

## Article

# Creating Futuristic Heritage Experiences: An Exploratory Co-Design Study through Design Fiction

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**Abstract:** This study adopted design fiction and co-design as the two main methodological approaches for designers and artists to explore the complex relationships and intersections of futuristic heritage experience and engagement. A literature-based seminar and a co-design workshop were conducted with 26 participants from multidisciplinary backgrounds, via Miro Board. A series of collaborative design practices and science fiction films were utilised as key media for propelling thinking, raising awareness or questions, provoking actions, inaugurating discussions, and offering alternatives necessary for a heritage setting. Additionally, this study reflects upon the complexities of using design fiction activities to re-think the technological future of heritage engagement and experience.

**Keywords:** design fiction; co-design; future heritage design



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## 1. Introduction

The futuristic exploration around historical traces and memories can be reflected through various forms, based on the multidisciplinary characteristics of digital heritage. For example, outside discussions of emerging technologies, in a solution-driven design setting both speculative design [1] and design fiction [2], as individual disciplines, offer greater possibilities for exploring, probing, exploiting, and critiquing the possible futures and technologies we would have to embrace [3]. A specific area that needs further exploration is speculative and imaginative work by designers and artists across the arts and sciences, which would allow innovative engagements with heritage that go beyond the current frameworks. Participatory and co-design-based practice can play a significant role in exploring the possibilities and positioning of digital heritage, especially its potential for creating a shared space for heritage professionals, stakeholders, practitioners, human-computer interaction (HCI) researchers, and audiences to discuss heritage-related practices and prototypes [4–6]. However, understanding ways of integrating design fiction into co-design activities, in order to facilitate speculation over design practice, is an area that needs further exploration. Therefore, this study adopts design fiction and co-design as two methodological approaches to understanding designers' and artists' exploration of the complex relationships and intersections of futuristic heritage experience and engagement, as well as the potential societal and technological issues that can emerge in a digital heritage setting. A literature-based seminar and co-design workshop were conducted with 26 participants from multidisciplinary backgrounds, via Miro Board (an online whiteboard tool). A series of collaborative design practices and science fiction films were utilised as key media for propelling thinking, raising awareness or questions, provoking actions, inaugurating discussions, and offering alternatives necessary for a heritage setting. Additionally, this study reflects upon the complexities of using design fiction activities to re-think the technological future of heritage engagement and experience.

## 2. Related Work

This section focuses on related work, and specifically on recent work in the digitalisation of heritage and design fiction, since it is closest to the focus of this study.

### 2.1. Cultural Heritage and Technology

Cultural heritage is a worldwide resource and product of selection by society that is inherited from past generations. It includes tangible culture (i.e., physical artifacts produced, maintained, and transmitted intergenerationally in a society), intangible culture (stated by UNESCO as nonphysical intellectual wealth), and natural heritage (encompassing the countryside and natural environment) [7–9]. An interesting question to consider is, ‘Is there an emerging digital heritage?’ Case studies on emerging technologies in heritage studies are abundant, and as a result, digital heritage and cultural computing have been transformed into promising fields for the application of diverse computer technologies and scientific methods to cultural studies, arts, and humanities [10]. This would demonstrate, enhance, and transform innovative experiences, products, and processes [11,12]. Specifically, digital heritage has been extensively discussed within the domain of HCI [13–17]. These discussions address various emerging technologies such as augmented reality (AR), virtual reality (VR), and mixed reality (MR) [18], digital archives [19], tangible interfaces [20], and live streaming [21], which have been applied to several aspects of heritage studies, such as heritage exhibitions, learning, safeguarding, promotion, and enhancement [21–25]. Furthermore, user-centred design and co-design have been extensively adopted as approaches for exploring the evolution of users’ roles in designing and demanding digital technology [26–28]. However, in the current HCI literature, exploratory studies that specifically discuss the futuristic and heritage-related contexts of emerging technology, future forms of heritage, and the potential future features of heritage in society are extremely sparse. This underlines the importance of designing a creative approach to facilitate heritage stakeholders’ inspiration, expression, and contribution.

### 2.2. Design Fiction

It is important that designers have a perspective and think deeply about the future, as they often need to imagine and anticipate impending changes, such as in user experience scenarios, or situations that can impact their design outcome when developing a new product. This illustrates the validity and importance of design fiction, and the necessary speculation that it allows over why a design is the way it is, or conversely, what it would look like if a different approach was taken, or what the correct approach actually is [29]. However, such speculation could also disrupt the timeline and development of an emerging technology if various design practices and ideologies are implemented together [30]. The classic diagram designed by Dunne and Raby [31] illustrates different potential futures, and uses the words ‘possible’ for what might happen, ‘plausible’ for what could happen, and ‘probable’ in the context of speculation in design practice. Coulton and his colleagues expanded upon this interpretation by adding another keyword, ‘impossible - based on current knowledge’, to acknowledge certain design fiction-based concepts that exceed existing scientific knowledge [30,32]. Additionally, design fiction provides an open set of tools and techniques for apprehending, modelling, and testing possible futures, and better understanding future technological challenges. As with speculative design, design fiction operates on prototype formation, but is accompanied by a narrative.

In an interview with Slate magazine in 2012, Sterling defined design fiction as the ‘deliberate use of diegetic prototypes to suspend disbelief about change’. This study follows this definition, by utilising a methodological approach that envisions technologies in the distant future and positions them in a new context. Specifically, design fiction practices engage participants in the use of ‘diegetic prototypes’, rather than just ‘prototype’, which better reflects their understanding of design in a fictional setting. Kirby [33] further explains how diegetic prototypes can be created through ‘dialogue, plot, rationalisation, character interaction, and narrative structure’ within a technology’s lifecycle. Compared to the coherent functionality of a prototype, a diegetic prototype is a functional piece of technology in a fictional world that has ‘potential’ for creating a story [34].

### 3. Design Practice

The design practice of this study comprised three stages, which exploited the complex relationships and intersections of futuristic heritage experience and engagement, as well as the potential societal and technological issues within a digital heritage setting. More specifically, it engaged participants from an art or design background in co-exploring: 1. The positioning of future heritage, and the future context of present and emerging heritage; 2. Novel forms of heritage that exceed current frameworks and explore futuristic representation, experience, and engagement; and 3. The role that heritage could play in future society, and potential challenges to the resilience and sustainability of heritage.

Three activities were conducted gradually to engage participants in exploring the aforementioned topics. The first activity was ‘peer sharing’, which required participants to share their design skills with other participants. The second activity was a ‘literature-based seminar’ that allowed the participants to learn and discuss their understanding of future heritage with regard to emerging technology. The third activity was a workshop titled ‘Future Heritage Design Workshop’, which took co-design and design fiction as the two main approaches for exploring the future of heritage and its accompanying challenges. All three activities were conducted virtually via an online collaborative whiteboard tool, Miro, and using the proprietary videoconferencing software, Zoom. The activities were conducted over a three-week period; further details about durations, the software used, and outcomes are presented in Table 1.

**Table 1.** Time duration, software selection, and outcomes of the three activities.

Activity	Time Duration	Software Selection	Outcome
Peer Sharing	2 h	Zoom, Miro	Whiteboard
Literature-based Seminar	2 h (pre-activity) + 3 h	Zoom, Miro	Whiteboard, Presentation
Future Heritage Design Workshop	1 h (pre