.g. just before the study, a week before etc), where (e.g. in a laboratory environment, in a field setting etc) and in what form (e.g. paper, email etc) information will be provided to prospective participants.
- how to refuse to answer any particular question, or withdraw any information they have provided at any time before completion of data collection;
- how and when to ask any further questions about the study or get more information.
- the form in which the findings will be disseminated and how participants can access a summary of the findings from the study when it is concluded.

Before the first pilot study commences, all potential pilot study participants will be invited for their participation via emails.

Once a pilot study participant agreed, the researcher will email the participant the *Participant Information Sheet* and *Consent Form* along with a request for selecting one heritage-related location and providing a short reason of the location selection.

The researcher will then confirm the location selection with the participant via email and inform them about the selection of another heritage-related location within walking distance of the participant's chosen location. The researcher will also let the participant know about the plan of walking from the first location to the second.

The researcher and the participant will together choose a date and time to perform the study. One or two more time slots will be negotiated in addition to a preferred one to avoid inappropriate weather conditions.

Once the pilot studies and the protocol refinement are completed, the participants of the formal study sessions will be recruited using the same approach as stated above.

From the time when the *Participant Information Sheet* and *Consent Form* is sent to the participant to 28 February 2019 (a date which is currently assumed to be two months later than the day on which the last study session is completed), the researcher will be responsible to answer any question regarding the research and any other related activity.

For each study session, the researcher will meet the participant at the first location. After presenting the information of *Participant Information Sheet* and *Consent Form* to the participant, obtaining their consent, attaching the recording devices to the clothes and switching them on, the researcher will interview the participant to acquire the heritage item metadata that associates with the first location. The researcher will also attach a badge or wear some accessories (e.g., a hat) to role-play as the first (i.e., an international traveller) and second personas (i.e., a type of heritage resource users that the participant is familiar with) for gathering the adapted narratives from the participant.

The researcher will then present a laminated printout of the second activity to the participant to kick off the prototyping activity. The participant will be requested to elaborate on how certain types of possible functionalities could assist them to narrate using several tangible models of such functionalities (each with a one-line description). *Teleporting artefacts* will be the first one that is to be examined. The participant will be requested to choose another two types of possible functionalities for the prototyping purposes. In any case that the participant is not able to imagine, the researcher will prompt them using a laminated printout of the prompt.

The participant and the researcher will walk to the second location from the first location after the prototyping activity. The researcher will interview the participant and role-play as the third persona (i.e., a local commuter) at the same time for gathering any adaptation of the location-centred narrative of the heritage item metadata.

On arrival at the second location, the researcher will role-play the second and then the first personas and conduct another round of the semi-structured interview to acquire the heritage item metadata that associates with the location.

For the second-round prototyping, *Teleporting artefacts* will still be the first functionality that is to be examined. The participant will be requested to choose another two types of possible functionalities (i.e., the previously chosen ones will no longer be the options) for the prototyping purposes.

The researcher will conclude the study by asking the participant if they would like to offer more information. Lastly, the researcher will express the gratitude to the participant. During the entire study session, the participant can refuse to answer any question. The participants can also inform the researcher either via email or letter or in person to withdraw from the study before 28 February 2019 without giving any reason.

The findings will be included as a part of the relevant chapters of the researcher's PhD thesis and possibly published conference or journal paper. The participants can request the researcher via either email or letter to access a summary of the findings of the study.

Please see the attached *Protocol-for-In-situ-Information-Acquisition-and-Prototyping* and *scms-ethics-information-and-consent-form* for further details.

### 3.5 Describe how you get their consent. (Attach a consent form if you use one).

As described in the sections 2.3 and 3.4, a digital copy of the *Participant Information Sheet* and *Consent Form* will be sent to each participant once they agreed to participate. A printed copy of the *Participant Information Sheet* and *Consent Form* will be provided to the participant at the beginning of each study session. If they agree to the conditions listed on the *Participant Information Sheet*, they would circle or tick the relevant conditions and sign the *Consent Form*. The signed form will be kept by the researcher.

Please see the attached *Protocol-for-In-situ-Information-Acquisition-and-Prototyping* and *scms-ethics-information-and-consent-form* for further details.

### 3.6 Explain incentives and/or compulsion for participants to be involved in this study, including monetary payment, prizes, goods, services, or favours, either directly or indirectly.

No incentives or compulsion. The involvement of being a participant is completely voluntary.

## 4. Minimise deception

If your research or related activity involves deception – this includes incomplete information to participants -- explain the rationale. Describe how and when you will provide full information or reveal the complete truth about the research or related activity including reasons for the deception.

Not applicable. No deception involved.

## 5. Respect privacy and confidentiality

### 5.1 Explain how any publications and/or reports will have the participants' consent.

The participant will be informed in writing (in the *Participant Information Sheet*) that one possible outcome of the study is publication that may include the researcher's PhD thesis and/or conference or journal paper.

They will give their consent if they agree to participate in the study under the conditions listed in the *Participant Information Sheet* at the beginning of their study session.

The participants could withdraw from the study before 28 February 2019. By withdrawing all data collected from their session will not be included in any publication.

5.2 Explain how you will protect participants' identities (or why you will not).

The researcher will anonymise the participants as P1 to Pn in the published results. Due to the factors such as the selected locations and heritage items for the study, the nature of work in the heritage field, etc., the participants might still get identified. The researcher will give the participants the right of refusal for including any information before publishing any results.

Another issue in ensuring anonymity is getting the pedestrians recorded. The act itself is by no means purposeful and unavoidable. If the researcher has to use any material (e.g. a screenshot of a video recording) in which any pedestrian is shown, such material will be pre-processed (e.g. via pixelisation) to protect the pedestrian's identity.

5.3 Describe who will have access to the information/data collected from participants. Explain how you will protect or secure confidential information.

The researcher's chief supervisor Associate Professor David Nichols, Professor Michael Twidale at the University of Illinois Urbana-Champaign (both involved in the design of this research) and the researcher's co-supervisors Associate Professor Sally Jo Cunningham and Professor David Bainbridge.

The researcher will keep the notes, photos, recordings and anonymised transcriptions before the completion of the PhD and then archive the anonymised transcriptions, but will treat them with the strictest confidentiality. On completion of this study, the data that may include the notes, pre-processed photos, recordings and anonymised transcriptions will also be stored in the Faculty of Computing and Mathematical Sciences (FCMS) Data Archive for five years.

## 6. Minimise harm to participants

'Harm' includes pain, stress, emotional distress, fatigue, embarrassment and exploitation.

6.1 Where participants risk change from participating in this research or related activity compared to their daily lives, identify that risk and explain how your procedures minimize the consequences.

The study session aims to gather data in the form of informal discussion of heritage-centred matters, which should be a part of frequent practice for the participants. Therefore, it is considered as a low-risk and normal activity.

6.2 Describe any way you are associated with participants that might influence the ethical appropriateness of you conducting this research or related activity – either favourably (e.g., same language or culture) or unfavourably (e.g., dependent relationships such as employer/employee,

supervisor/worker, lecturer/student). As appropriate, describe the steps you will take to protect the participants.

The researcher's supervisors might help out in the pilot studies, their identities would be protected in any publication. The researcher has no association with any other participants.

- 6.3 Describe any possible conflicts of interest and explain how you will protect participants' interests and maintain your objectivity.

No anticipated conflicts of interest.

## 7. Exercise social and cultural sensitivity

- 7.1 Identify any areas in your research or related activity that are potentially sensitive, especially from participants' perspectives. Explain what you do to ensure your research or related activity procedures are sensitive (unlikely to be insensitive). Demonstrate familiarity with the culture as appropriate.

As addressed in 6.1, an informal discussion centred around heritage is anticipated to be a frequent practice or everyday conversation for the participants. Thus it is anticipated as insensitive.

- 7.2 If the participants as a group differ from the researcher in ways relevant to the research or related activity, describe your procedures to ensure the research or related activity is culturally safe and non offensive for the participants.

The participants are anticipated to be domain experts who have heritage-specific knowledge. These differences are not anticipated to cause any problems for the study.

## **B3: Participant Information Sheet and Consent Form**

### *Participant Information Sheet*

Ethics Committee, Faculty of Computing and Mathematical Sciences, University of Waikato

### **Project Title**

*In-situ heritage information acquisition and prototyping*

### **Purpose**

To build a better understanding of the location-centred heritage item information and possible interactions with heritage items in the real world outside the memory institutions.

### **What is this research project about?**

The study aims at eliciting heritage-centred narratives from the local a) libraries, archives and museums (LAM) professionals, b) heritage experts and c) enthusiastic amateurs in field and exploring possible design ideas.

### **What will you have to do and how long will it take?**

The researcher will first interview you about heritage-centred narratives based at a location that is chosen by you. After that, the researcher will be working with you to explore changes to such narratives under different circumstances using non-digital tools. Then the researcher and you will be walking to the second location that is chosen by the researcher. The researcher will communicate with you during the walking, and upon the arrival at the second location, you will be going through a process that is similar to what you have done at the first. This study should take no longer than *60 minutes*. The researcher may ask for relevant documents or sources accessible for this research. If you give consent, the audio and video of the interview may be recorded, and photos may be taken. You will be asked to give consent prior to the interview and may be asked to give consent at a later stage.

### **What will happen to the information collected?**

The information collected will be used by the researcher to write research publications including the doctoral thesis. Only the researcher, supervisor and co-authors will be privy to the notes, photos and recordings from the study. Transcription of the study session may be made by a third party under a confidentiality agreement. Some of your responses might be quoted, and a small number of the photos (anything shown on the photos that might lead to identification will be pre-processed) might be used in the publications. As these types of information might lead to identification due to the factors such as the selected locations and items for the study, the nature of work in the heritage field, etc., you will be contacted for confirming whether you agree to have such information included in any publications. You will not be named in the publications, and every effort will be made to disguise your identity. The researcher will keep the notes, photos, recordings and anonymised transcriptions before the completion of the PhD and then archive the anonymised

transcriptions, but will treat them with the strictest confidentiality. On completion of this study, the data that may include the notes, pre-processed photos, recordings and anonymised transcriptions will also be stored in the Faculty of Computing and Mathematical Sciences (FCMS) Data Archive for five years.

### **Declaration to participants**

If you take part in the study, you have the right to:

- Refuse to answer any question and to withdraw from the study before 28 February 2019. If you wish to withdraw, contact the researcher, Can Zhao (cz93@students.waikato.ac.nz). You do not need to give any reason for withdrawing from the study.
- Ask any further questions about the study that occur to you during your participation.
- Be given access to a summary of findings from the study when it is concluded.

### **Who's responsible?**

If you have any questions or concerns about the project, either now or in the future, please feel free to contact either:

Researcher:

*Can Zhao*

*Department of Computer Science*

*University of Waikato*

*Private Bag 3105*

*Hamilton, New Zealand*

*Email: cz93@students.waikato.ac.nz*

Supervisor:

*Associate Professor David Nichols*

*Department of Computer Science*

*University of Waikato*

*Private Bag 3105*

*Hamilton, New Zealand*

*Email: david.nichols@waikato.ac.nz*

*Research Consent Form*

Ethics Committee, Faculty of Computing and Mathematical Sciences, University of Waikato

***In-situ heritage information acquisition and prototyping*****Consent Form for Participants**

I have read the **Participant Information Sheet** for this study and have had the details of the study explained to me. My questions about the study have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I also understand that I am free to withdraw from the study before **28 February 2019** or to decline to answer any question in the study. I understand I can withdraw any information I have provided up until the researcher has commenced analysis on my data. I agree to provide information to the researchers under the conditions of confidentiality set out on the **Participant Information Sheet**.

I agree to participate in this study under the conditions set out in the **Participant Information Sheet**.

Signed: \_\_\_\_\_

Name: \_\_\_\_\_

Date: \_\_\_\_\_

**Additional Consent as Required**

I agree / do not agree to the use of audio and video recording of my responses.

If I agree to audio and video recording, then I understand that I may review the recording within three days of the study and may withdraw the audio and video recording from the study. Withdrawn audio and video recordings will be deleted.

I agree / do not agree to the use of photographs of me and/or artefacts present during the interview.

If I agree to photographs being taken, then I understand that I may review them at the end of the study and may withdraw any photograph from the study. Withdrawn photographs will be deleted.

Signed: \_\_\_\_\_

Name: \_\_\_\_\_

Date: \_\_\_\_\_

**Contact information:****Researcher:***Can Zhao**Department of Computer Science**University of Waikato**Private Bag 3105**Hamilton, New Zealand**Email: cz93@students.waikato.ac.nz***Supervisor:***Associate Professor David Nichols**Department of Computer Science**University of Waikato**Private Bag 3105**Hamilton, New Zealand**Email: david.nichols@waikato.ac.nz*

## **B4: Provisional Protocol for In-situ Heritage Information Acquisition and Prototyping**

### *Before the study*

- Invitation  
We ask the potential participants for their participation via email.
- Communication  
Once a potential participant agreed to join in the study, we email them more details of the study including Participant Information Sheet and Consent Form and a request of place selection and the reason for selecting it. Specifically:
  - We ask the participant to select 1 place.
  - We ask that the selected place to have interesting stories to tell and to tie to one or more artefacts.
  - We ask the participant to send a short note giving the reason for selecting the place.

If the participant is from Hamilton East Community Trust, we first ask would they be comfortable to select a place that is tied to some artefacts.

- Confirmation
  - We confirm the place selection with the participant.
  - We select another place which is within walking distance from the place selected by the participant.
  - We email the participant about the second place and the plan of walking from the first to the second.

### **Short description of personas**

- International traveller  
Travelling to overseas destinations at least once per year. Often travels to local museums for a glance of local stories. Curious about cultural differences. Some language barriers.
- Commuter  
Commuting from home to place of work every day through some heritage artefact-related locales. Has a very general idea that heritage is something nice to have. But thinks heritage never changes.

### **Recording options**

- Option 1  
An audio recorder with 1 wired (the researcher) and 1 wireless microphones (the participant), a wearable action camera (the researcher)
- Option 2  
An audio recorder with 1 wired (the researcher) and 1 wireless microphones (the participant), a portable camcorder operated by another person in the research team
- Option 3  
An audio recorder with 1 wired (the researcher) and 1 wireless microphones (the participant), a camera/mobile phone for photograph taking (the researcher)
- Option 4

An audio recorder with 1 wired (the researcher) and 1 wireless microphones (the participant) only

### Research instruments

- Participant Information Sheet with L-shaped pocket, Consent Form, study protocol, a laminated printout of the prototyping activity, a pen & a clipboard
- Tangible models of magical power (each with a one-line description), laminated printouts of the prompts for each magical power

### *The study*

#### Meeting with the participant at the first place

##### Preparation

- The researcher gives and presents the information of Participant Information Sheet and Consent Form to the participant, then requests their consent.
- The researcher and the participant attach the recording devices to our clothes and turn them on.

##### Metadata acquisition

1. Could you tell us your duties as a [the participant's role] at [their institution]?
2. [the researcher wears his hat/attach a badge] Imagine I've just landed in New Zealand the day before yesterday for spending my holiday here, how would you introduce this place to me?
  - a) Follow-up: What's interesting about this place?
  - b) Follow-up: What's interesting about this (by pointing to any items presented on site)?
  - c) Follow-up: Could you share with me some (more) stories that were occurred at or relevant to this place?
  - d) Follow-up: Imagine I'm a different person [the researcher takes his hat off/changes his badge], would there be any different stories worth telling? Also, please describe this person.
    - i. Prompt: So I'm no longer an international traveller ...
      1. Prompt: I could be a person who in general thinks heritage is something nice to have or to know. Does this sound familiar? Could you further describe them or give me an example?
      2. Follow-up: Yes, imagine I'm him [the example that was given by the participant], would there be any different stories worth telling?
3. Any artefacts relate to that story?
  - a) Follow-up: What do we know about this/these artefact(s)? OR Imagine the artefact(s) can introduce themselves to me, what would that introduction be like?
  - b) Follow-up: Any other things that relate to the combination of the artefact(s) and this particular place?
    - i. Prompt: For example, another (set of) artefact(s), persons, stories, events and so on?

##### Prototyping

1. [the researcher presents a laminated printout of the prototyping activity to the participant] Imagine you can use magical powers to tell the stories of the artefact(s) that were occurred at or relevant to this place, I'd like to know from your perspective, how could certain types of magical power assist you.

- a) Let's first try *Teleporting artefacts* - bringing in a) the replica(s) of the artefact(s), and b) the replica(s) of any other related artefacts from any other institutions to this place.
  - i. Prompt: For example, we were talking about [a particular artefact from institution X]
 

...
2. [the researcher presents all types of magical power, each with a one-line description in tangible form] We have different types of magical power for you to choose from here, choose 2 more. Please consider once the particular types were chosen for this place, you'll need to choose another 2 or more for the next place. How could they assist you?
  - a) *Label building* - putting labels onto the relevant buildings.
    - i. [if the participant isn't able to imagine, the researcher presents a laminated printout of each prompt as follows] Prompt: For example, we could have a label that is obvious enough presented on each of the relevant buildings such as [this one] ...
  - b) *Draw attention* - pointing out where the information should be attached to.
    - i. Prompt: For example, we could have a pointer to show any relationship between an artefact and anything we could see here, it could be as obvious as [this] building or [this] tree or subtler, such as [this] plaque or even a trace.
  - c) *Reconstruct setting* - bringing surroundings back to this place.
    - i. Prompt: For example, we could have the surroundings reappears as it is in a particular time, partially or entirely, realistically or dramatically, or have a bird's-eye view of the surroundings.
  - d) *Show timeline* - showing the artefact at different times.
    - i. Prompt: For example, we could have a timeline of the place, then the artefact could show themselves in the wider environment at each particular time point. Or we could have the artefact placed at different spots, each with a timestamp.
  - e) *Show around* - pointing out where to go to interact more with the artefact.
    - i. Prompt: For example, we could have a pointer to show the next place to go to interact with the artefact, it could be in the physical world such as in an institution or in field, or a place on line.
  - f) *Let artefacts speak* - having the artefacts explain/interview themselves.
    - i. Prompt: For example, we could have the artefact to tell their own stories regarding their stay at and relationship with this place. What did they witness, how did they adapt themselves into the life here, how did they gain and lose their company, etc.
  - g) *Let people speak* - having other people: a) the locals, b) the experts, c) the visitors say about the artefact and the place.
    - i. Prompt: For example, we could have different groups of people to tell their own stories regarding their relationship with and view of the artefact and the place. What did they witness, what did they find out, how did they relate the artefact and the place to their lives, etc.

### **Walking to the second place**

1. What's interesting about this (by pointing to any items presented on the way)?
2. Imagine I am a commuter, who lives here and goes past this place very frequently but does not know much about local history. If I was on holiday somewhere else, I'd probably go to a museum and find out about that place because the history of places I visit is interesting. But somehow, I don't think so much about the history of where I live. What would you tell me?

### **Being at the second place**

### Metadata acquisition

1. So I'm still the person we've talked about when we were at [the first place] (i.e., not the commuter), how would you introduce this place to me?
  - a) Follow-up: What's interesting about this place?
  - b) Follow-up: What's interesting about this (by pointing to any items presented on site)?
  - c) Follow-up: Could you share with me some (more) stories that were occurred at or relevant to this place?
  - d) Follow-up: Imagine I'm turning back to the international traveller [the researcher wears his hat/changes his badge], would there be any different stories worth telling?
2. Any artefacts relate to that story?
  - a) Follow-up: What do we know about this/these artefact(s)? OR Imagine the artefact(s) can introduce themselves to me, what would that be like?
  - b) Follow-up: Any other things that relate to the combination of the artefact(s) and this particular place?
    - i. Prompt: For example, another (set of) artefact(s), persons, stories, events?

### Prototyping

1. Then it's time for magical powers and the stories of the artefact(s) that were occurred at or relevant to this place, again I'd like to know from your perspective, how could certain types of magical power assist you.
  - a) Let's use *Teleporting artefacts* - bringing in a) the replica(s) of the artefact(s), and b) the replica(s) of any other related artefacts from any other institutions to this place.
    - i. Prompt: For example, we were talking about [a particular artefact from institution X]  
...
2. [the researcher presents the remaining types of magical power, each with a one-line description in tangible form] Choose 2 types of magical power other than the previously chosen ones. Feel free to choose more if you think they are appropriate. How could they assist you?
  - a) *Label building* - putting labels onto the relevant buildings.
    - i. [if the participant isn't able to imagine, the researcher presents a laminated printout of each prompt as follows] Prompt: For example, we could have a label that is obvious enough presented on each of the relevant buildings such as [this one] ...
  - b) *Draw attention* - pointing out where the information should be attached to.
    - i. Prompt: For example, we could have a pointer to show any relationship between an artefact and anything we could see here, it could be as obvious as [this] building or [this] tree or subtler, such as [this] plaque or even a trace.
  - c) *Reconstruct setting* - bringing surroundings back to this place.
    - i. Prompt: For example, we could have the surroundings reappears as it is in a particular time, partially or entirely, realistically or dramatically, or have a bird's-eye view of the surroundings.
  - d) *Show timeline* - showing the artefact at different times.
    - i. Prompt: For example, we could have a timeline of the place, then the artefact could show themselves in the wider environment at each particular time point. Or we could have the artefact placed at different spots, each with a timestamp.
  - e) *Show around* - pointing out where to go to interact more with the artefact.
    - i. Prompt: For example, we could have a pointer to show the next place to go to interact with the artefact, it could be in the physical world such as in an institution or in field, or a place on line.
  - f) *Let artefacts speak* - having the artefacts explain/interview themselves.

- i. Prompt: For example, we could have the artefact to tell their own stories regarding their stay at and relationship with this place. What did they witness, how did they adapt themselves into the life here, how did they gain and lose their company, etc.
- g) *Let people speak* - having other people: a) the locals, b) the experts, c) the visitors say about the artefact and the place.
  - i. Prompt: For example, we could have different groups of people to tell their own stories regarding their relationship with and view of the artefact and the place. What did they witness, what did they find out, how did they relate the artefact and the place to their lives, etc.

### Closing

1. From your own perspective as a [member of the community trust/historical society / staff member of city libraries/museum], what else could you think of making use of the relationships between the artefacts and these places?
  - a) Prompt: So you chose [4] types of magical powers today to assist yourself for telling artefact-related stories to [2-3] types of people ...

Study finished, thank the participant.

## B5: Approval Letter to First Ethics Application

Faculty of Computing and  
Mathematical Sciences  
*Rorohiko me ngā Pūtaiao Pāngarau*  
The University of Waikato  
Private Bag 3105  
Hamilton  
New Zealand

Phone +64 7 838 4322  
www.cms.waikato.ac.nz



THE UNIVERSITY OF  
**WAIKATO**  
*Te Whare Wānanga o Waikato*

5 October 2018

Can Zhao  
C/- Department of Computer Science  
**THE UNIVERSITY OF WAIKATO**

Dear Can

### **Request for approval to conduct a user study with human participants**

On the basis of the information you have provided on the FCMS Preliminary Ethics Application Form relating to your research "in-situ heritage information acquisition and prototyping" the committee has given you approval to proceed with your proposed study.

We wish you well with your research.

A handwritten signature in blue ink, appearing to read 'Mark Apperley', with a horizontal line underneath.

**Mark Apperley**  
Human Research Ethics Committee  
Faculty of Computing and Mathematical Sciences

## **B6: Formal Request for Change of Expiration Date of Participant Right to Withdraw**

Can Zhao

Department of Computer Science

University of Waikato

5 March 2019

Professor Mark Apperley

Human Research Ethics Committee

Faculty of Computing and Mathematical Sciences

University of Waikato

Dear Prof Apperley,

### **Request for change of expiration date of participant right to withdraw**

We request to make a change to the expiration date of participant right to withdraw stated on the Participant Information Sheet and Consent Form of my study “In-situ heritage information acquisition and prototyping” to 28 February 2020.

Thank you very much.

Yours sincerely,

Can Zhao

## **B7: Formal Request for Addition of a Participant Recruitment Approach**

Can Zhao

Department of Computer Science

University of Waikato

12 April 2019

Professor Mark Apperley

Human Research Ethics Committee

Faculty of Computing and Mathematical Sciences

University of Waikato

Dear Prof Apperley,

### **Request for addition of a participant recruitment approach**

We plan to add a participant recruitment approach to my study “In-situ heritage information acquisition and prototyping” due to the insufficient number of replies received from the potential participants.

We request to add “Participant recruitment advertisement will be posted at relevant cultural heritage-related organisations in Hamilton when permission is obtained” to the subsections 3.1, 3.3 and 3.4 of the Outline of Research or Related Activity form.

Please also refer to the attached poster. Thank you very much.

Yours sincerely,

Can Zhao

## B8: Participant Recruitment Advertisement

### Participants needed for informal session on locations, artefacts and stories

#### PURPOSE

To understand heritage artefact information and explore new digital ways to engage with artefacts

#### WE ARE SEEKING

Heritage enthusiasts and experts in Hamilton

#### WHAT YOU NEED TO DO

- Select one location in Hamilton and associated heritage artefact(s)
- Visit two locations (the other will be selected by us within short walking distance) and talk about associated artefacts and stories with a researcher

#### TIME COMMITMENT

The informal session should take less than one hour

Please contact Can Zhao for more information:

Email: [cz93@students.waikato.ac.nz](mailto:cz93@students.waikato.ac.nz)

Mobile:

The study has received approval from the Human Research Ethics Committee, Faculty of Computing and Mathematics Sciences, University of Waikato.



Can Zhao  
cz93@students.waikato.ac.nz

## B9: Approval Letter to Formal Request for Addition of a Participant Recruitment Approach

Faculty of Computing and  
Mathematical Sciences  
*Rorohiko me ngā Pūtaiao Pāngarau*  
The University of Waikato  
Private Bag 3105  
Hamilton  
New Zealand

Phone +64 7 838 4322  
www.cms.waikato.ac.nz



16 April 2019

Can Zhao  
C/- Department of Computer Science  
**THE UNIVERSITY OF WAIKATO**

Dear Can

### **Request for approval for an addition to your approved user study with human participants**

We refer to your previously approved ethics application dated 5 October 2018 "In-situ heritage information acquisition and prototyping".

The committee has given you approval to proceed with your proposed additional request to place advertisement posters at relevant cultural heritage-related organizations in Hamilton, dependent on you first receiving written permission from each.

We wish you well with this new approach.



**Mark Apperley**  
Human Research Ethics Committee  
Faculty of Computing and Mathematical Sciences

## **Appendix C. Material for Acquiring Object Biography Metadata Samples**

This appendix contains the material that was prepared for conducting the study described in Chapter 5.

C1, C2, an annotated blank spreadsheet file (C3 shows the content of the file) and C4 were submitted to support the application to the CMS Ethics Committee, School of Computing and Mathematical Sciences of the University. C5 was consequently received, dated 15 January 2020.

C6, C7, C8, C9, C10 and C11 constituted a study plan that would involve two participants, one selecting and populating the spreadsheet with metadata values and the other offering a critique of the values. The plan was finalised on 14 November 2019, though was not used.

# C1: Preliminary Ethics Application Form

Faculty of Computing and Mathematical Sciences

## FCMS Preliminary Ethics Application Form for Usability Studies, Surveys and Related Personal Data Gathering



Please note that older versions of Adobe Reader may not enable completed forms to be saved.

Please complete all sections of this form.

### General Applicant Details

Applicant's name: Can Zhao

Department:  Computer Science  
 Mathematics  
 Statistics  
 Other:

Email address: cz93@students.waikato.ac.nz

Phone number:   
(Best number for contact during standard working hours)

Faculty of Computing and Mathematical Sciences

**Applicant Status** Staff Student

Supervisor's name: David Nichols

 Dissertation / thesis research

Code code: COMP900

 Course assignment / project Other: Other:

**General Research Activity Details**

Short, descriptive title:           Extracting heritage artefact metadata  
(<10 words)

Activity outline:                    The activity aims at extracting the metadata of some selected heritage artefacts in a biographical form from any resources that a participant would find appropriate. In a paragraph describe the activity this application relates to, methods to be used, outcomes hoped for, and how it fits with a broader project (if applicable).            The metadata will be used to create an Android application prototype to demonstrate a novel way of interacting with artefacts outside museums. The activity includes two tasks: a) select several heritage artefacts collected by the Waikato Museum and, b) populate the cells of a spreadsheet with the metadata of the selected artefacts. We will invite one participant to perform both the tasks a) and b) via contracting with them. We will have a semi-structured interview in a debriefing meeting form with the participant to discuss the metadata, anything that is worth noting and their experience of the activity.

Approximate start date:           January 2020

Expected activity duration        90 minutes for the semi-structured interview (in a debriefing meeting form) involving subjects:  
(i.e. excluding later analysis)

Expected overall                    March 2020  
completion date:  
(including analysis and reporting)

**Planned Approach** Field-based usability study Laboratory-based usability study Survey / Questionnaire Personal information / Data gathering

Other: The researcher will first send the Participant Information Sheet and Consent Form and Sample Sheet to and request the participant to select several heritage artefacts according to three criteria. The participant will let the researcher know their list of the selected artefacts and time used, then be given a spreadsheet with the name of each artefact enter on a separate sheet and populate the cells. The researcher will receive a copy of the spreadsheet and time information, arrange a semi-structured interview with the participant. The venue should be a place with access to the related resources. During the interview, the researcher will ask some pre-defined questions and might follow up for more details. Please see the attached protocol (word document) for more details. The researcher will analyse the data and report the results.

## Faculty of Computing and Mathematical Sciences

- Data gathering from subject:  Computer activity, through software  
 AV recordings  
 Biometric data  
 Experimenter will monitor manually  
 Other:

Data gathering details: The researcher will collect the information of the selected artefacts, the metadata entered in the spreadsheet and the time (in hours) spent on completing the tasks. For the semi-structured interview, the researcher will record video, audio and still image of the occasion in which the participant and researcher talking with each other if a written consent is given. The researcher will also manually record some keywords from the reponses for asking follow-up questions. Therefore the researcher will gather each participant's verbal, gestural and facial experssions, as well as any related physical and digital resources.

**Participants**Approximate number  
of participants: <5 6-10 11-20 21-50 >50 There are specific requirements for choosing participants

Notes on numbers and requirements: We will contract with one participant who is a museum professional or heritage expert.

Recruitment method:

 Personal contact Advertisement Online / Email Other:

## Faculty of Computing and Mathematical Sciences

Will participants provide specific informed consent for their involvement in this study?

Yes  No

Signed paper form

Electronic form

How will participants be provided the necessary information about this study?

Signed paper form

Electronically pushed

Electronically pulled

(See Participant Information Sheet)

Other: An e-copy of the Participant Information Sheet and Consent Form will be sent to the participant once they are contracted.

Will you have direct personal engagement with all participants?

Yes  No

Will participants' personal identification details (e.g. name, address, phone number, email, computer IP address or other personal ID) be recorded?

Yes  No

Details: For the recruitment and communication purposes, the researcher may record the name, work email address and possibly work phone number of the participant.

Is there any compulsion and/or will participants/subjects receive any incentives for their involvement?

Yes  No

Details: Due to the complexity of extracting artefact metadata from various resources, the participant will be contracted to perform the activity.

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Can you ensure that an individual participant can withdraw after completing the activity but before the data is analysed and reported?

Yes  No

Does your study involve any contrived deception, for example withholding some relevant information from participants for the purpose of the study?

Yes  No

Is there a possibility that participants may incur, or have greater risk of, physical, psychological, social, economic or cultural harm as a result of being involved in this study?

Yes  No

**Reporting and Publication of Results**

How will the outcomes will be reported?

Published journal or conference paper

Thesis or dissertation

Limited circulation research report

Published working paper or research report

Course assignment

Popular press

Other:

Is it likely that individual participants could be identified from the published results?

Yes

No

How can you ensure the anonymity of participants?

The researcher will anonymise the participant in the published results. Due to the factors such as the uniqueness of the selected artefacts, the nature of work in the heritage field, etc., the participant might still get identified. The researcher will give the participant the right of refusal for including any information before publishing any results.

Will the data obtained from the experiment will be made available publicly (e.g. through a public database)?

Yes

No

**Storage of Results**

Length of time data  
will be retained:

- Data will not be retained following the study
- <1 year
- 1-5 years
- >5 years

The gathered data  
will be stored in:

- Not applicable
- Faculty archive (safe)
- Computer archive – offline back up
- Computer archive – online or cloud
- Personal office
- Other:

Date: 07/01/2020  
(Required format: dd/mm/yyyy)

## C2: Participant Information Sheet and Consent Form

### **Participant Information Sheet**



### **Ethics Committee, School of Computing and Mathematical Sciences**

#### **Project Title**

*Extracting heritage artefact metadata*

#### **Purpose**

To extract the metadata of some selected artefacts from any available resources.

#### **What is this research project about?**

The study aims at collecting the artefact metadata to enable creating a novel way of interacting with artefacts outside museums using mobile phones.

#### **What will you have to do and how long will it take?**

We will ask you to: a) select several heritage artefacts collected by the Waikato Museum and, b) fill in the boxes of each corresponding sheet with the metadata of an artefact. We will also ask you to record the time spent on accomplishing both tasks. For the task a), explanations and criteria will guide you through the process. We will request the artefact list and time information once a) is done and provide you with an Excel file with the name of each artefact entered on a separate sheet. When the task b) is completed, we will request a copy of the Excel file and time information, and organise a debriefing meeting in a venue that has access to the materials you have used to discuss the results, anything that is worth noting and your experience. Prior to this discussion you will be asked to give consent to your participation in the project. The debriefing meeting should take no longer than *90 minutes*. If you give consent, the audio and video of the meeting may be recorded, and photos may be taken.

#### **What will happen to the information collected?**

The information collected will be used by the researcher to build a mobile application prototype and write research publications including the doctoral thesis. Only the researcher, supervisor and co-authors will be privy to the notes, photos and recordings from the project. Transcription of the debriefing meeting may be made by a third party under a confidentiality agreement. Some of your responses might be quoted, and a small number of the photos (anything shown on the photos that might lead to identification will be pre-processed) might be used in the publications. As these types of information might lead to identification due to the factors such as the uniqueness of the selected artefacts, the nature of work in the heritage field, etc., you will be contacted for confirming whether you agree to have such information included in any publications. You will not be named in the publications, and every effort will be made to disguise your identity. The researcher will keep the notes, photos, recordings and anonymised transcriptions before the completion of the PhD and then archive the anonymised transcriptions, but will treat them with the strictest confidentiality. On completion of this project, the data that may include the notes, pre-processed photos, recordings and anonymised transcriptions will also be stored in the School of Computing and Mathematical Sciences (SCMS) Data Archive for five years.

#### **Declaration to participants**

If you take part in the study, you have the right to:

- Refuse to answer any question and to withdraw from the project before 30 June 2020. If you wish to withdraw, contact the researcher, Can Zhao (cz93@students.waikato.ac.nz). You do not need to give any reason for withdrawing from the project.
- Ask any further questions that occur to you during your participation.
- Be given access to a summary of findings from the project when it is concluded.

#### **Who's responsible?**

If you have any questions or concerns, either now or in the future, please feel free to contact either:

Researcher:  
*Can Zhao*  
 Department of Computer Science  
 University of Waikato  
 Private Bag 3105  
 Hamilton, New Zealand  
 Email: [cz93@students.waikato.ac.nz](mailto:cz93@students.waikato.ac.nz)

Supervisor:  
*Associate Professor David Nichols*  
 Department of Computer Science  
 University of Waikato  
 Private Bag 3105  
 Hamilton, New Zealand  
 Email: [david.nichols@waikato.ac.nz](mailto:david.nichols@waikato.ac.nz)

**Research Consent Form****Ethics Committee, School of Computing and Mathematical Sciences****Extracting heritage artefact metadata****Consent Form for Participants**

I have read the **Participant Information Sheet** for this project and have had the details of the project explained to me. My questions about the project have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I also understand that I am free to withdraw from the project before **30 June 2020** or to decline to answer any question in the project. I understand I can withdraw any information I have provided up until the researcher has commenced analysis on my data. I agree to provide information to the researchers under the conditions of confidentiality set out on the **Participant Information Sheet**.

I agree to participate in this project under the conditions set out in the **Participant Information Sheet**.

Signed: \_\_\_\_\_

Name: \_\_\_\_\_

Date: \_\_\_\_\_

**Additional Consent as Required**

I agree / do not agree to the use of audio and video recording of my responses.

If I agree to audio and video recording, then I understand that I may review the recording within three days of the debriefing meeting and may withdraw the audio and video recording. Withdrawn audio and video recordings will be deleted.

I agree / do not agree to the use of photographs of me, artefacts and/or the related materials.

If I agree to photographs being taken, then I understand that I may review them at the end of the debriefing meeting and may withdraw any photograph. Withdrawn photographs will be deleted.

Signed: \_\_\_\_\_

Name: \_\_\_\_\_

Date: \_\_\_\_\_

**Contact information:**

Researcher:  
*Can Zhao*  
*Department of Computer Science*  
*University of Waikato*  
*Private Bag 3105*  
*Hamilton, New Zealand*  
*Email: [cz93@students.waikato.ac.nz](mailto:cz93@students.waikato.ac.nz)*

Supervisor:  
*Associate Professor David Nichols*  
*Department of Computer Science*  
*University of Waikato*  
*Private Bag 3105*  
*Hamilton, New Zealand*  
*Email: [david.nichols@waikato.ac.nz](mailto:david.nichols@waikato.ac.nz)*

## C3: Content of Sample Spreadsheet for Extracting Heritage Artefact Metadata

### *Readme on Sheet 1*

This table is created to give you an idea about what you would be asked to do for the artefact metadata activity. The metadata will be used to create a novel way of interacting with artefacts outside museums using mobile phones. We would ask you to accomplish two tasks:

- a) Select several heritage artefacts collected by the Waikato Museum.
- b) Fill in the boxes of each corresponding sheet with the metadata of an artefact.

For completing the task a), we first introduce the concepts of Direct Place, Relevant Place and Hybrid Place:

**Direct Place:** a place where an artefact has been (e.g., the places an artefact was created, stayed, etc.).

**Relevant Place:** a place where an event occurred but was not attended by an artefact, though the event is relevant to another event that occurred in another place and was attended by the artefact.

**Hybrid Place:** a place is both a direct place for one or more artefacts and a relevant place for another or more artefacts.

We set the following four criteria to aid you to select artefacts. We need:

1) Five places. The selection should include a mixture of direct places and relevant places (e.g. three direct, two relevant). The inclusion of hybrid places is ideal but not compulsory.

2) At least one of the places should be either a direct place to two or more artefacts or a hybrid place.

3) The five places should be located close to each other (i.e., take less than ten minutes to walk from one to another), ideally in the city centre.

4) At least three artefacts should be selected. We would suggest selecting Ticket to South Africa vs. Waikato, Rugby Park, Hamilton (1985/12/88) collected by the Waikato Museum as one artefact.

Please record how many hours are used for the task a). Once you finished the task a), please let us know your selection and the hours used.

For completing the task b), we will provide you with an Excel file with the name of each artefact entered on a separate sheet. You could use any materials, the fictional artefact

example and additional notes that are given on the other two sheets of this file for the task. We encourage you to fill in as many boxes as possible.

Please again record how many hours are used for the task b). When you completed the task b), please send us a copy of the Excel file and let us know the hours used.

We will arrange a debriefing meeting with you at a place with access to the used materials to discuss the results, anything that you believe is worth noting and your experience. If you give consent before the debriefing, the audio and video of the meeting may be recorded, and photos may be taken.

Please contact Can Zhao (cz93@students.waikato.ac.nz) at any time if you have any questions.



### **Additional notes provided on columns and rows of *Artefact metadata sheet***

#### *Creation:*

Please populate the cells to describe how the artefact was created.

#### *Exchange:*

Please populate the cells to describe how the artefact was exchanged. An exchange event can be: 1) exchanging commodities, or 2) gifting.

#### *Exchange 2:*

If you think there are more worth noting exchange events, please specify this one and populate the cells.

#### *Another Pre-Accession Event:*

If you think there is a worth noting pre-accession event, please specify this one and populate the cells.

#### *Another Pre-Accession Event 2:*

If you think there are more worth noting pre-accession events, please specify this one and populate the cells.

#### *Accession:*

Please populate the cells to describe how the artefact was accessioned. Accession is a special case among the exchange events. An accession event can be but may not be limited to: 1) gifting/donation, or 2) acquisition.

#### *In-Museum Event:*

Please populate the cells to describe how the artefact was used in museum.

#### *In-Museum Event 2:*

If you think there are more worth noting in-museum events, please specify this one and populate the cells.

#### *(Artefact) Name:*

Please populate the cells if the names of the artefact during the time of an event is known. An artefact may be (re)named during one or more events.

#### *Other Artefact Used:*

Please populate the cells if other known artefacts were used during the events. Listing the names of the artefacts with their accession numbers would be preferred.

#### *Manifestation of Exchange Value:*

Please populate the cells if the manifestations of exchange value in any exchange and accession events are known. A manifestation of exchange value can be something that is tangible or intangible.

*(Person) Name:*

Please populate the cells if the names of any persons who directly involved in the events are known.

*Role:*

Please populate the cells for the roles played by the persons in the events. A distinction should be made for individuals and corporates.

*Time:*

Please populate the cells if the starting and/or ending times, or a duration of the events are known. A longer yet definitive duration would be preferred to the presence of "circa".

*(Place) Name/Toponym:*

Please populate the cells if the names of any places where the events occurred are known. The place names that were commonly used during the events are preferred.

*Location & Extent:*

Please populate the cells if the locations and extents of the places listed in the previous column are known. Such information could include GPS Coordinates, legal descriptions or other relevant descriptive information.

*(Place) Name/Toponym of Relevant Place:*

Please populate the cells if the names of any relevant places are known. We would consider a place where an event occurred but was not attended by the artefact is relevant to another place where a related event occurred and was attended by an artefact. Whether a place is relevant is at your discretion.

*Additional Note/Miscellaneous:*

Please populate the cells if you have anything to add.

***A fictional artefact example on Sheet3*** (The content was originally filled in the sheet)

*Creation event*

*(Artefact) Name:*

[Mason's internal code-name for the soup plate]

*Other Artefact Used:*

[Some tools]

*Manifestation of Exchange Value:*

N/A

*(Person) Name & Role:*

- Doyle Foy, Individual Creator
- Katie Arthur, Stilt-maker & Individual Contributor
- Mould runner, jiggerer, glazer, etc. on the shift, Corporate Contributor
- Mason's, Corporate Creator

*Time:*

Late 1810s - 1840s

*(Place) Name/Toponym:*

Mason's Staffordshire Pottery Factory

*Location & Extent:*

Hanley, Stoke-on-Trent, United Kingdom

*(Place) Name/Toponym of Relevant Place:*

N/A

*Additional Note/Miscellaneous:*

- From the museum catalogue: "[The soup plate] was made to regimental colours of the 65 Regiment but with no number or crest. "Crown surmounted by 'Mason's', over a banner with 'PATENT IRONSTONE CHINA'. "Floral pattern around the edge and in the centre."
- <https://www.keele.ac.uk/discover/artskeele/whatson/ravenmason/masonsmarks/>
- The making of the soup plate is too complicated to cover using the available columns, I'd like to talk to you if you were looking for more details.

*Exchange event*

*(Artefact) Name:*

Mason's ironstone soup plate

*Other Artefact Used:*

- Mason's ironstone bread and butter plates
- Mason's ironstone tureens

*Manifestation of Exchange Value:*

The cost of the sets of tableware including the soup plate itself was paid using banknotes and coins that were worth [a monetary value].

*(Person) Name & Role:*

- Clayton Burns, Salesperson
- Burl Learmonth, Representative of Corporate Buyer
- Mason's, Corporate Seller
- 65th Regiment of Foot, Corporate Buyer

*Time:*

Mid-1840s

*(Place) Name/Toponym:*

Mason's Staffordshire Pottery Factory Shop

*Location & Extent:*

Hanley, Stoke-on-Trent, United Kingdom

*(Place) Name/Toponym of Relevant Place:*

N/A

*Additional Note/Miscellaneous:*

Again, more information is available (e.g. record of purchase in regimental archives) but didn't seem to work with the columns well.

*Exchange 2 event**(Artefact) Name:*

Special plate

*Other Artefact Used:*

1 jar

*Manifestation of Exchange Value:*

The soup plate and the jar were exchanged using [an artwork].

*(Person) Name & Role:*

- Jeanie Spencer, Individual Buyer
- Giles Spencer, Representative of Individual Buyer
- Abram Carnall, Individual Seller

*Time:*

c. 1882

*(Place) Name/Toponym:*

Gwynne's Hamilton Hotel

*Location & Extent:*

Victoria Street, Hamilton, New Zealand, Part Allotment 53 Hamilton West

*(Place) Name/Toponym of Relevant Place:*

Royal Hotel

*Additional Note/Miscellaneous:*

- Lawrence Dodson: "I know some pieces of the tableware were auctioned by the descendants of an original owner."
- Note: It was common that the exchanges including auctions would be arranged in places like Hamilton Hotel or Royal Hotel.
- Also indirectly associated with a recorded event - a ship arriving in NZ that we think transported the soup plate.

*Family Dinner event*

*(Artefact) Name:*

- Jane's plate (called by Irene & Amelia Spencer)
- My plate (called by Jane Spencer)

*Other Artefact Used:*

- Cookbook of Irene Spencer (by Irene Spencer)
- 1 wine glass (by Jane Spencer)

*Manifestation of Exchange Value:*

N/A

*(Person) Name & Role:*

Spencer Family including Irene, Amelia and Jane Spencer and Lawrence Dodson

- Irene Spencer, Organiser, preparer and attendee, The grandmother of Lawrence Dodson.
- Amelia Spencer, Preparer and attendee, The mother of Lawrence Dodson.
- Jane Spencer, Attendee, One of the aunts of Lawrence Dodson.
- Lawrence Dodson, Attendee, one of the donors.

*Time:*

September 1945

*(Place) Name/Toponym:*

House of Spencer Family

*Location & Extent:*

Pt Sec 305 Hamilton East

*(Place) Name/Toponym of Relevant Place:*

Hamilton East Market

*Additional Note/Miscellaneous:*

- Lawrence Dodson: "... Sometimes I'd go to the market with my grandmother."
- Lawrence Dodson: "I know my grandmother had it for many years even if I don't know when the plate was passed down to her. ... My grandma used to move a lot - she lived in Auckland in the 30s, and Huntly briefly then Hamilton. ... The tableware was kept by her in good condition."

*Accession event*

*(Artefact) Name:*

One of the dinner set kept by my grandmother

*Other Artefact Used:*

- A wine glass that was also used for family dinners and special occasions
- A donation certificate issued by Regional Museum

*Manifestation of Exchange Value:*

- The soup plate and the smaller wine glass were donated for fulfilling a wish of memorising the past events and making the artefacts more useful.

- A donation certificate was given to the donors in recognition of their contribution to preserving heritage.

*(Person) Name & Role:*

Lawrence & Elaine Dodson, Corporate Donor

*Time:*

4 May 2005

*(Place) Name/Toponym:*

Research Room, Regional Museum

*Location & Extent:*

Gate One, Knighton Road, Hamilton 3216 (address changed for protecting privacy)

*(Place) Name/Toponym of Relevant Place:*

Burial of Irene Spencer, Hamilton East Cemetery

*Additional Note/Miscellaneous:*

The original set was scattered. The bread and butter plate included in the donated set was not made for 65th Regiment but still by Mason's with different colours.

*Putting on display event**(Artefact) Name:*

14590.1 (Accession Number) Soup plate of Spencer china

*Other Artefact Used:*

14590.2 (Accession Number) Smaller wine glass

*Manifestation of Exchange Value:*

N/A

*(Person) Name & Role:*

Christine Anderson, Curator of the exhibition

*Time:*

Beginning of August 2017, before 5 August 2017

*(Place) Name/Toponym:*

Gallery 1, Regional Museum

*Location & Extent:*

Gate One, Knighton Road, Hamilton 3216 (address changed for protecting privacy)

*(Place) Name/Toponym of Relevant Place:*

Keele Hall, Keele University (The Raven Mason Collection)

*Additional Note/Miscellaneous:*

The exhibition was titled "Early days of a settlement", ran from 5 August to 26 November 2017.

## C4: Protocol for the Tasks of Extracting Heritage Artefact Metadata and Debriefing Meeting

### Recruitment and Task

- We will approach the potential participants who are either museum professionals or heritage experts in person and via email. We will contract with one participant to perform the activity. We will also send them:
  - A copy of the *Participant Information Sheet* and *Consent Form*.
  - A copy of the *Sample Sheet* that contains an artefact metadata sheet with no value and a fictional artefact example.
- We will request the participant to accomplish two tasks:
  - a) Select several heritage artefacts collected by the Waikato Museum.
  - b) Populate the cells of each corresponding spreadsheet with the metadata of an artefact.

### Task a)

- We will introduce the concepts of *Direct Place*, *Relevant Place* and *Hybrid Place* to the participant:
  - *Direct Place*: a place where an artefact has been (e.g., the places an artefact was created, stayed, etc.).
  - *Relevant Place*: a place where an event occurred but was not attended by an artefact, though the event is relevant to another event that occurred in another place and was attended by the artefact.
  - *Hybrid Place*: a place is both a direct place for one or more artefacts and a relevant place for another or more artefacts.
- We will then provide the following four criteria to aid the participant to select artefacts:
  - *Five places*. The selection should include a mixture of direct places and relevant places (e.g. three direct, two relevant). The inclusion of hybrid places is ideal but not compulsory.
  - *At least one of the places* should be either a direct or a hybrid place to *two or more artefacts*.
  - The five places should be located close to each other (i.e., take less than *ten minutes* to walk from one to another), ideally in the city centre.
  - *At least three artefacts* should be selected. We would suggest selecting *Ticket to South Africa vs. Waikato, Rugby Park, Hamilton (1985/12/88)* collected by the Waikato Museum as one artefact.
- We will ask the participant to record the time spent on accomplishing the task. Once the artefacts are selected, we will:
  - Request a list of the selected artefacts and the information about how many hours were used.
  - Provide the participant with a spreadsheet file with the name of each artefact entered on a separate sheet for performing the task b).

### Task b) & Debriefing Meeting

- The participant should populate the cells of each sheet by referring to the related materials of the selected or given artefacts, fictional artefact example and additional notes provided for each row and column.
- We will ask the participant to record the time spent on accomplishing the task. Once the cells are populated, we will:
  - Request a copy of the spreadsheet file and the information about how many hours were used.
  - Arrange a debriefing meeting with the participant.

### Debriefing Meeting

#### Venue

A place with access to the related materials of the selected artefacts, such as a meeting room or an office in a museum, etc.

#### Potential Recording Tools

- An audio recorder
- A handycam or an action camera
- A still camera

#### Before Debriefing

- The researcher gives and presents the information of the *Participant Information Sheet* and *Consent Form* to the participant, then requests their consent.
- The researcher configures the recording devices.

#### Semi-structured Interview Questions

1. Could you tell us a little about your heritage artefact-related life?
  - a. *For museum professionals, if not mentioned, follow-up:* Are you involved in collection cataloguing practice?
2. Why did you choose this/these artefacts?
  - a. *Follow-up:* When did you first encounter with this/these artefacts?
  - b. *Follow-up:* Did this/any of these artefacts get involved in your work or even other aspects of your life ever since? How?
3. Is there anything in the sheets/tables you'd like to clarify or discuss?
  - a. *If the participant mentioned something that is not or partially listed in the sheets, follow-up:* Why did you choose to clarify this information (*related to 4 b) & c)*?
  - b. *Follow-up:* Could you clarify this bit of information (by pointing to a cell)?
4. When you were filling information into the boxes, did you have a plan on what sort of things you would enter?
  - a. *Follow-up:* For the completed boxes, what was less time-consuming? What took you more time? Why?
  - b. *Follow-up:* For the empty boxes, have you tried entering anything? Was it time-consuming? Why?

- c. *Follow-up*: Have you thought of anything that is not listed in the sheets/tables? Have you tried entering them? Was it time-consuming? Why?
5. Did this activity get you to think of anything?
  - a. *If nothing and the participant is involved in cataloguing, follow-up*: How about the collection cataloguing practice?
  - b. *If another activity, especially a curatorial or interpretation activity is mentioned, follow-up*: Would this activity be relevant to [the mentioned activity]? How? Any similarities and differences between [the mentioned activity] and this activity?
6. A final follow-up depending on the responses, if necessary.

Debriefing finished, thank the participant.

## C5: Approval Letter to Ethics Application

**School of Computing and Mathematical Sciences**

*Rorohiko me ngā Pūtaiao Pāngarau*

The University of Waikato

Private Bag 3105

Hamilton, New Zealand

Phone: +64 7 838 4322

Website: [www.cms.waikato.ac.nz](http://www.cms.waikato.ac.nz)

Email: [cms@waikato.ac.nz](mailto:cms@waikato.ac.nz)



THE UNIVERSITY OF

**WAIKATO**

*Te Whare Wānanga o Waikato*

15 January 2020

Can Zhao

c/- Department of Computer Science

**THE UNIVERSITY OF WAIKATO**

Dear Can

**Request for approval to conduct a user study with human participants**

On the basis of the information you have provided on the SCMS Preliminary Ethics Application Form relating to your research "Extracting heritage artefact metadata", the committee has given you approval to proceed with your proposed study. The approval number is CMS-20-01, which you should include on the Participant Information Sheet.

We wish you well with your research.

A handwritten signature in blue ink, appearing to read 'Mark Apperley', with a horizontal line underneath.

**Mark Apperley**

CMS Ethics Committee Convenor

School of Computing and Mathematical Sciences

## C6: Preliminary Ethics Application Form (Unused)

Faculty of Computing and Mathematical Sciences

### FCMS Preliminary Ethics Application Form for Usability Studies, Surveys and Related Personal Data Gathering



Please note that older versions of Adobe Reader may not enable completed forms to be saved.

Please complete all sections of this form.

#### General Applicant Details

Applicant's name: Can Zhao

Department:  Computer Science  
 Mathematics  
 Statistics  
 Other:

Email address: cz93@students.waikato.ac.nz

Phone number:   
(Best number for contact during standard working hours)

Faculty of Computing and Mathematical Sciences

**Applicant Status** Staff Student

Supervisor's name: David Nichols

 Dissertation / thesis research

Code code: COMP900

 Course assignment / project Other: Other:

**General Research Activity Details**

Short, descriptive title:           Extracting heritage artefact metadata  
(<10 words)

Activity outline:                       The activity aims at extracting the metadata of some selected heritage artefacts in a biographical form from any resources that a participant would find appropriate. In a paragraph describe the activity this application relates to, methods to be used, outcomes hoped for, and how it fits with a broader project (if applicable).                       The metadata will be used to create an Android application prototype to demonstrate a novel way of interacting with artefacts outside museums. The activity includes two tasks: a) select several heritage artefacts collected by the Waikato Museum or a museum in the Waipa District and, b) populate the cells of a spreadsheet with the metadata of the selected artefacts. We will invite one participant (P1) to perform both the tasks a) and b) via contracting with them. Another participant (P2) might be contracted to critique the metadata extracted by P1, if gathering more information from an alternative perspective is deemed to be feasible and beneficial. We will have a semi-structured interview in a debriefing meeting form with P1 and possibly P2 to discuss the metadata, anything that is worth noting and their experience of the activity.

Approximate start date:           December 2019

Expected activity duration involving subjects:           90 minutes for each semi-structured interview (in a debriefing meeting form)  
(i.e. excluding later analysis)

Expected overall completion date:                       March 2020  
(including analysis and reporting)

**Planned Approach** Field-based usability study Laboratory-based usability study Survey / Questionnaire Personal information / Data gathering

Other: The researcher will first send the Participant Information Sheet and Consent Form and Sample Sheet to and request P1 to select several heritage artefacts according to three criteria. P1 will let the researcher know their list of the selected artefacts and time used, then be given a spreadsheet with the name of each artefact enter on a separate sheet and populate the cells. The researcher will receive a copy of the spreadsheet and time information, arrange a semi-structured interview with the participant. The venue should be a place with access to the related resources. During the interview, the researcher will ask some pre-defined questions and might follow up for more details. The researcher might invite P2 to critique the extracted metadata, which would produce more metadata and have the semi-structured interview with them, if necessary. Also see the attached protocol (word document). The researcher will analyse the data and report the results.

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- Data gathering from subject:  Computer activity, through software  
 AV recordings  
 Biometric data  
 Experimenter will monitor manually  
 Other:

Data gathering details: The researcher will collect the information of the selected artefacts, the metadata entered in the spreadsheet and the time (in hours) spent on completing the tasks. For the semi-structured interview(s), the researcher will record video including the on-screen activity and the occasion in which the participant and researcher talking with each other, audio and still image if a written consent is given. The researcher will also manually record some keywords from the responses for asking follow-up questions. Therefore the researcher will gather each participant's verbal, gestural and facial expressions, on-screen activity (e.g., the participant hovers the pointer over a particular cell), as well as any related physical and digital resources.

**Participants**

Approximate number  
of participants:

- <5  
 6-10  
 11-20  
 21-50  
 >50

There are specific requirements for choosing participants

Notes on numbers and requirements: We will contract with one participant who is a museum professional or heritage expert. We will also retain an option of contracting with another heritage expert or enthusiast to gather additional metadata from an alternative perspective.

Recruitment method:

Personal contact  
 Advertisement

Online / Email

Other:

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Will participants provide specific informed consent for their involvement in this study?

Yes  No

Signed paper form

Electronic form

How will participants be provided the necessary information about this study?

Signed paper form

Electronically pushed

Electronically pulled

(See Participant Information Sheet)

Other: An e-copy of the Participant Information Sheet and Consent Form will be sent to the participant(s) once they are contracted.

Will you have direct personal engagement with all participants?

Yes  No

Will participants' personal identification details (e.g. name, address, phone number, email, computer IP address or other personal ID) be recorded?

Yes  No

Details: For the recruitment and communication purposes, the researcher may record the names, work email addresses and possibly work phone numbers of the participant(s).

Is there any compulsion and/or will participants/subjects receive any incentives for their involvement?

Yes  No

Details: Due to the complexity of extracting artefact metadata from various resources, the participant(s) will be contracted to perform the activity.

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Can you ensure that an individual participant can withdraw after completing the activity but before the data is analysed and reported?

Yes  No

Does your study involve any contrived deception, for example withholding some relevant information from participants for the purpose of the study?

Yes  No

Is there a possibility that participants may incur, or have greater risk of, physical, psychological, social, economic or cultural harm as a result of being involved in this study?

Yes  No

**Reporting and Publication of Results**

How will the outcomes  
will be reported?

Published journal or conference paper

Thesis or dissertation

Limited circulation research report

Published working paper or research report

Course assignment

Popular press

Other:

Is it likely that individual participants could be identified from the published results?

Yes  No

How can you ensure the  
anonymity of participants?

The researcher will anonymise the participant(s) in the published results. Due to the factors such as the uniqueness of the selected artefacts, the nature of work in the heritage field, etc., the participant(s) might still get identified. The researcher will give the participant(s) the right of refusal for including any information before publishing any results.

Will the data obtained from the experiment will be made available publicly (e.g. through a public database)?

Yes  No

**Storage of Results**

Length of time data  
will be retained:

- Data will not be retained following the study
- <1 year
- 1-5 years
- >5 years

The gathered data  
will be stored in:

- Not applicable
- Faculty archive (safe)
- Computer archive – offline back up
- Computer archive – online or cloud
- Personal office
- Other:

Date: 13/11/2019

(Required format: dd/mm/yyyy)

# C7: Participant Information Sheet and Consent Form for P1 (Unused)

## Participant Information Sheet



### Ethics Committee, Faculty of Computing and Mathematical Sciences

#### Project Title

*Extracting heritage artefact metadata*

#### Purpose

To extract the metadata of some selected artefacts from any available resources.

#### What is this research project about?

The study aims at collecting the artefact metadata to enable creating a novel way of interacting with artefacts outside museums using mobile phones.

#### What will you have to do and how long will it take?

We will ask you to do: a) select several heritage artefacts collected by the Waikato Museum (if you are Hamilton-based) or a museum in the Waipa District (if you are Waipa-based) and, b) fill in the boxes of each corresponding sheet with the metadata of an artefact. We will also ask you to record the time spent on accomplishing both tasks. For the task a), explanations and criteria will guide you through the process. We will request the artefact list and time information once a) is done and provide you with an Excel file with the name of each artefact entered on a separate sheet. When the task b) is completed, we will request a copy of the Excel file and time information, and organise a debriefing meeting in a venue that has access to the materials you have used to discuss the results, anything that is worth noting and your experience. This meeting should take no longer than *90 minutes*. If you give consent, the audio and video of the meeting, including on-screen activity may be recorded, and photos may be taken. You will be asked to give consent prior to the meeting and may be asked to give consent at a later stage.

#### What will happen to the information collected?

The information collected will be used by the researcher to build a mobile application prototype and write research publications including the doctoral thesis. Only the researcher, supervisor and co-authors will be privy to the notes, photos and recordings from the project. Transcription of the debriefing meeting may be made by a third party under a confidentiality agreement. Some of your responses might be quoted, and a small number of the photos (anything shown on the photos that might lead to identification will be pre-processed) might be used in the publications. As these types of information might lead to identification due to the factors such as the uniqueness of the selected artefacts, the nature of work in the heritage field, etc., you will be contacted for confirming whether you agree to have such information included in any publications. You will not be named in the publications, and every effort will be made to disguise your identity. The researcher will keep the notes, photos, recordings and anonymised transcriptions before the completion of the PhD and then archive the anonymised transcriptions, but will treat them with the strictest confidentiality. On completion of this project, the data that may include the notes, pre-processed photos, recordings and anonymised transcriptions will also be stored in the Faculty of Computing and Mathematical Sciences (FCMS) Data Archive for five years.

#### Declaration to participants

If you take part in the study, you have the right to:

- Refuse to answer any question and to withdraw from the project before 30 June 2020. If you wish to withdraw, contact the researcher, Can Zhao (cz93@students.waikato.ac.nz). You do not need to give any reason for withdrawing from the project.
- Ask any further questions that occur to you during your participation.
- Be given access to a summary of findings from the project when it is concluded.

#### Who's responsible?

If you have any questions or concerns, either now or in the future, please feel free to contact either:

Researcher:  
 Can Zhao  
 Department of Computer Science  
 University of Waikato  
 Private Bag 3105  
 Hamilton, New Zealand  
 Email: [cz93@students.waikato.ac.nz](mailto:cz93@students.waikato.ac.nz)

Supervisor:  
 Associate Professor David Nichols  
 Department of Computer Science  
 University of Waikato  
 Private Bag 3105  
 Hamilton, New Zealand  
 Email: [david.nichols@waikato.ac.nz](mailto:david.nichols@waikato.ac.nz)

**Research Consent Form****Ethics Committee, Faculty of Computing and Mathematical Sciences****Extracting heritage artefact metadata****Consent Form for Participants**

I have read the **Participant Information Sheet** for this project and have had the details of the project explained to me. My questions about the project have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I also understand that I am free to withdraw from the project before **30 June 2020** or to decline to answer any question in the project. I understand I can withdraw any information I have provided up until the researcher has commenced analysis on my data. I agree to provide information to the researchers under the conditions of confidentiality set out on the **Participant Information Sheet**.

I agree to participate in this project under the conditions set out in the **Participant Information Sheet**.

Signed: \_\_\_\_\_

Name: \_\_\_\_\_

Date: \_\_\_\_\_

**Additional Consent as Required**

I agree / do not agree to the use of audio and video recording of my responses.

If I agree to audio and video recording, then I understand that I may review the recording within three days of the debriefing meeting and may withdraw the audio and video recording. Withdrawn audio and video recordings will be deleted.

I agree / do not agree to the use of photographs of me, artefacts and/or the related materials.

If I agree to photographs being taken, then I understand that I may review them at the end of the debriefing meeting and may withdraw any photograph. Withdrawn photographs will be deleted.

Signed: \_\_\_\_\_

Name: \_\_\_\_\_

Date: \_\_\_\_\_

**Contact information:**

Researcher:  
*Can Zhao*  
*Department of Computer Science*  
*University of Waikato*  
*Private Bag 3105*  
*Hamilton, New Zealand*  
*Email: [cz93@students.waikato.ac.nz](mailto:cz93@students.waikato.ac.nz)*

Supervisor:  
*Associate Professor David Nichols*  
*Department of Computer Science*  
*University of Waikato*  
*Private Bag 3105*  
*Hamilton, New Zealand*  
*Email: [david.nichols@waikato.ac.nz](mailto:david.nichols@waikato.ac.nz)*

## C8: Participant Information Sheet and Consent Form for P2 (Unused)

### **Participant Information Sheet**



#### **Ethics Committee, Faculty of Computing and Mathematical Sciences**

##### **Project Title**

*Extracting heritage artefact metadata*

##### **Purpose**

To extract the metadata of some selected artefacts from any available resources.

##### **What is this research project about?**

The study aims at collecting the artefact metadata to enable creating a novel way of interacting with artefacts outside museums using mobile phones.

##### **What will you have to do and how long will it take?**

We will ask you to critique the metadata of and add new metadata for several heritage artefacts that are collected either by the Waikato Museum or a museum in the Waipa District. We will also ask you to record the time spent on accomplishing the task. We will provide you with an Excel file with the metadata of each artefact entered on a separate sheet. When the task is completed, we will request a copy of the Excel file and time information, and organise a debriefing meeting in a venue that has access to the materials you have used to discuss the results, anything that is worth noting and your experience. This meeting should take no longer than *90 minutes*. If you give consent, the audio and video of the meeting, including on-screen activity may be recorded, and photos may be taken. You will be asked to give consent prior to the meeting and may be asked to give consent at a later stage.

##### **What will happen to the information collected?**

The information collected will be used by the researcher to build a mobile application prototype and write research publications including the doctoral thesis. Only the researcher, supervisor and co-authors will be privy to the notes, photos and recordings from the project. Transcription of the debriefing meeting may be made by a third party under a confidentiality agreement. Some of your responses might be quoted, and a small number of the photos (anything shown on the photos that might lead to identification will be pre-processed) might be used in the publications. As these types of information might lead to identification due to the factors such as the uniqueness of the selected artefacts, the nature of work in the heritage field, etc., you will be contacted for confirming whether you agree to have such information included in any publications. You will not be named in the publications, and every effort will be made to disguise your identity. The researcher will keep the notes, photos, recordings and anonymised transcriptions before the completion of the PhD and then archive the anonymised transcriptions, but will treat them with the strictest confidentiality. On completion of this project, the data that may include the notes, pre-processed photos, recordings and anonymised transcriptions will also be stored in the Faculty of Computing and Mathematical Sciences (FCMS) Data Archive for five years.

##### **Declaration to participants**

If you take part in the study, you have the right to:

- Refuse to answer any question and to withdraw from the project before 30 June 2020. If you wish to withdraw, contact the researcher, Can Zhao (cz93@students.waikato.ac.nz). You do not need to give any reason for withdrawing from the project.
- Ask any further questions that occur to you during your participation.
- Be given access to a summary of findings from the project when it is concluded.

##### **Who's responsible?**

If you have any questions or concerns, either now or in the future, please feel free to contact either:

Researcher:  
*Can Zhao*  
*Department of Computer Science*  
*University of Waikato*  
*Private Bag 3105*  
*Hamilton, New Zealand*  
 Email: [cz93@students.waikato.ac.nz](mailto:cz93@students.waikato.ac.nz)

Supervisor:  
*Associate Professor David Nichols*  
*Department of Computer Science*  
*University of Waikato*  
*Private Bag 3105*  
*Hamilton, New Zealand*  
 Email: [david.nichols@waikato.ac.nz](mailto:david.nichols@waikato.ac.nz)

**Research Consent Form****Ethics Committee, Faculty of Computing and Mathematical Sciences****Extracting heritage artefact metadata****Consent Form for Participants**

I have read the **Participant Information Sheet** for this project and have had the details of the project explained to me. My questions about the project have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I also understand that I am free to withdraw from the project before **30 June 2020** or to decline to answer any question in the project. I understand I can withdraw any information I have provided up until the researcher has commenced analysis on my data. I agree to provide information to the researchers under the conditions of confidentiality set out on the **Participant Information Sheet**.

I agree to participate in this project under the conditions set out in the **Participant Information Sheet**.

Signed: \_\_\_\_\_

Name: \_\_\_\_\_

Date: \_\_\_\_\_

**Additional Consent as Required**

I agree / do not agree to the use of audio and video recording of my responses.

If I agree to audio and video recording, then I understand that I may review the recording within three days of the debriefing meeting and may withdraw the audio and video recording. Withdrawn audio and video recordings will be deleted.

I agree / do not agree to the use of photographs of me, artefacts and/or the related materials.

If I agree to photographs being taken, then I understand that I may review them at the end of the debriefing meeting and may withdraw any photograph. Withdrawn photographs will be deleted.

Signed: \_\_\_\_\_

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Contact information:

Researcher:  
*Can Zhao*  
*Department of Computer Science*  
*University of Waikato*  
*Private Bag 3105*  
*Hamilton, New Zealand*  
*Email: [cz93@students.waikato.ac.nz](mailto:cz93@students.waikato.ac.nz)*

Supervisor:  
*Associate Professor David Nichols*  
*Department of Computer Science*  
*University of Waikato*  
*Private Bag 3105*  
*Hamilton, New Zealand*  
*Email: [david.nichols@waikato.ac.nz](mailto:david.nichols@waikato.ac.nz)*

## C9: Content of Sample Spreadsheet for Extracting Heritage Artefact Metadata for P1 (Unused)

### *Readme on Sheet1*

This table is created to give you an idea about what you would be asked to do for the artefact metadata activity. The metadata will be used to create a novel way of interacting with artefacts outside museums using mobile phones. We would ask you to accomplish two tasks:

- a) Select several heritage artefacts collected by the Waikato Museum (if you are Hamilton-based) or a museum in the Waipa District (if you are Waipa-based).
- b) Fill in the boxes of each corresponding sheet with the metadata of an artefact.

For completing the task a), we first introduce the concepts of Direct Place, Relevant Place and Hybrid Place:

**Direct Place:** a place where an artefact has been (e.g., the places an artefact was created, stayed, etc.).

**Relevant Place:** a place where an event occurred but was not attended by an artefact, though the event is relevant to another event that occurred in another place and was attended by the artefact.

**Hybrid Place:** a place is both a direct place for one or more artefacts and a relevant place for another or more artefacts.

We set the following four criteria to aid you to select artefacts. We need:

- 1) Five places. The selection should include a mixture of direct places and relevant places (e.g. three direct, two relevant). The inclusion of hybrid places is ideal but not compulsory.
- 2) At least one of the places should be either a direct place to two or more artefacts or a hybrid place.
- 3) The five places should be located close to each other (i.e. take less than ten minutes to walk from one to another), ideally in the city or town centre.
- 4) At least three artefacts should be selected. If you are based in Hamilton, we would suggest selecting Ticket to South Africa vs. Waikato, Rugby Park, Hamilton (1985/12/88) collected by the Waikato Museum as one artefact.

Please record how many hours are used for the task a). Once you finished the task a), please let us know your selection and the hours used.

For completing the task b), we will provide you with an Excel file with the name of each artefact entered on a separate sheet. You could use any materials, the fictional artefact example and additional notes that are given on the other two sheets of this file for the task. We encourage you to fill in as many boxes as possible.

Please again record how many hours are used for the task b). When you completed the task b), please send us a copy of the Excel file and let us know the hours used.

We will arrange a debriefing meeting with you at a place with access to the used materials to discuss the results, anything that you believe is worth noting and your experience. If you give consent before the debriefing, the audio and video of the meeting, including on-screen activity may be recorded, and photos may be taken.

Please contact Can Zhao (cz93@students.waikato.ac.nz) at any time if you have any questions.

***Artefact metadata sheet on Sheet2, Additional notes provided on columns and rows of Artefact metadata sheet and A fictional artefact example on Sheet3*** were the same as their counterparts in C3.

## **C10: Content of Sample Spreadsheet for Extracting Heritage Artefact Metadata for P2 (Unused)**

### ***Readme on Sheet1***

This table is created to give you an idea about what you would be asked to do for the artefact metadata activity. The metadata will be used to create a novel way of interacting with artefacts outside museums using mobile phones. We would ask you to critique the metadata entered, and add new metadata for several artefacts collected by either the Waikato Museum or a museum in the Waipa District.

For completing the task, we will provide you with an Excel file with the metadata of each artefact entered on a separate sheet. You could use any materials, the fictional artefact example and additional notes that are given on the other two sheets of this file for the task. You could critique any value shown on the sheets (e.g., the entire record of an artefact, one or more particular or not yet covered events, or one or more boxes).

Please record how many hours are used. Once you completed the task, please send us a copy of the Excel file and let us know the hours used.

We will arrange a debriefing meeting with you at a place with access to the used materials to discuss the results, anything that you believe is worth noting and your experience. If you give consent before the debriefing, the audio and video of the meeting, including on-screen activity may be recorded, and photos may be taken.

Please contact Can Zhao ([cz93@students.waikato.ac.nz](mailto:cz93@students.waikato.ac.nz)) at any time if you have any questions.

***Artefact metadata sheet on Sheet2, Additional notes provided on columns and rows of Artefact metadata sheet and A fictional artefact example on Sheet3*** were the same as their counterparts in C3.

## C11: Protocol for the Tasks of Extracting Heritage Artefact Metadata and Debriefing Meeting (Unused)

### Recruitment and Task

- We will approach the potential participants who are either museum professionals or heritage experts in person and via email. We will contract with one participant (*P1*) to perform the activity. We will also send them:
  - A copy of the *Participant Information Sheet* and *Consent Form*.
  - A copy of the *Sample Sheet* that contains an artefact metadata sheet with no value and a fictional artefact example.
- We will request the participant to accomplish two tasks:
  - a) Select several heritage artefacts collected by the Waikato Museum (if the participant is Hamilton-based) or a museum in the Waipa District (if the participant is Waipa-based).
  - b) Populate the cells of each corresponding spreadsheet with the metadata of an artefact.
- We might contract with another participant (*P2*) who is a heritage expert or enthusiast if we have enough time, and the artefact representations would benefit from displaying more information from an alternative perspective. We might ask them to critique the metadata extracted by the first participant.

### P1

#### Task a)

- We will introduce the concepts of *Direct Place*, *Relevant Place* and *Hybrid Place* to P1:
  - *Direct Place*: a place where an artefact has been (e.g., the places an artefact was created, stayed, etc.).
  - *Relevant Place*: a place where an event occurred but was not attended by an artefact, though the event is relevant to another event that occurred in another place and was attended by the artefact.
  - *Hybrid Place*: a place is both a direct place for one or more artefacts and a relevant place for another or more artefacts.
- We will then provide the following four criteria to aid P1 to select artefacts:
  - *Five places*. The selection should include a mixture of direct places and relevant places (e.g. three direct, two relevant). The inclusion of hybrid places is ideal but not compulsory.
  - At least *one of the places* should be either a direct or a hybrid place to *two or more artefacts*.
  - The five places should be located close to each other (i.e. take less than *ten minutes* to walk from one to another), ideally in the city or town centre.
  - At least *three artefacts* should be selected. If P1 is based in Hamilton, we would suggest selecting *Ticket to South Africa vs. Waikato, Rugby Park, Hamilton (1985/12/88)* collected by the Waikato Museum as one artefact.
- We will ask P1 to record the time spent on accomplishing the task. Once the artefacts are selected, we will:

- Request a list of the selected artefacts and the information about how many hours were used.
- Provide P1 with a spreadsheet file with the name of each artefact entered on a separate sheet for performing the task b).

#### Task b) & Debriefing Meeting

- P1 should populate the cells of each sheet by referring to the related materials of the selected or given artefacts, fictional artefact example and additional notes provided for each row and column.
- We will ask P1 to record the time spent on accomplishing the task. Once the cells are populated, we will:
  - Request a copy of the spreadsheet file the information about how many hours were used.
  - Arrange a debriefing meeting with P1.

#### P2 (optional)

##### Critique & Debriefing Meeting

- We will provide P2 with the spreadsheet file sent through by P1 for critique.
- We will also ask P2 to record the time spent on accomplishing the critique. Once the critique is done, we will:
  - Request a copy of the spreadsheet file and the information about how many hours were used.
  - Arrange a debriefing meeting with P2.

##### Debriefing Meeting

##### Venue

A place with access to the related materials of the selected artefacts, such as a meeting room in a museum, office, etc.

##### Potential Recording Tools

- Morae Recorder
- An audio recorder
- A handycam or an action camera
- A still camera

##### Before Debriefing

- The researcher gives and presents the information of the *Participant Information Sheet* and *Consent Form* to the participant, then requests their consent.
- The researcher configures the recording devices.

##### Semi-structured Interview Questions

1. Could you tell us a little about your heritage artefact-related life?
  - a. *For museum professionals, if not mentioned, follow-up:* Are you involved in collection cataloguing practice?

2. For P1: Why did you choose this/these artefacts?  
For P2: Why did you choose to critique the metadata of this/these artefacts?
  - a. *Follow-up*: When did you first encounter with this/these artefacts?
  - b. *Follow-up*: Did this/any of these artefacts get involved in your work or even other aspects of your life ever since? How?
3. Is there anything in the sheets/tables you'd like to clarify or discuss?
  - a. Also 4 b) & c), *If the participant mentioned something that is not or partially listed in the sheets, follow-up*: Why did you choose to clarify this information?
  - b. *Follow-up*: Could you clarify this bit of information (by pointing to a cell)?
4. When you were filling information into the boxes, did you have a plan on what sort of things you would enter/critique?
  - a. *Follow-up*: For the completed boxes, what was less time-consuming? What took you more time? Why?
  - b. *Follow-up*: For the empty boxes, have you tried entering/critiquing anything? Was it time-consuming? Why?
  - c. *Follow-up*: Have you thought of anything that is not listed in the sheets/tables? Have you tried entering them? Was it time-consuming? Why?
5. Did this activity get you to think of anything?
  - a. *If nothing and the participant is involved in cataloguing, follow-up*: How about the collection cataloguing practice?
  - b. *If another activity, especially a curatorial or interpretation activity is mentioned, follow-up*: Would this activity be relevant to [the mentioned activity]? How? Any similarities and differences between [the mentioned activity] and this activity?
6. A final follow-up depending on the responses, if necessary.

Debriefing finished, thank the participant.

## **Appendix D. Material for Designing and Evaluating Object Biography Application Prototype**

This appendix contains three sets of paper prototypes (D1, D2 and D3), two sets of digital wireframes (D4 and D5) and the material that was prepared for evaluating ItemTrails described in Chapter 6.

D6, D7, D8 and D9 were submitted to support the application for performing the evaluation to the CMS Ethics Committee, School of Computing and Mathematical Sciences of the University. D10 was consequently received, dated 9 April 2020.

D11, D12, D13 and D14 were submitted to inform that some revisions (highlighted in yellow) were made to the initial material. On 23 June 2020, the CMS Ethics Committee accepted the revisions and considered they were within the original approval; therefore no formal letter was necessary.

## D1: Paper Prototype One (PP1)

Date of Creation: 3 December 2019

Version: 1

### Navigating on a map



Figure 1 Welcome dialog

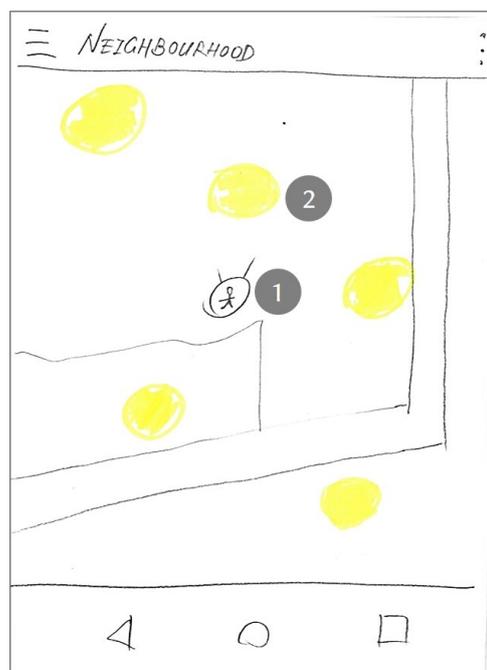


Figure 2 Neighbourhood screen

#### Notes:

By launching the application, a user would be landing on the Neighbourhood screen and be prompted with a Welcome dialog—Label 1 on Figure 1.

Once they close the dialog, they would be able to see from a map the nearby points of interest (abbreviated hereafter as *PoIs*) such as Label 2 on Figure 2, their location and direction that they are facing—Label 1 on Figure 2.

#### Issues:

None

## Accessing navigation menu

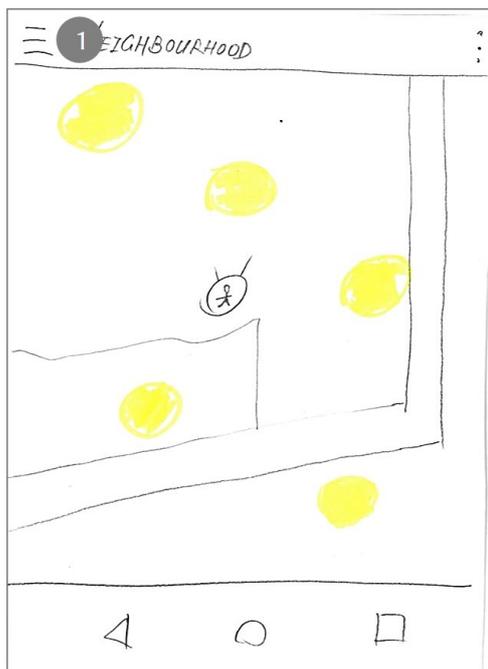


Figure 3 Navigation menu button

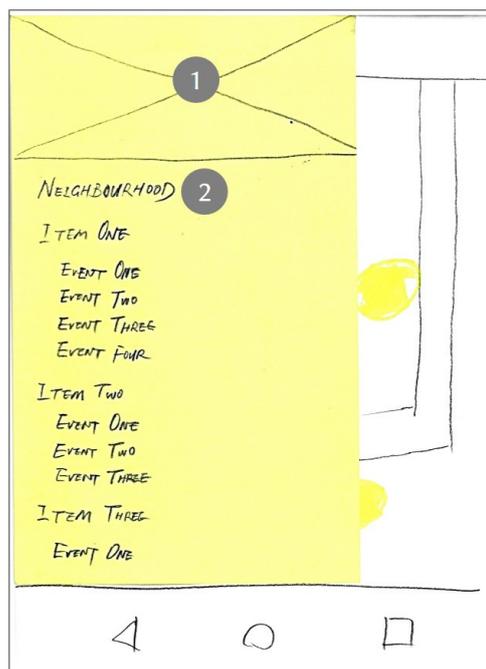


Figure 4 Modal navigation drawer

### Notes:

The user could tap on the navigation menu button on any screen—Label 1 on Figure 3, the modal navigation drawer would be shown.

An item trail-representing image would be displayed in the placeholder—Label 1 on Figure 4. The navigation drawer allows the user to access the Neighbourhood, any Item or Story screens shown below Label 2 on Figure 4.

### Issues:

- Lengthy menu list that includes all events below Label 2 on Figure 4
- No links provided for accessing the Place screens

## Accessing prototype purpose information

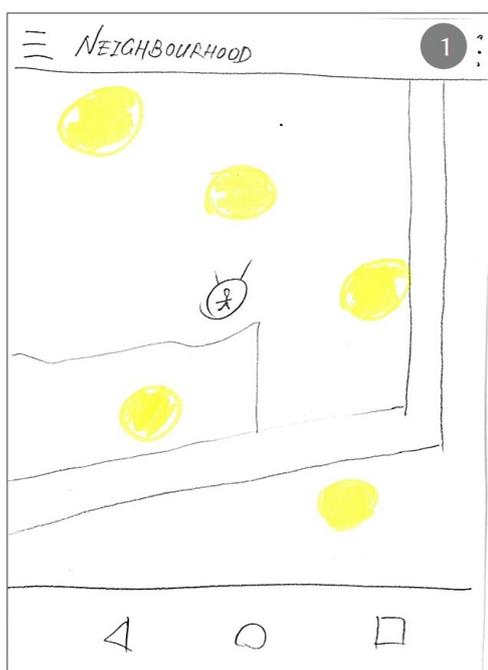


Figure 5 Overflow menu button

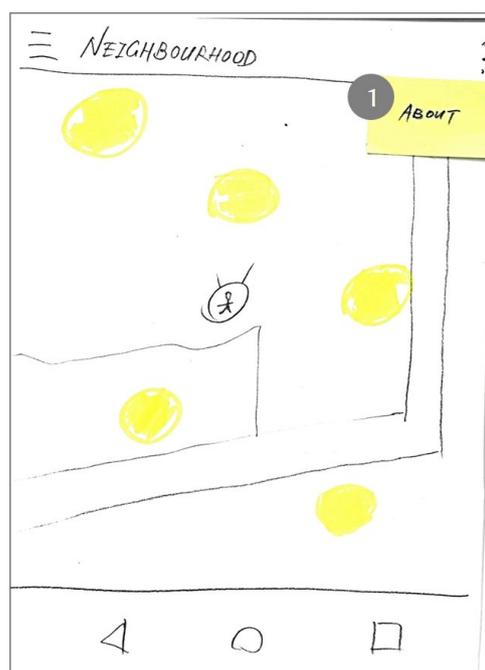


Figure 6 About choice of the menu

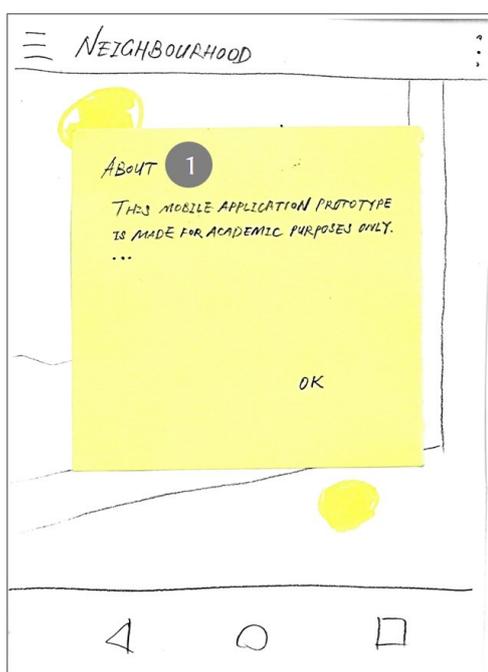


Figure 7 About dialog

### Notes:

The user could tap on the overflow menu button on any screen—Label 1 on Figure 5 to view the dropdown menu—Label 1 on Figure 6.

By tapping on the About choice of the menu, the About dialog—Label 1 on Figure 7 that conveys an additional piece of information regarding the purposes of the prototype would be shown.

### Issues:

- Only one choice offered by the dropdown menu—About, unnecessarily lengthy sequence of interaction

### Starting exploration of items at a PoI

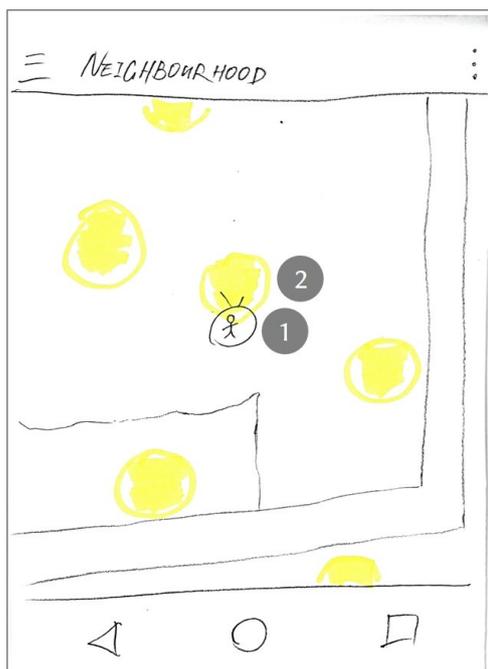


Figure 8 Arriving at a PoI

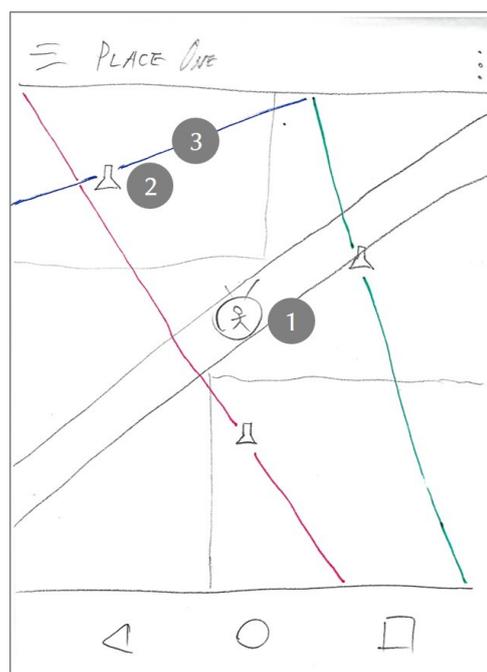


Figure 9 Place screen

#### Notes:

Once the user enters the geofencing circle of a PoI—Labels 1 and 2 on Figure 8, the Place screen would be shown.

The user should be able to see their current location—Label 1 on Figure 9, all the items that have been to the PoI such as Label 2 on Figure 9 and the colour coded lines such as Label 3 on Figure 9—each represents a section the trail of the item.

By tapping on any item icon—Label 2 on Figure 9 on the Place screen, the user should be able to proceed to the Item screen—Figure 10.

#### Issues:

- Disadvantages of having Place screens such as not conveying much information and difficult to locate items on a map

## Exploring further information of an item

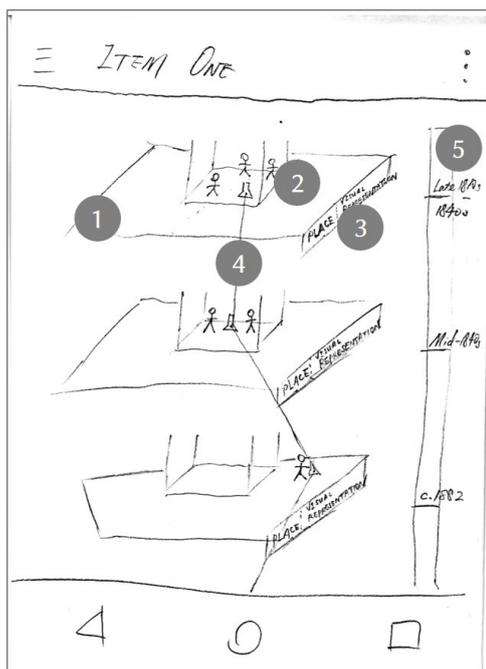


Figure 10 Item screen

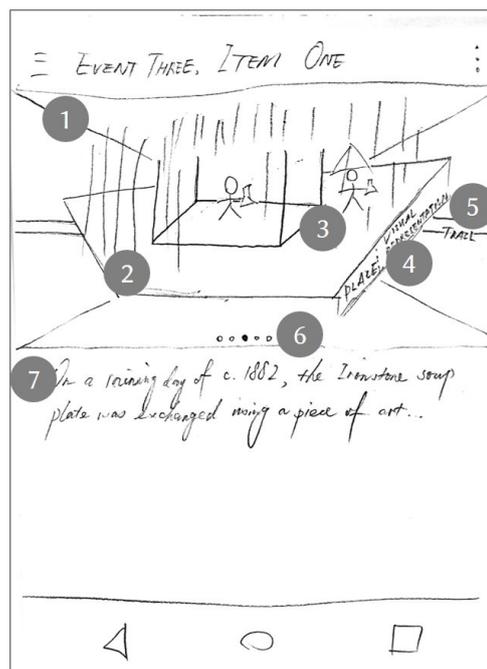


Figure 11 Item event screen

### Notes:

When landed on an Item screen, all the item-participated events would be shown with a vertical timeline—Label 5 on Figure 10. An item trail-representing line would be present between any two neighbouring events such as Label 4 on Figure 10. The metadata visualisation of each event would include:

- terrain of a PoI—Label 1 on Figure 10
- items, original buildings and people—Label 2 on Figure 10
- PoI name by the time (e.g., Kirikiriroa for Hamilton before the settlement was renamed) and visual representation (e.g., vexillological patterns or coats of arms) of the PoI—Label 3 on Figure 10

By tapping any event visualisation on the Item screen, the user should be able to proceed to the Event screen. In addition to a free-text event description that would be based on metadata, the visualisation that could feature fine-grained metadata would include:

- related heritage background image to populate the placeholder—Label 1 on Figure 11
- terrain of a PoI—Label 2 on Figure 11

- items, original buildings, weather conditions and people—Label 3 on Figure 11
- PoI name by the time and visual representation of the PoI—Label 4 on Figure 11
- line that represent the item trail—Label 5 on Figure 11
- dots of carousel control—Label 6 on Figure 11 that enables the user to explore other events of the item

*Issues:*

- inconsistency of item trail and timeline on the Item and Event screens (i.e., vertical and horizontal views)

## D2: Paper Prototype Two (PP2)

Date of Creation: 3 December 2019

Version: 1

### Navigating on a map (the same as PP1)



Figure 1 Welcome dialog

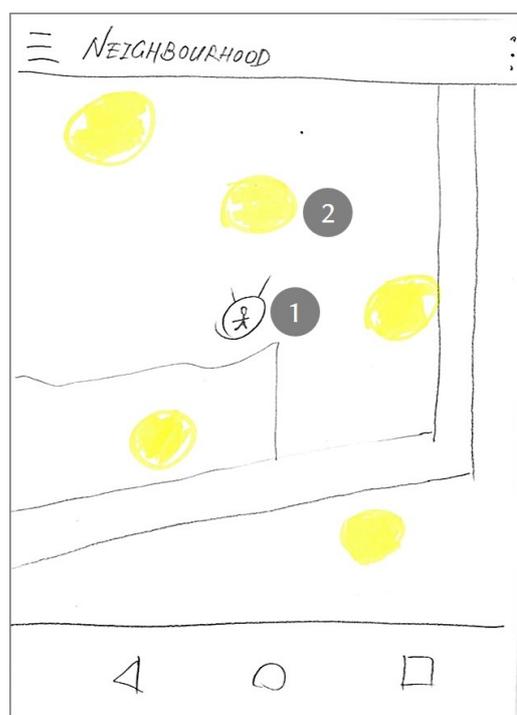


Figure 2 Neighbourhood screen

#### Notes:

By launching the application, a user would be landing on the Neighbourhood screen and be prompted with a Welcome dialog—Label 1 on Figure 1.

Once they close the dialog, they would be able to see from a map the nearby POIs such as Label 2 on Figure 2, their location and direction that they are facing—Label 1 on Figure 2.

#### Issues:

None

### Accessing navigation menu (the same as PP1)

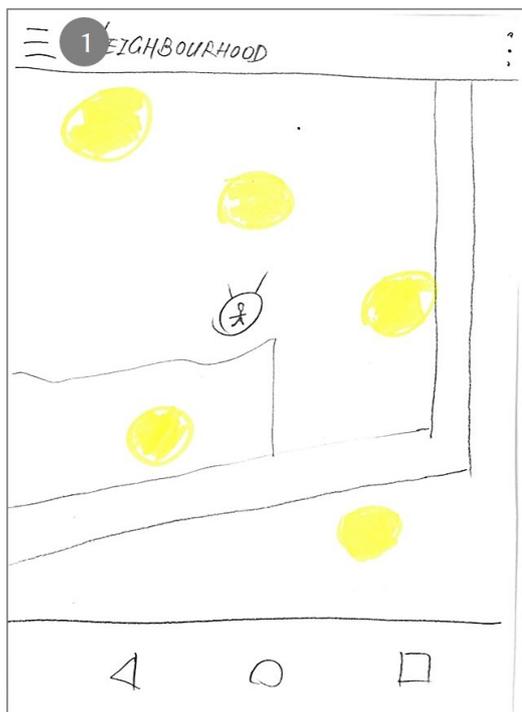


Figure 3 Navigation menu button

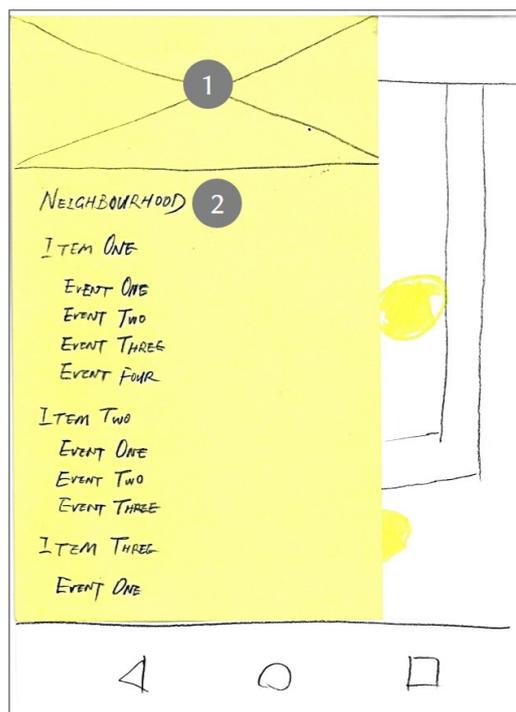


Figure 4 Modal navigation drawer

#### Notes:

The user could tap on the navigation menu button on any screen—Label 1 on Figure 3, the modal navigation drawer would be shown.

An item trail-representing image would be displayed in the placeholder—Label 1 on Figure 4. The navigation drawer allows the user to access the Neighbourhood, any Item or Story screens shown below Label 2 on Figure 4.

#### Issues:

- Lengthy menu list that includes all events below Label 2 on Figure 4
- No links provided for accessing the Place screens

## Accessing prototype purpose information (the same as PP1)

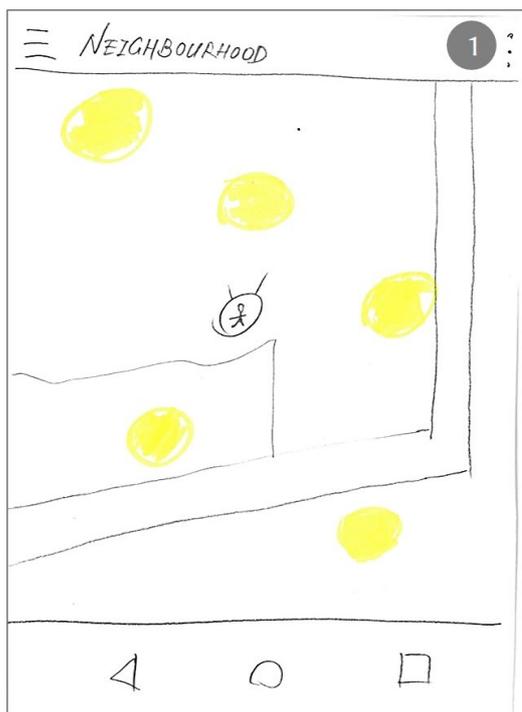


Figure 5 Overflow menu button

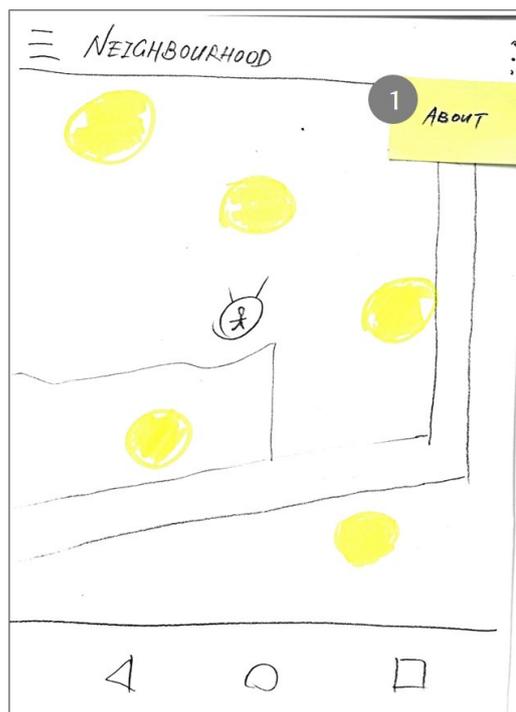


Figure 6 About choice of the menu



Figure 7 About dialog

### Notes:

The user could tap on the overflow menu button on any screen—Label 1 on Figure 5 to view the dropdown menu—Label 1 on Figure 6.

By tapping on the About choice of the menu, the About dialog—Label 1 on Figure 7 that conveys an additional piece of information regarding the purposes of the prototype would be shown.

### Issues:

- Only one choice offered by the dropdown menu—About, unnecessarily lengthy sequence of interaction

## Starting exploration of items at a PoI

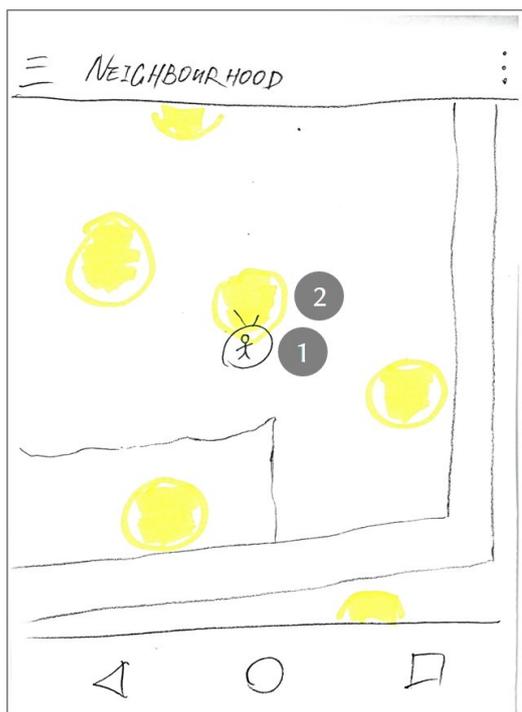


Figure 8 Arriving at a PoI

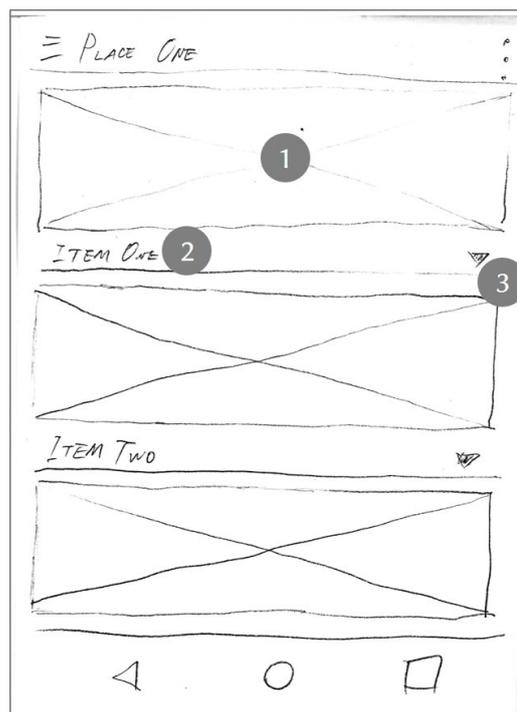


Figure 9 Place screen

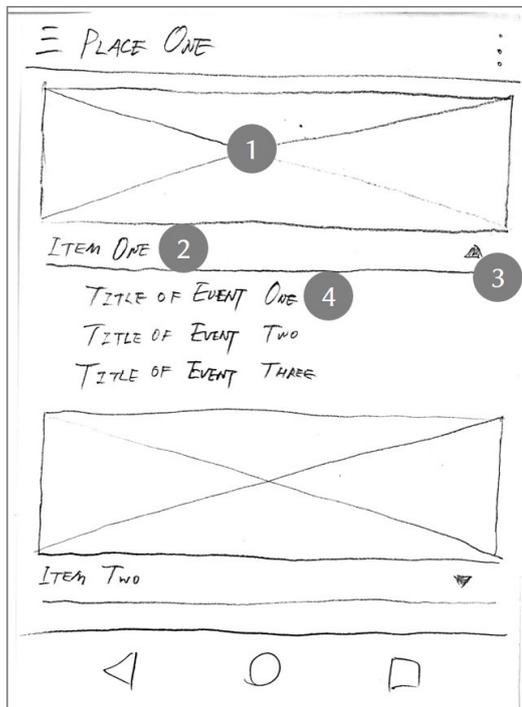


Figure 10 Place screen (item information expanded)

### Notes:

Once the user enters the geofencing circle of a PoI—Labels 1 and 2 on Figure 8, the Place screen would be shown. The placeholder—Label 1 would present image for an item—Label 2, both on Figure 9 and Figure 10. The user should be able to open and close the item information—Label 4 on Figure 10 via tapping on the triangle button—Label 3 on Figure 9 and Figure 10. By tapping on the image or information of an item, the user should be able to proceed to the Event tab of the Item screen—Figure 10.

### Issues:

- Not much information conveyed by the Place screen
- Lack of screen change notification

## Exploring further information of an item

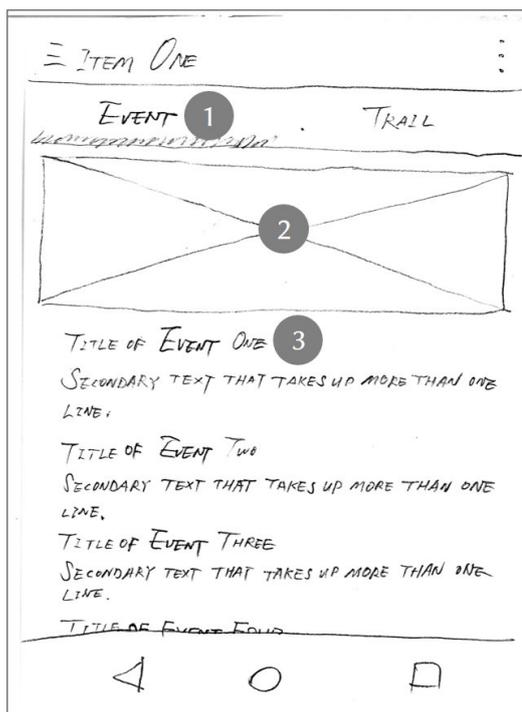


Figure 11 Event tab on Item screen

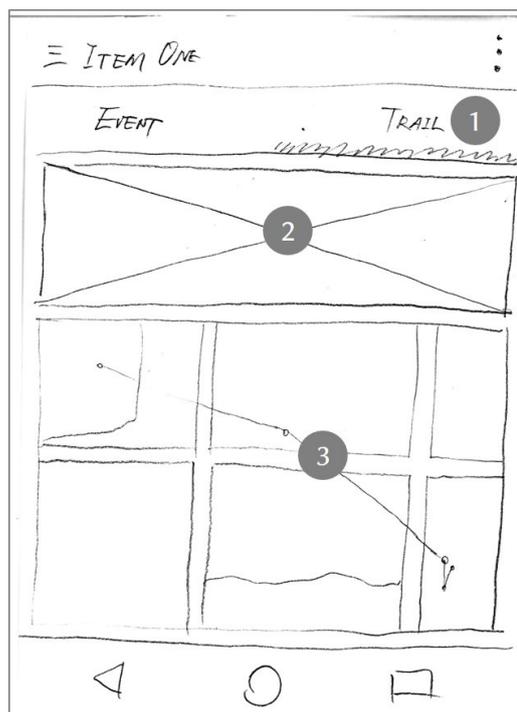


Figure 12 Trail tab on Item screen

### Notes:

When landed on the Event tab of the Item screen—Label 1 on Figure 11, the information of all the item-participated events would be shown in a form of free-text description based on metadata—Label 3 on Figure 11.

The user could tap on the Trail tab label—Label 1 on Figure 12 to view the trail of the item visualised on a map—Label 3 on Figure 12.

An item image would be present in the placeholder—Label 2 on Figure 11 and Figure 12.

### Issues:

- Lack of integration of or mapping between the information of item events and trails

## D3: Paper Prototype Three (PP3)

*Date of Creation:* 3 December 2019

*Version:* 1

### Navigating on a map (the same as PP1 and PP2)



Figure 1 Welcome dialog

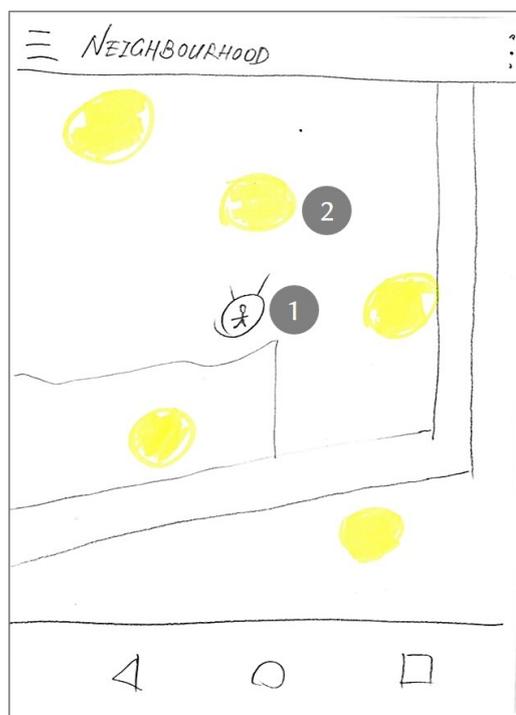


Figure 2 Neighbourhood screen

#### *Notes:*

By launching the application, a user would be landing on the Neighbourhood screen and be prompted with a Welcome dialog—Label 1 on Figure 1.

Once they close the dialog, they would be able to see from a map the nearby PoIs such as Label 2 on Figure 2, their location and direction that they are facing—Label 1 on Figure 2.

#### *Issues:*

None

### Accessing navigation menu (the same as PP1 and PP2)

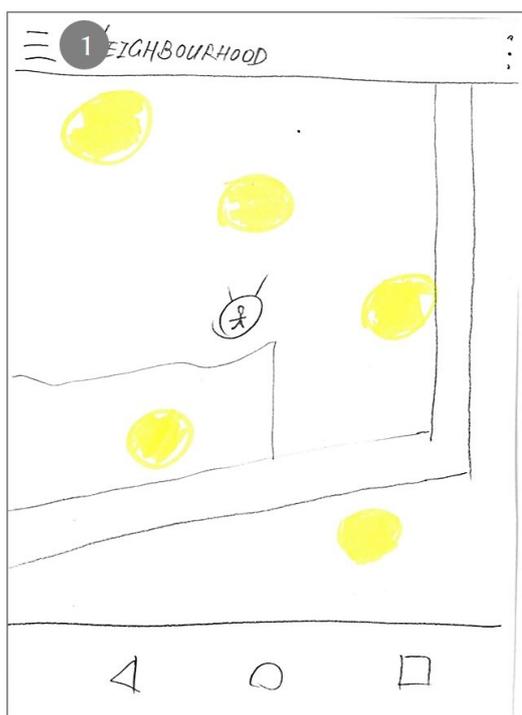


Figure 3 Navigation menu button



Figure 4 Modal navigation drawer

#### Notes:

The user could tap on the navigation menu button on any screen—Label 1 on Figure 3, the modal navigation drawer would be shown.

An item trail-representing image would be displayed in the placeholder—Label 1 on Figure 4. The navigation drawer allows the user to access the Neighbourhood, any Item or Story screens shown below Label 2 on Figure 4.

#### Issues:

- Lengthy menu list that includes all events below Label 2 on Figure 4
- No links provided for accessing the Place screens

## Accessing prototype purpose information (the same as PP1 and PP2)

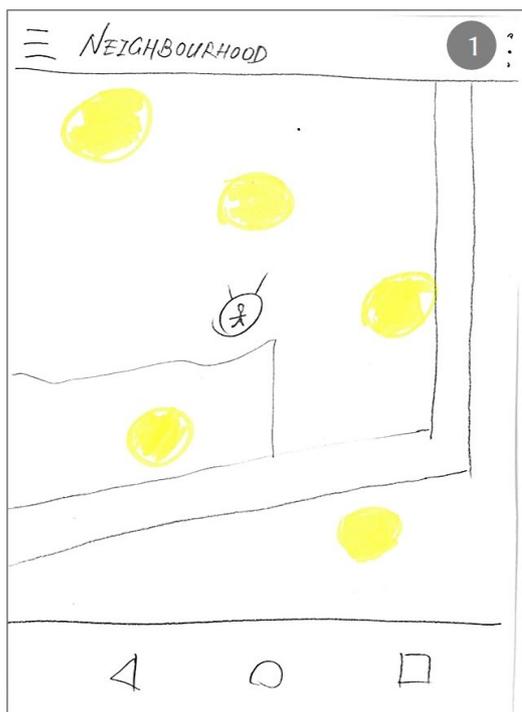


Figure 5 Overflow menu button

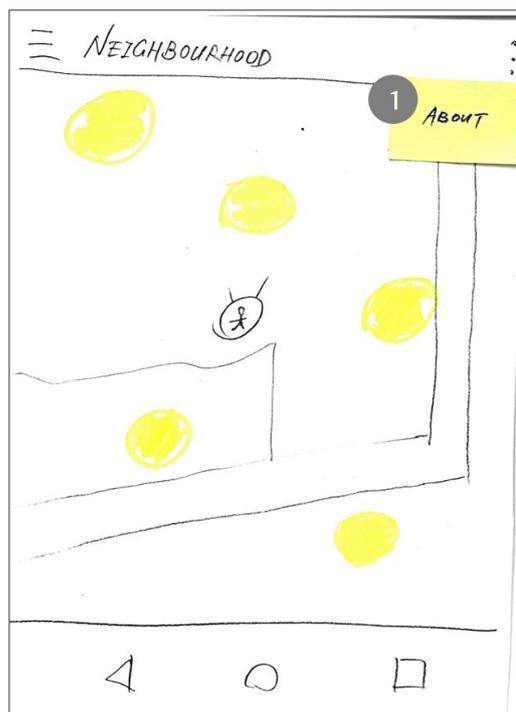


Figure 6 About choice of the menu



Figure 7 About dialog

### Notes:

The user could tap on the overflow menu button on any screen—Label 1 on Figure 5 to view the dropdown menu—Label 1 on Figure 6.

By tapping on the About choice of the menu, the About dialog—Label 1 on Figure 7 that conveys an additional piece of information regarding the purposes of the prototype would be shown.

### Issues:

- Only one choice offered by the dropdown menu—About, unnecessarily lengthy sequence of interaction

## Selecting an item at a PoI

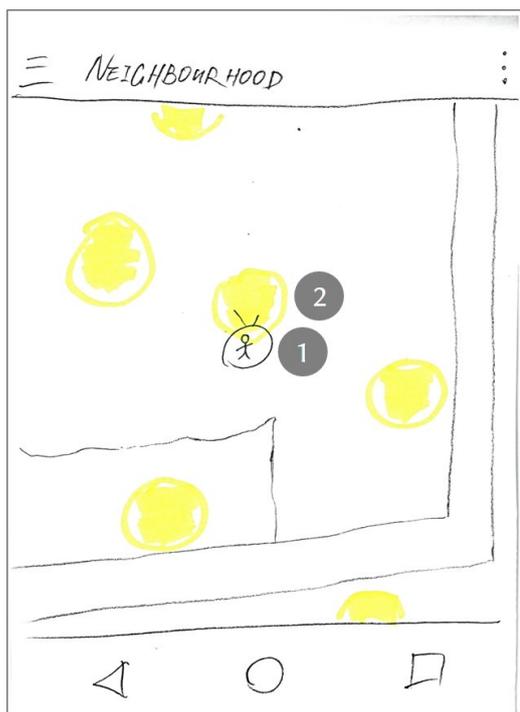


Figure 8 Arriving at a PoI

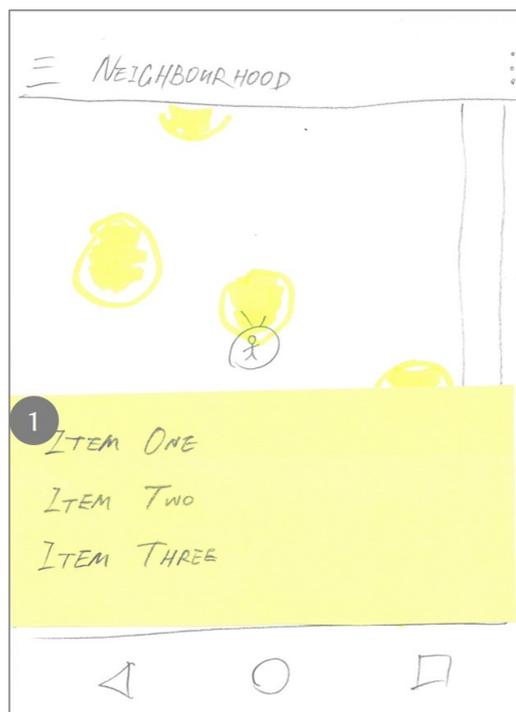


Figure 9 Item sheet

### Notes:

Once the user enters the geofencing circle of a PoI—Labels 1 and 2 on Figure 8, an item sheet that lists all the PoI-related items would be shown at the bottom of the screen—Label 1 on Figure 9.

By tapping on any item listed on the sheet, the user should be able to proceed to the Item screen—Figure 10.

### Issues:

- No option given to the user if they were not interested

## Exploring information of an item

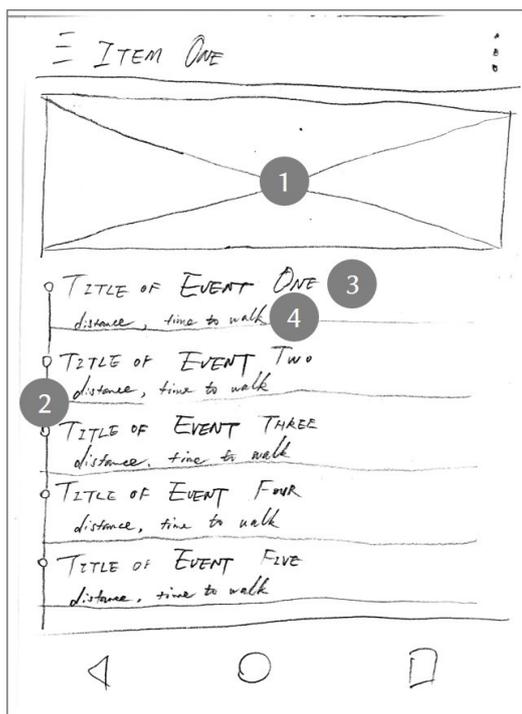


Figure 10 Item screen

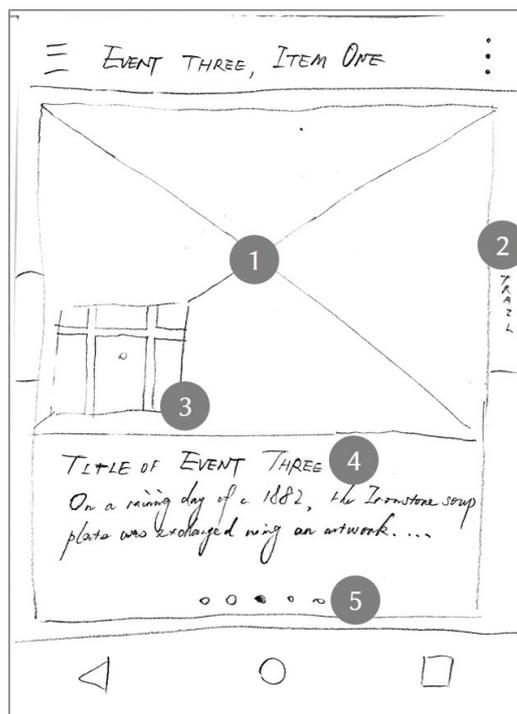


Figure 11 Event screen

### Notes:

When landed on the Item screen—Figure 10, the user would see an item image in the placeholder—Label 1 on Figure 10. The title of all the item-participated events would also be shown—Label 3 on Figure 10. Additionally, the distance and travelling time information would be present under each event title—Label 4 on Figure 10. These pieces of information would be accompanied by an item trail-representing line—Label 2 on Figure 10.

The user could tap on any event title to proceed to the Event screen—Figure 11. An item-related image would be present in the placeholder—Label 1 on Figure 11 with a small map that indicates the PoI at the bottom left on top of the image—Label 3 on Figure 11. The title and free-text description based on metadata—Label 4 on Figure 11 would follow. An item trail-representing line—Label 2 on Figure 11 would serve as a visual cue to imply the user to view other events, which would be enabled by the carousel control—Label 5 on Figure 11.

### Issues:

- inconsistency of item trail on the Item and Event screens (i.e., vertical and horizontal views)
- little information conveyed by the small map on the Event screen

# D4: Digital Wireframe One

## Neighbourhood screen

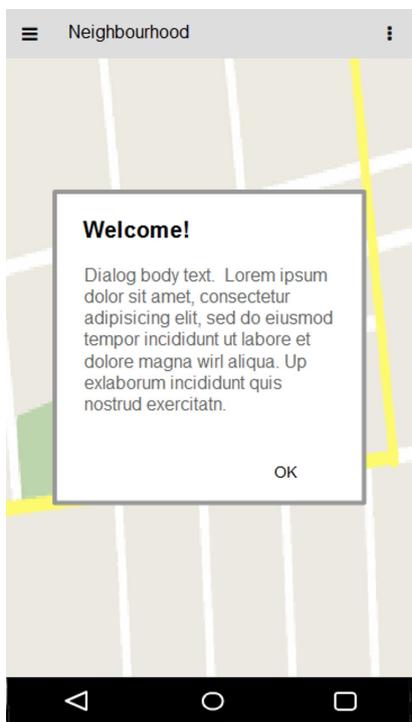


Figure 1 Initial dialog

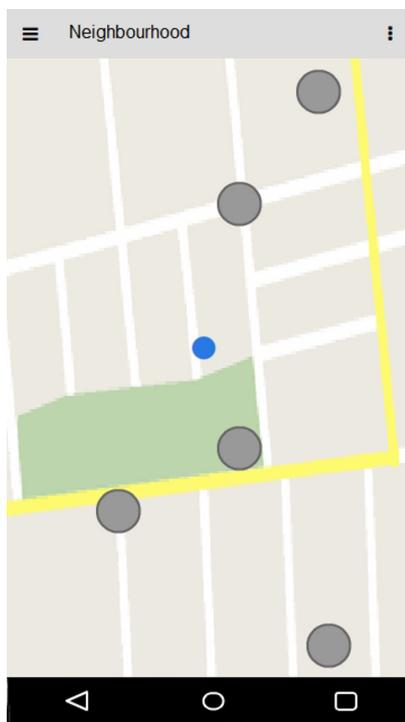


Figure 2 Map

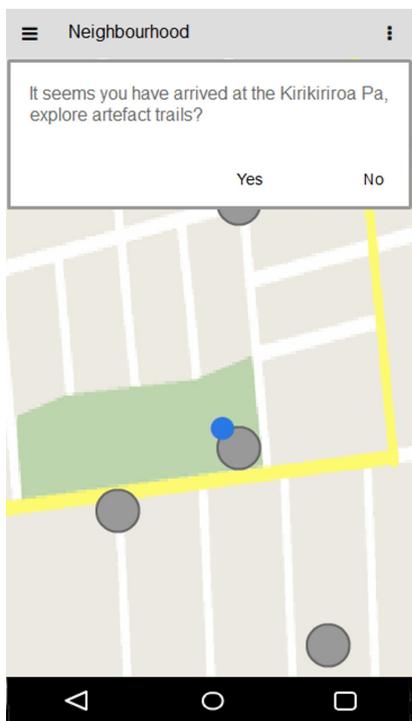


Figure 3 Map: "Arrival" banner

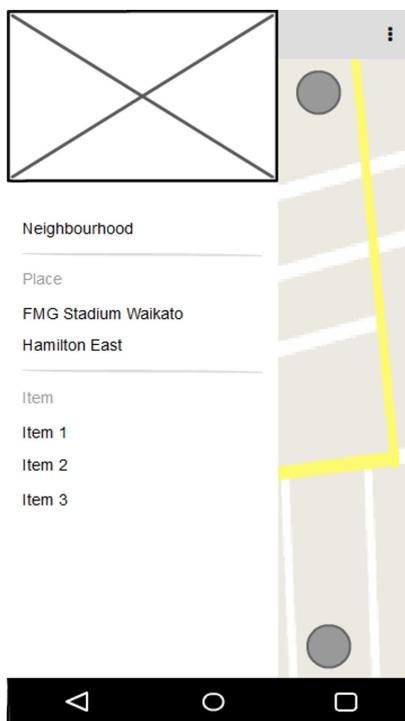


Figure 4 Map: Navigation drawer

## Place screen

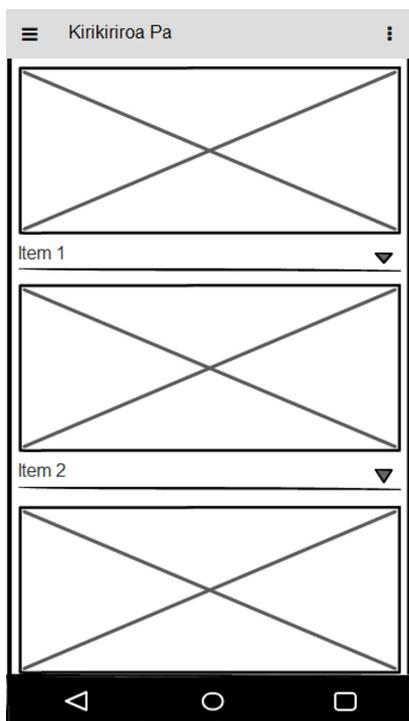


Figure 5 Place

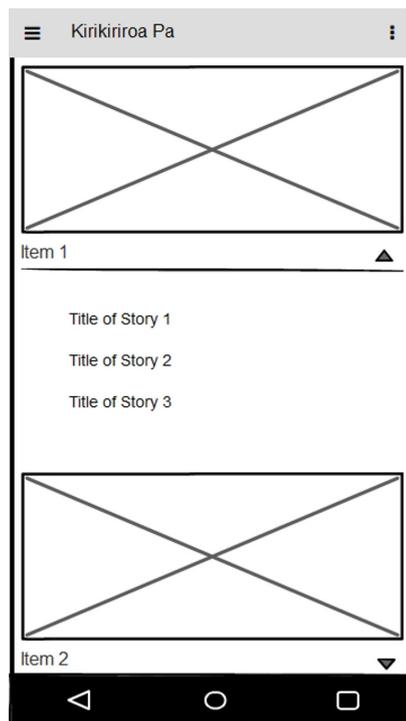


Figure 6 Place: card expanded

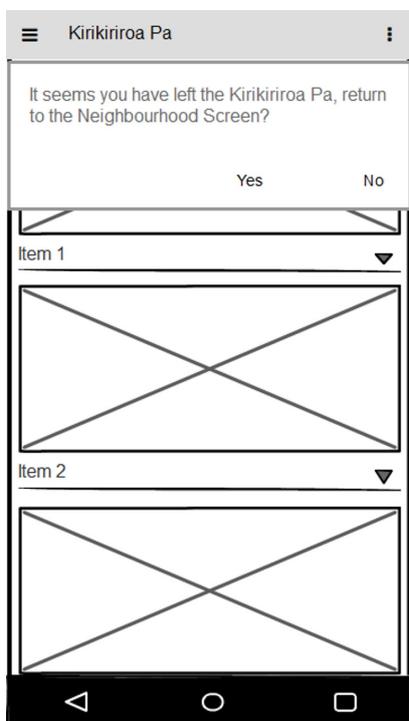


Figure 7 Place: "Return" banner

## Artefact screen

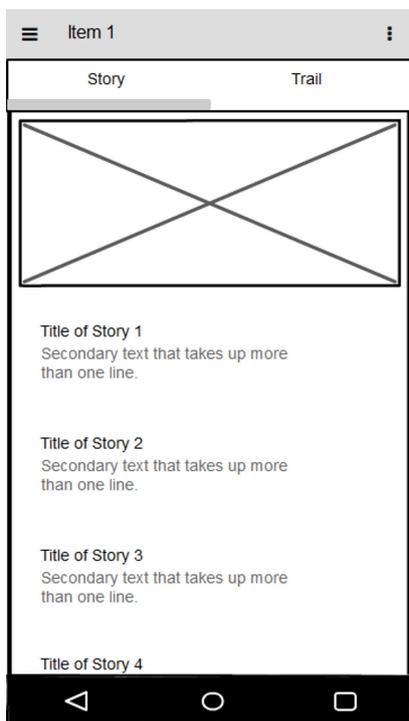


Figure 8 Artefact: Story tab

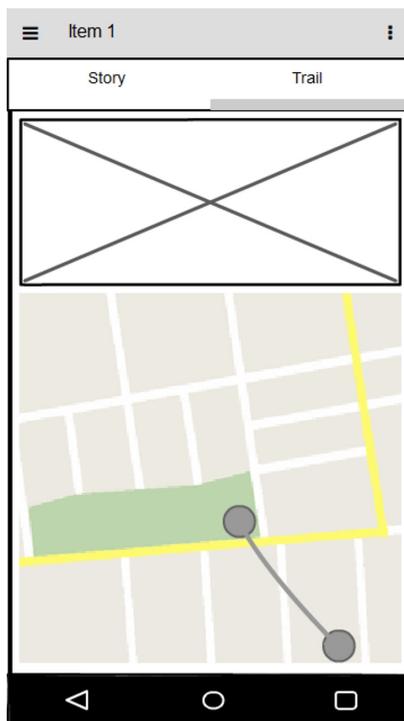


Figure 9 Artefact: Trail tab

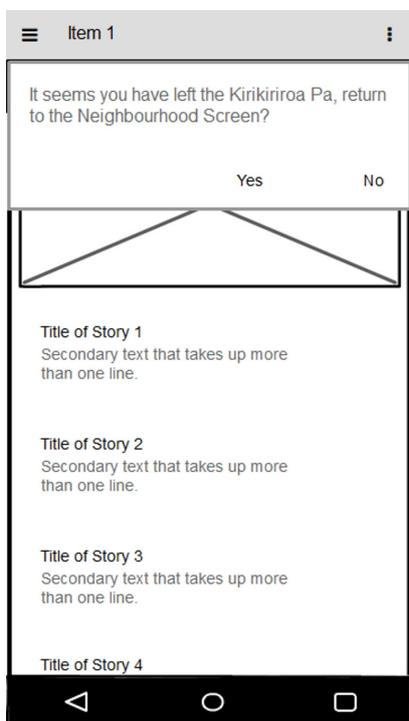


Figure 10 Artefact: "Return" banner

## D5: Digital Wireframe Two

### Neighbourhood screen



Figure 1 Neighbourhood: Initial dialog

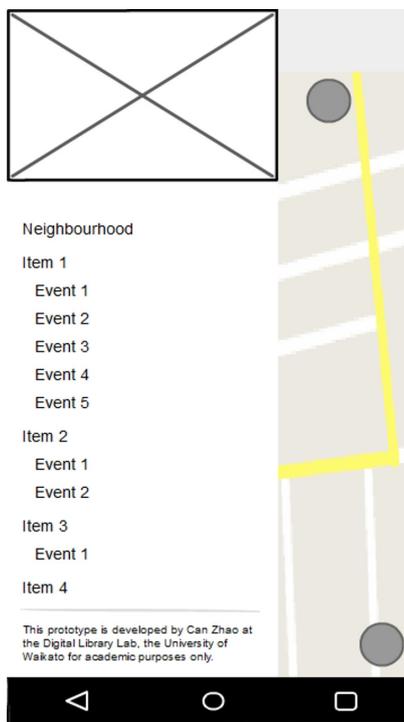


Figure 2 Neighbourhood: Navigation drawer

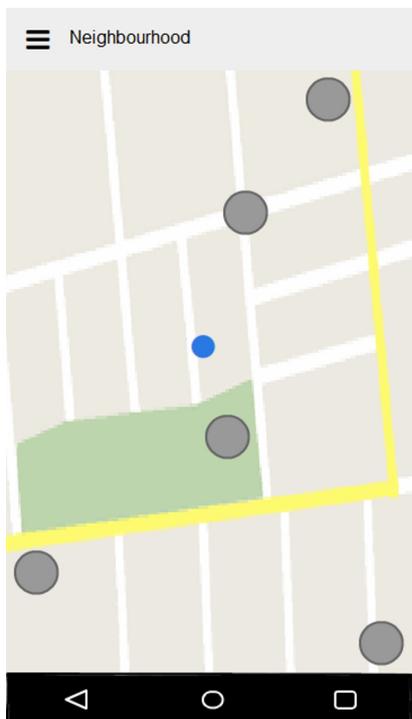


Figure 3 Neighbourhood

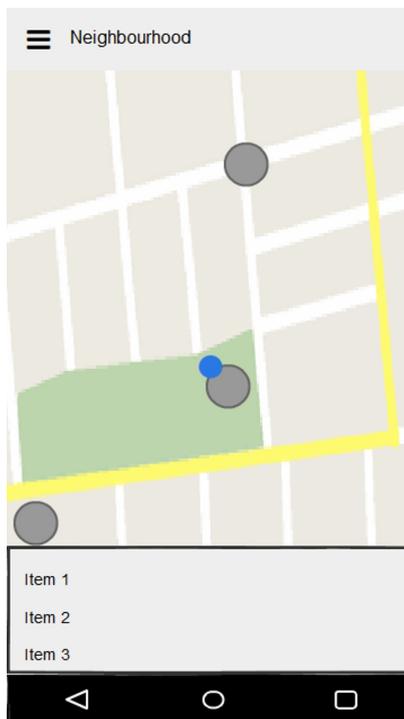


Figure 4 Neighbourhood: Item sheet

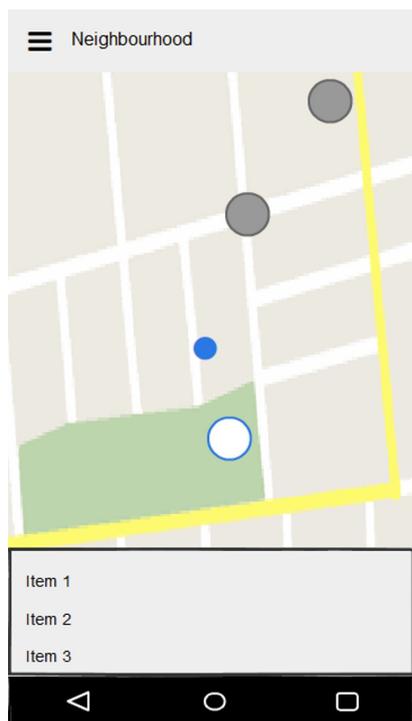


Figure 5 Neighbourhood: Item sheet  
(a PoI tapped)

Item screen

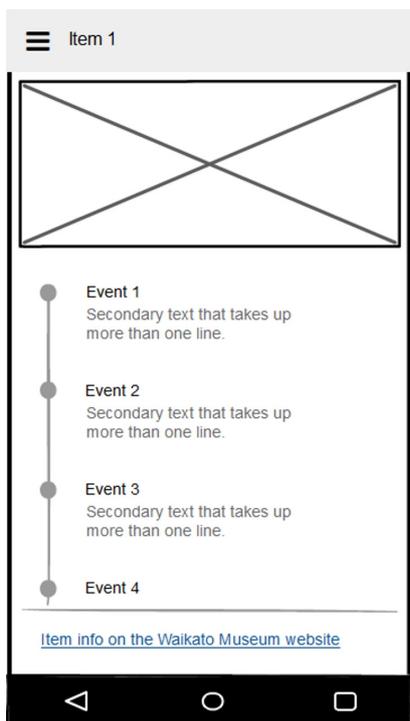


Figure 6 Item

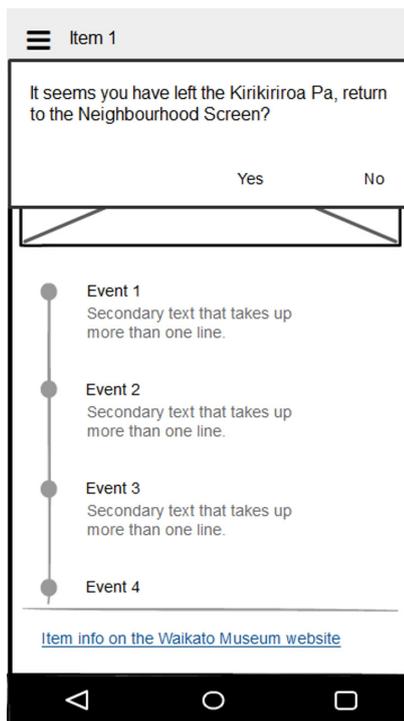


Figure 7 Item: "Return" banner

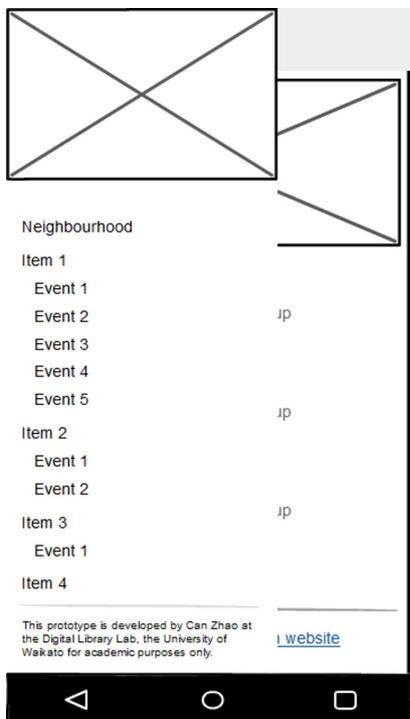


Figure 8 Item: Navigation drawer

Item event screen

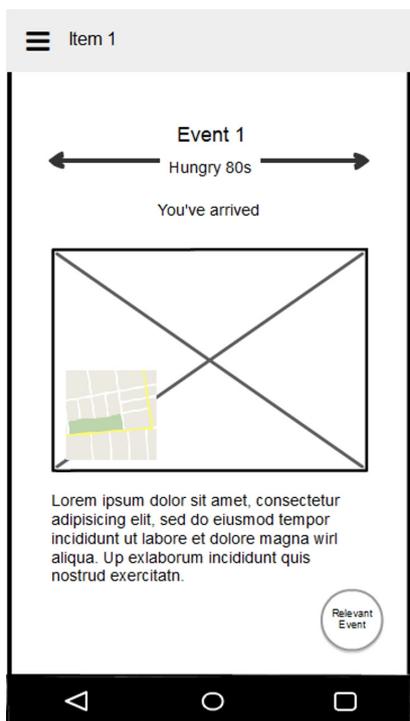


Figure 9 Item event

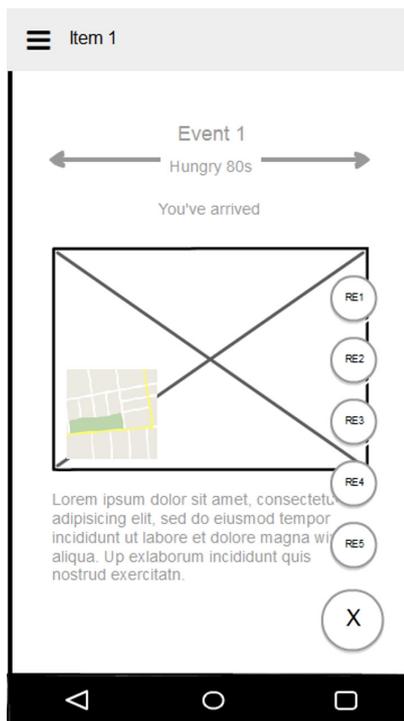


Figure 10 Item event: Relevant event tapped

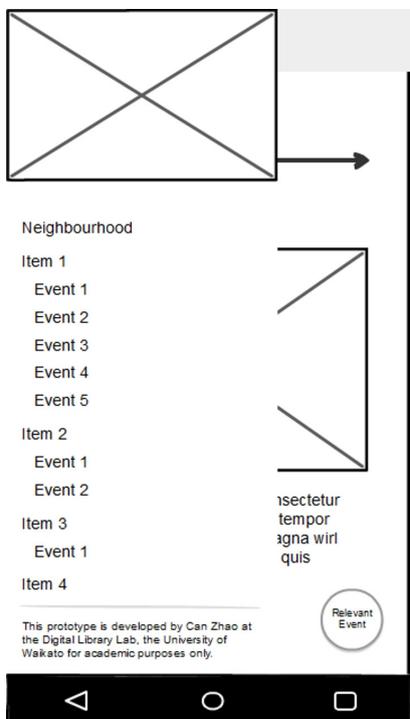


Figure 11 Item event: Navigation drawer

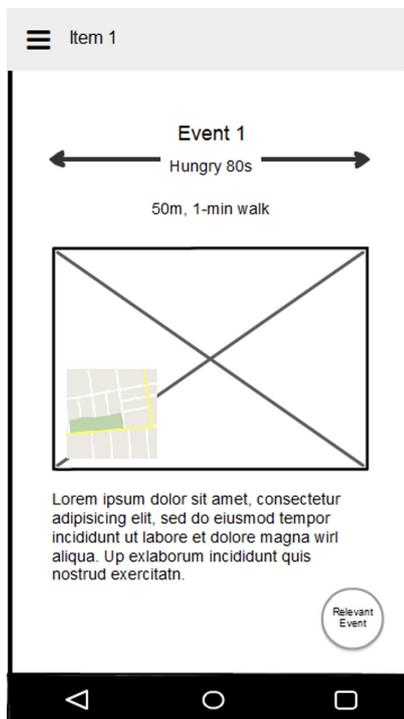


Figure 12 Item event: Not arrived

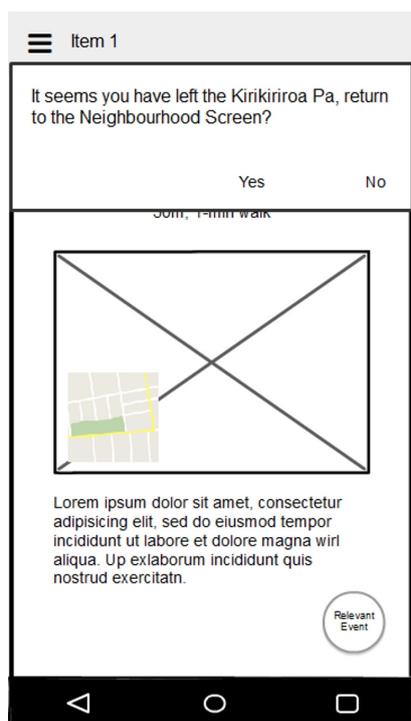


Figure 13 Item event: "Return" banner

# D6: Preliminary Ethics Application Form for Evaluating Android App Prototype

Faculty of Computing and Mathematical Sciences

## FCMS Preliminary Ethics Application Form for Usability Studies, Surveys and Related Personal Data Gathering



Please note that older versions of Adobe Reader may not enable completed forms to be saved.

Please complete all sections of this form.

### General Applicant Details

Applicant's name: Can Zhao

Department:  Computer Science  
 Mathematics  
 Statistics  
 Other:

Email address: cz93@students.waikato.ac.nz

Phone number:   
(Best number for contact during standard working hours)

Faculty of Computing and Mathematical Sciences

**Applicant Status** Staff Student

Supervisor's name: David Nichols

 Dissertation / thesis research

Code code: COMP900

 Course assignment / project Other: Other:

**General Research Activity Details**

Short, descriptive title: Evaluating Android application prototype  
(<10 words)

Activity outline: The activity aims at evaluating the usability of a heritage artefact-centred Android application prototype at two outdoor locations in Hamilton and gaining more feedback from the participants. The activity will employ a mixture of observation and semi-structured interview techniques. The collected data will be analysed and used to inform the design refinement of the prototype and support the writing of research publications.

In a paragraph describe the activity this application relates to, methods to be used, outcomes hoped for, and how it fits with a broader project (if applicable). The participants and researcher will only visit two locations that are either public spaces or a subset of the notion - locations that are outside a particular venue. The currently known options as per the artefact metadata obtained include 1) outside Waikato Stadium, 2) Garden Place and 3) outside Waikato Museum. The spread of COVID-19 has put a high degree of uncertainty to the approximate start and completion dates.

Approximate start date: May 2020

Expected activity duration involving subjects: Up to 60 minutes for each study session  
(i.e. excluding later analysis)

Expected overall completion date: April 2021  
(including analysis and reporting)

**Planned Approach** Field-based usability study

Will you conduct / be present during the study?

 Yes No Laboratory-based usability study Survey / Questionnaire Personal information / Data gathering Other:

## Faculty of Computing and Mathematical Sciences

- Data gathering from subject:  Computer activity, through software  
 AV recordings  
 Biometric data  
 Experimenter will monitor manually  
 Other:

Data gathering details: The researcher will collect the participants' verbal, gestural and facial expressions via video and audio recording, as well as on-screen interactions via software. The researcher may also record participants' uses of the prototype in relation to any elements featured in particular circumstances via note taking.

**Participants**

Approximate number  
of participants:

<5

6-10

11-20

21-50

>50

There are specific requirements for choosing participants

Notes on numbers and requirements: The study will involve female and male participants with prior experiences in visiting cultural heritage sites or museums and in using Android mobile phones.

Recruitment method:

Personal contact

Advertisement

Specify: If needed, we would request approval from the local heritage institutions to post advertisements on their noticeboards.

Online / Email

Specify: Emails may be sent to the specific persons and email lists (e.g. the currently enrolled history students, the local genealogy group members, etc.).

Other: Snowball sampling

We would ask the participants for suggestions.

Approaching people in the local heritage institutions  
If needed, we would try recruiting the patrons and visitors to participate in the evaluation.

## Faculty of Computing and Mathematical Sciences

Other:  Yes  No  
 Signed paper form  
 Electronic form

How will participants be provided the necessary information about this study?  
 (See Participant Information Sheet)

Signed paper form  
 Electronically pushed  
 Electronically pulled  
 Other: An e-copy of the Participant Information Sheet and Consent Form will be provided to each participant before the commencement of their study session.

Will you have direct personal engagement with all participants?  Yes  No

Will participants' personal identification details (e.g. name, address, phone number, email, computer IP address or other personal ID) be recorded?  Yes  No

Details: For the recruitment and communication purposes, the researcher may record the names, work email addresses and possibly work phone numbers of the participants.

Is there any compulsion and/or will participants/subjects receive any incentives for their involvement?  Yes  No

## Faculty of Computing and Mathematical Sciences

Can you ensure that an individual participant can withdraw after completing the activity but before the data is analysed and reported?

Yes  No

Does your study involve any contrived deception, for example withholding some relevant information from participants for the purpose of the study?

Yes  No

Is there a possibility that participants may incur, or have greater risk of, physical, psychological, social, economic or cultural harm as a result of being involved in this study?

Yes  No

**Reporting and Publication of Results**

How will the outcomes  
will be reported?

Published journal or conference paper

Thesis or dissertation

Limited circulation research report

Published working paper or research report

Course assignment

Popular press

Other:

Is it likely that individual participants could be identified from the published results?

Yes  No

Will the data obtained from the experiment will be made available publicly (e.g. through a public database)?

Yes  No

**Storage of Results**

Length of time data  
will be retained:

- Data will not be retained following the study
- <1 year
- 1-5 years
- >5 years

The gathered data  
will be stored in:

- Not applicable
- Faculty archive (safe)
- Computer archive – offline back up
- Computer archive – online or cloud
- Personal office
- Other:

Date: 02/04/2020

(Required format: dd/mm/yyyy)

## D7: Participant Information Sheet and Consent Form

### **Participant Information Sheet**



### **Ethics Committee, School of Computing and Mathematical Sciences**

#### **Project Title**

Evaluating Android application prototype

#### **Purpose**

To assess the usability of a heritage artefact-centred Android application prototype and reflect on the design approach the researcher has chosen.

#### **What is this research project about?**

The activity aims at evaluating the usability of the prototype and elicit feedback from the participants regarding their experiences with and thoughts on this particular design approach.

#### **What will you have to do and how long will it take?**

You will meet the researcher at a public space in Hamilton, fill in a demographic form (i.e. age range, how long you have been in Hamilton, etc.), freely explore the prototype on an Android phone provided to you for a while and view the information of some heritage artefacts at where you met and another place (You and the researcher will walk from the first to the second place). The researcher will discuss your experience of using the prototype with you. You will be asked to give consent prior to the activity, which should take no longer than *60 minutes*. If you give consent, the audio and video of the session may be recorded, and photos may be taken.

#### **What will happen to the information collected?**

The information collected will be used by the researcher to refine the design of the prototype and write research publications including the doctoral thesis. Only the researcher, supervisor and co-authors will be privy to the notes, photos and recordings from the project. Transcription of the debriefing meeting may be made by a third party under a confidentiality agreement. Some of your responses might be quoted, and a small number of the photos (anything shown on the photos that might lead to identification will be pre-processed) might be used in the publications. You will not be named in the publications, and every effort will be made to disguise your identity. The researcher will keep the notes, photos, recordings and anonymised transcriptions before the completion of the PhD and then archive the anonymised transcriptions, but will treat them with the strictest confidentiality. On completion of this project, the data that may include the notes, pre-processed photos, recordings and anonymised transcriptions will also be stored in the School of Computing and Mathematical Sciences (SCMS) Data Archive for five years.

#### **Declaration to participants**

If you take part in the study, you have the right to:

- Refuse to answer any question and to withdraw from the study before 30 June 2020. If you wish to withdraw, contact the researcher, Can Zhao (cz93@students.waikato.ac.nz). You do not need to give any reason for withdrawing from the project.
- Ask any further questions that occur to you during your participation.
- Be given access to a summary of findings from the project when it is concluded.

#### **Who's responsible?**

If you have any questions or concerns, either now or in the future, please feel free to contact either:

Researcher:  
*Can Zhao*  
*Department of Computer Science*  
*University of Waikato*  
*Private Bag 3105*  
*Hamilton, New Zealand*  
 Email: [cz93@students.waikato.ac.nz](mailto:cz93@students.waikato.ac.nz)

Supervisor:  
*Associate Professor David Nichols*  
*Department of Computer Science*  
*University of Waikato*  
*Private Bag 3105*  
*Hamilton, New Zealand*  
 Email: [david.nichols@waikato.ac.nz](mailto:david.nichols@waikato.ac.nz)

**Research Consent Form****Ethics Committee, School of Computing and Mathematical Sciences*****Extracting heritage artefact metadata*****Consent Form for Participants**

I have read the **Participant Information Sheet** for this project and have had the details of the project explained to me. My questions about the project have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I also understand that I am free to withdraw from the project before **30 June 2020** or to decline to answer any question in the project. I understand I can withdraw any information I have provided up until the researcher has commenced analysis on my data. I agree to provide information to the researchers under the conditions of confidentiality set out on the **Participant Information Sheet**.

I agree to participate in this project under the conditions set out in the **Participant Information Sheet**.

Signed: \_\_\_\_\_

Name: \_\_\_\_\_

Date: \_\_\_\_\_

**Additional Consent as Required**

I agree / do not agree to the use of audio and video recording of my responses.

If I agree to audio and video recording, then I understand that I may review the recording within three days of the activity and may withdraw the audio and video recording. Withdrawn audio and video recordings will be deleted.

I agree / do not agree to the use of photographs of me and/or the related materials.

If I agree to photographs being taken, then I understand that I may review them at the end of the activity and may withdraw any photograph. Withdrawn photographs will be deleted.

Signed: \_\_\_\_\_

Name: \_\_\_\_\_

Date: \_\_\_\_\_

**Contact information:**

Researcher:  
*Can Zhao*  
*Department of Computer Science*  
*University of Waikato*  
*Private Bag 3105*  
*Hamilton, New Zealand*  
 Email: [cz93@students.waikato.ac.nz](mailto:cz93@students.waikato.ac.nz)

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*Associate Professor David Nichols*  
*Department of Computer Science*  
*University of Waikato*  
*Private Bag 3105*  
*Hamilton, New Zealand*  
 Email: [david.nichols@waikato.ac.nz](mailto:david.nichols@waikato.ac.nz)

## D8: Demographic Form for Evaluating Android App Prototype

1. Your age range:

18 – 21

22 – 29

30 – 39

40 – 49

50 – 59

60 – 65

65+

2. Are you from Hamilton?

Yes

No

3. How many years / months have you been in Hamilton?

\_\_\_\_\_ years / months

## D9: Protocol for Evaluating Android App Prototype

### Recruitment

- We will approach the potential participants in person and via email, who have experiences of:
  - Using Android phones
  - Visiting cultural heritage sites or museums (preferably)
- We will provide them:
  - A copy of the Participant Information Sheet and Consent Form.
  - A copy of the Demographic Form.

### Prototype Walkthrough

The prototype features a three-screen design: Neighbourhood, Item and Event.

A user would land on the Neighbourhood screen, on which the locations are marked. Once a location marker is tapped, a bottom sheet would be showed with one or more artefacts listed (see Figure 1).

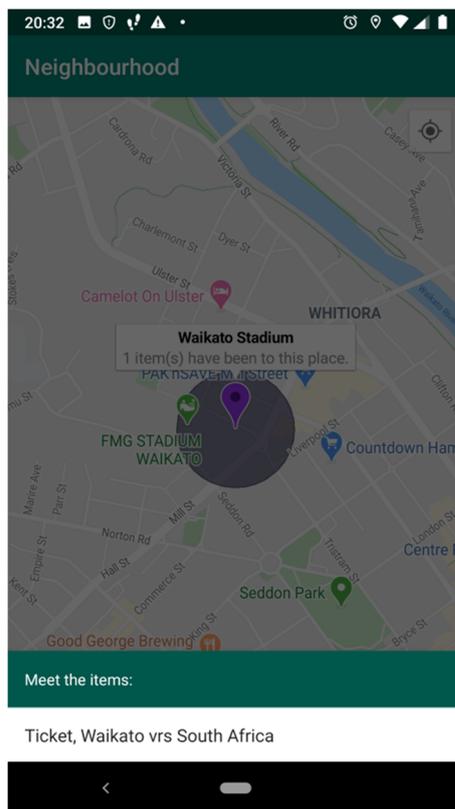


Figure 1 *Neighbourhood* screen

The user would tap on an artefact listed on the bottom sheet; the Item screen would be showed (See Figure 2). The user would tap on a particular event from the list view and proceed to the Event screen (See Figure 3). On the Event screen, they could tap on the

arrow buttons to view the previous and next events and the floating action button at the bottom right of the screen to see the relevant event (i.e. an event of another artefact).

The first version of the prototype is and will be iteratively built before the first evaluation session (excluding pilot tests). For example, the previous context-showing heritage image on the Event screen (See Figure 3) is being replaced by a map view featuring the trail of an artefact given the image licensing barriers.

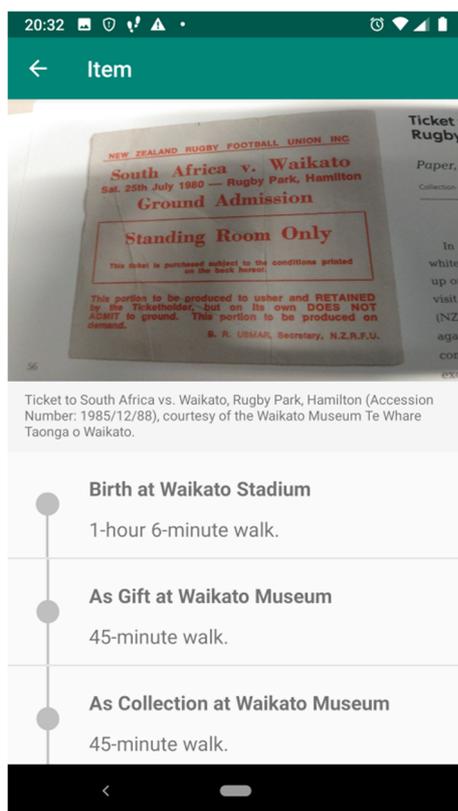


Figure 2 *Item* screen



Figure 3 *Event* screen

## Activity

### Venues

For each evaluation session, the participant and researcher will visit two outdoor locations that are either public spaces or a subset of it—locations that are outside a particular venue.

- First location: one of the artefact-associated location in the city
- Second location: another location that is associated with a relevant artefact

The currently known location options as per the artefact metadata obtained include 1) outside Waikato Stadium, 2) Garden Place and 3) outside Waikato Museum.

### Equipment

- An Android phone with the prototype installed and a micro SD card plugged in
- An Android application for recording on-screen interactions
- A mobile power bank
- An audio recorder

- An head-mounted action camera

Being at the *first venue* before the activity

- The researcher gives and presents the information of the Participant Information Sheet and Consent Form to the participant, then requests their consent.
- The researcher requests the participant to complete the Demographic Form.
- The researcher configures the recording devices.

Being at the *first venue*

- The researcher gives the Android phone to the participant with the screen recording application enabled.

Q1. Could you tell us a little about your experience visiting a cultural heritage site or museum, elsewhere and in this city?

Q2. Great. Now feel free to explore this prototype. Let me know once you finish your exploration. [Let the participant to finish their exploration or leave approximately two minutes for the participant to explore] So how was your impression?

[if the participant did not talk about 1) the artefact (may well be the only one connected to the location according to the artefact metadata we obtained), 2) a particular event of the artefact and 3) the relevant event]

Q3. We are at [the first location], could you tell me if there's anything that is relating to the [first artefact]?

[present the participant a sticky note with the task written on it]

[prompt the participant if they cannot find out the relevant event]

[summarise what has been explored and walk to the second venue to continue]

[if the participant did not talk about the clustered sign on the Map View of Event screen representing multiple events were taken place in one location]

Q4: Did you explore the mini map on the Event screen? Did you find anything? How about this sign that is clickable? Any thoughts on this particular design?

Being at the *second venue* (public transport may be needed in case that the walking time would be longer than 10 minutes, e.g. approximately 23 minutes from Waikato Stadium to Garden Place)

Q5: Could you pick up your favourite episode for the [second artefact]? Why?

Q6: How was your experience of using this prototype? Anything that you've noticed or want to add to it, (given your previous heritage visiting experience or experience as a local resident)?

Activity finished, thank the participant.

## D10: Approval Letter to Ethics Application

**School of Computing and Mathematical Sciences**

*Rorohiko me ngā Pūtaiao Pāngarau*

The University of Waikato

Private Bag 3105

Hamilton, New Zealand

Phone: +64 7 838 4322

Website: [www.cms.waikato.ac.nz](http://www.cms.waikato.ac.nz)

Email: [cms@waikato.ac.nz](mailto:cms@waikato.ac.nz)



THE UNIVERSITY OF

**WAIKATO**

*Te Whare Wānanga o Waikato*

9 April 2020

Can Zhao

c/- Department of Computer Science

**THE UNIVERSITY OF WAIKATO**

Dear Can

**Request for approval to conduct a user study with human participants**

On the basis of the information you have provided on the SCMS Preliminary Ethics Application Form relating to your research "Evaluating Android application prototype", the committee has given you approval to proceed with your proposed study. The approval number is CMS-20-05, which you should include on the Participant Information Sheet.

We wish you well with your research.

A handwritten signature in blue ink, appearing to read 'Mark Apperley', with a horizontal line underneath.

**Mark Apperley**

CMS Ethics Committee Convenor

School of Computing and Mathematical Sciences

# D11: Preliminary Ethics Application Form (Revised content only)

Faculty of Computing and Mathematical Sciences

## Participants

Approximate number of participants:

- <5  
 6-10  
 11-20  
 21-50  
 >50

There are specific requirements for choosing participants

Notes on numbers and requirements: The study will involve female and male participants with prior experiences in visiting cultural heritage sites or museums and in using Android mobile phones. We may recruit more people after thesis submission, the number may exceed 10.

Recruitment method:

Personal contact

Advertisement

Specify: If needed, we would request approval from the local heritage institutions to post advertisements on their noticeboards.

Online / Email

Specify: Emails may be sent to the specific persons and email lists (e.g. the currently enrolled history students, the local genealogy group members, etc.).

Other:

Snowball sampling  
 We would ask the participants for suggestions.

Approaching people in the local heritage institutions  
 If needed, we would try recruiting the patrons and visitors to participate in the evaluation.

**Storage of Results**

Length of time data  
will be retained:

- Data will not be retained following the study
- <1 year
- 1-5 years
- >5 years

The gathered data  
will be stored in:

- Not applicable
- Faculty archive (safe)
- Computer archive – offline back up
- Computer archive – online or cloud
- Personal office
- Other:

Date: 19/06/2020

(Required format: dd/mm/yyyy)

# D12: Participant Information Sheet and Consent Form (Revised)

## Participant Information Sheet



### Ethics Committee, School of Computing and Mathematical Sciences

#### Project Title

Evaluating Android application prototype

#### Purpose

To assess the usability of a heritage artefact-centred Android application prototype and reflect on the design approach the researcher has chosen.

#### What is this research project about?

The activity aims at evaluating the usability of the prototype and elicit feedback from the participants regarding their experiences with and thoughts on this particular design approach.

#### What will you have to do and how long will it take?

You will meet the researcher at a public space in Hamilton, fill in a demographic form (i.e. age range, how long you have been in Hamilton, etc.), freely explore the prototype on an Android phone provided to you for a while and view the information of some heritage artefacts at where you met and another place (You and the researcher will walk from the first to the second place). The researcher will discuss your experience of using the prototype with you. You will be asked to give consent prior to the activity, which should take no longer than *60 minutes*. If you give consent, the audio and video of the session may be recorded, and photos may be taken.

#### What will happen to the information collected?

The information collected will be used by the researcher to refine the design of the prototype and write research publications including the doctoral thesis. Only the researcher, supervisor and co-authors will be privy to the notes, photos and recordings from the project. Transcription of the debriefing meeting may be made by a third party under a confidentiality agreement. Some of your responses might be quoted, and a small number of the photos (anything shown on the photos that might lead to identification will be pre-processed) might be used in the publications. You will not be named in the publications, and every effort will be made to disguise your identity. The researcher will keep the notes, photos, recordings and anonymised transcriptions before the completion of the PhD and then archive the anonymised transcriptions, but will treat them with the strictest confidentiality. On completion of this project, the data that may include the notes, pre-processed photos, recordings and anonymised transcriptions will also be stored in the School of Computing and Mathematical Sciences (SCMS) Data Archive for five years.

#### Declaration to participants

If you take part in the study, you have the right to:

- Refuse to answer any question and to withdraw from the study before **30 April 2021**. If you wish to withdraw, contact the researcher, Can Zhao (cz93@students.waikato.ac.nz). You do not need to give any reason for withdrawing from the project.
- Ask any further questions that occur to you during your participation.
- Be given access to a summary of findings from the project when it is concluded.

#### Who's responsible?

If you have any questions or concerns, either now or in the future, please feel free to contact either:

Researcher:  
 Can Zhao  
 Department of Computer Science  
 University of Waikato  
 Private Bag 3105  
 Hamilton, New Zealand  
 Email: [cz93@students.waikato.ac.nz](mailto:cz93@students.waikato.ac.nz)

Supervisor:  
 Associate Professor David Nichols  
 Department of Computer Science  
 University of Waikato  
 Private Bag 3105  
 Hamilton, New Zealand  
 Email: [david.nichols@waikato.ac.nz](mailto:david.nichols@waikato.ac.nz)

**Research Consent Form****Ethics Committee, School of Computing and Mathematical Sciences****Extracting heritage artefact metadata****Consent Form for Participants**

I have read the **Participant Information Sheet** for this project and have had the details of the project explained to me. My questions about the project have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I also understand that I am free to withdraw from the project before **30 April 2021** or to decline to answer any question in the project. I understand I can withdraw any information I have provided up until the researcher has commenced analysis on my data. I agree to provide information to the researchers under the conditions of confidentiality set out on the **Participant Information Sheet**.

I agree to participate in this project under the conditions set out in the **Participant Information Sheet**.

Signed: \_\_\_\_\_

Name: \_\_\_\_\_

Date: \_\_\_\_\_

**Additional Consent as Required**

I agree / do not agree to the use of audio and video recording of my responses.

If I agree to audio and video recording, then I understand that I may review the recording within three days of the activity and may withdraw the audio and video recording. Withdrawn audio and video recordings will be deleted.

I agree / do not agree to the use of photographs of me and/or the related materials.

If I agree to photographs being taken, then I understand that I may review them at the end of the activity and may withdraw any photograph. Withdrawn photographs will be deleted.

Signed: \_\_\_\_\_

Name: \_\_\_\_\_

Date: \_\_\_\_\_

**Contact information:**

Researcher:  
*Can Zhao*  
*Department of Computer Science*  
*University of Waikato*  
*Private Bag 3105*  
*Hamilton, New Zealand*  
*Email: [cz93@students.waikato.ac.nz](mailto:cz93@students.waikato.ac.nz)*

Supervisor:  
*Associate Professor David Nichols*  
*Department of Computer Science*  
*University of Waikato*  
*Private Bag 3105*  
*Hamilton, New Zealand*  
*Email: [david.nichols@waikato.ac.nz](mailto:david.nichols@waikato.ac.nz)*

## D13: Demographic Form for Evaluating Android App Prototype (Revised)

1. Your age range:

18 – 21

22 – 29

30 – 39

40 – 49

50 – 59

60 – 65

65+

2. Are you from Hamilton (born and raised)?

Yes

No

3. How many years / months have you been in Hamilton?

\_\_\_\_\_ years / months

## D14: Protocol for Evaluating Android App Prototype (Revised)

### Recruitment

- We will approach the potential participants in person and via email, who have experiences of:
  - Using Android phones
  - Visiting cultural heritage sites or museums (preferably)
- We will provide them:
  - A copy of the Participant Information Sheet and Consent Form.
  - A copy of the Demographic Form.

### Prototype Walkthrough

The prototype features a three-screen design: Neighbourhood, Item and Event.

A user would land on the Neighbourhood screen, on which the locations are marked. Once a location marker is tapped, a bottom sheet would be showed with one or more artefacts listed (see Figure 1).

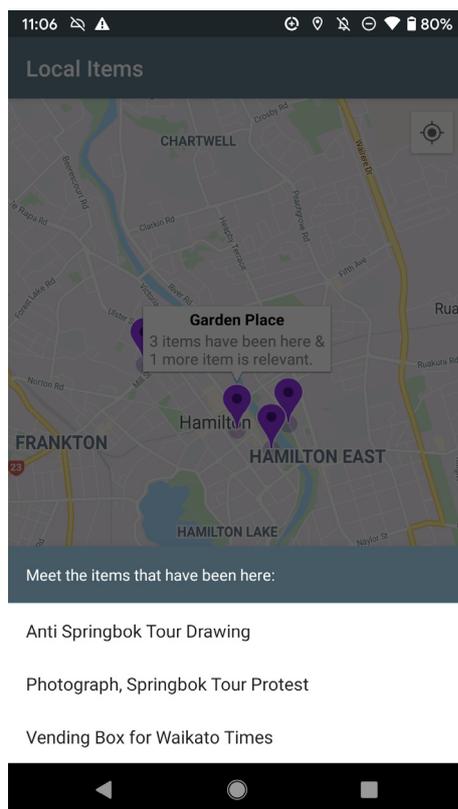


Figure 1 Local Item (Map) screen as of 19 June 2020

The user would tap on an artefact listed on the bottom sheet; the Item screen would be showed (See Figure 2). The user would tap on a particular **episode** from the list view and

proceed to **the Episode screen** (See Figure 3). On **the Episode screen**, they could tap on the arrow buttons to view the previous and next episodes **of the artefact** and **drag up the bottom sheet** to see the relevant **episodes** (i.e. **episodes experienced by** another artefact).

The prototype is iteratively built, and **the first version will be finalised before** the first evaluation session (**not counting** pilot tests).

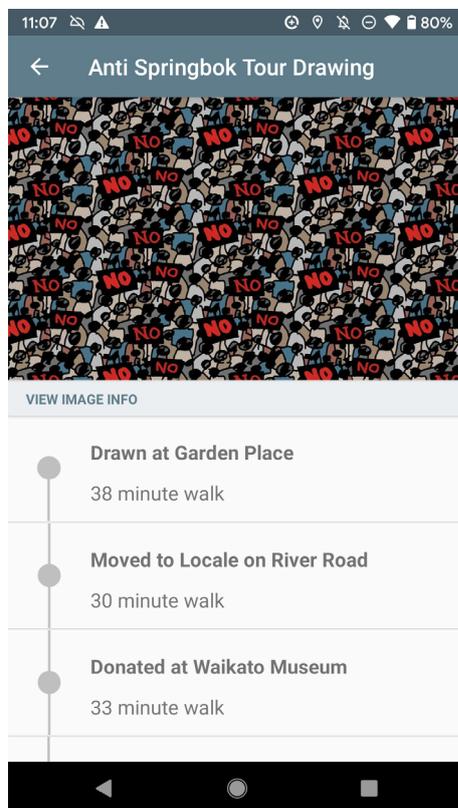


Figure 2 Item screen as of 19 June 2020 (Used for pilot tests only, the sample image was originally uploaded to Flickr by Jørgen Carling. <https://flic.kr/p/Teo6ZS>)

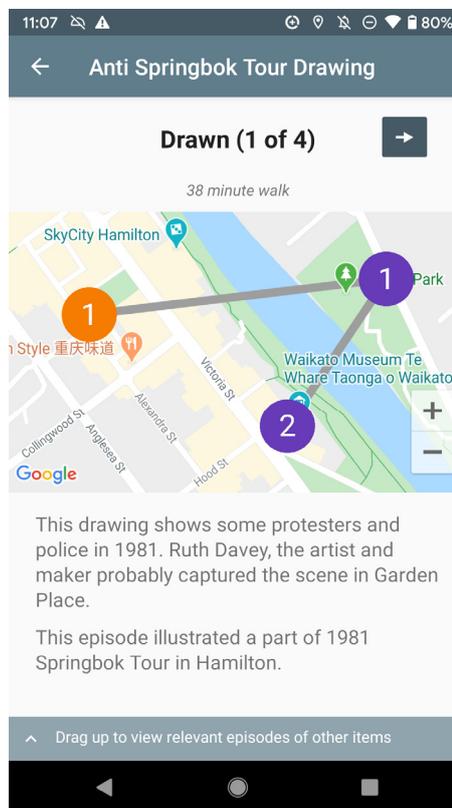


Figure 3 Episode screen as of 19 June 2020

## Activity

### Venues

For each evaluation session, the participant and researcher will visit two outdoor locations that are either public spaces or a subset of it—locations that are outside a particular venue.

- First location: one of the artefact-associated location in the city
- Second location: another location that is associated with a relevant artefact

The travelling options as per the artefact metadata obtained include 1) from Waikato Stadium to Garden Place, or in an opposite order, 2) from Garden Place to Waikato Museum, or in an opposite order.

### Equipment

- An Android phone with the prototype installed and a micro SD card plugged in

- An Android application for recording on-screen interactions
- A mobile power bank
- An audio recorder
- An head-mounted action camera

Being at the *first venue* before the activity

- The researcher gives and presents the information of the Participant Information Sheet and Consent Form to the participant, then requests their consent.
- The researcher requests the participant to complete the Demographic Form.
- The researcher configures the recording devices.

Being at the *first venue*

- The researcher gives the Android phone to the participant with the screen recording application enabled.

Q1. Could you tell us a little about your experience of using a guiding tool or communicating with a (human) guide (or in general other people) when visiting a cultural heritage site or museum?

Q2. Great. Now feel free to explore this prototype. Let me know once you finish your exploration. [Let the participant to finish their exploration or leave approximately two minutes for the participant to explore] So how was your impression?

Q3. So [the artefact] had taken part in [the episode] here at [the first location]. Could you show me if there's anything that is relating to [the episode of the artefact], starting from the beginning? Any thoughts on that?

- The researcher presents the participant a sticky note with the task written on it
- The researcher prompts the participant if they cannot find out the relevant episode of another artefact

Q4: About the small map on the Episode screen, did you find anything on the map? How about these circles, any thoughts?

Optional Q (en route): That's all for [the first location]. Before we move to [the second location], let's imagine that an item could travel by itself, as we have a grey line to represent the concept of *trail* on the small map. An item may have done [the episode] here at [the first location], then it may have travelled to [the second location] and joined in another episode there.

An question would be: As we travel to [the second location] just as the item did, would there be any elements en route/along the way that you'd consider as interesting and relevant to the travel of the item?

- The researcher presents the participant a sticky note with the question and its context written on it

Finished reading? Let's go.

Travelling from the *first location* to the *second*

- The researcher repeats key points of the option question when necessary.
- The researcher points to any element indicated by the participant en route when necessary.

Being at the *second venue* (public transport may be needed in case that the walking time would be longer than 10 minutes, e.g. approximately 23 minutes from Waikato Stadium to Garden Place)

Q5: Could you show me [the relevant episode of the other artefact] you've accessed at [the first location], starting from the beginning? Any thoughts on that? How would you think of the connection between the two episodes and the respective descriptions?

- The researcher presents the participant a sticky note with the task written on it
- The researcher prompts the participant if they cannot find out the episode

Q6: Could you choose one episode that you thought was interesting and another one that you thought was not? Why?

Q7: How was your experience of using this prototype? Anything that you've noticed or want to add to it, (given your previous heritage visiting experience or experience as a local resident)?

Activity finished, thank the participant.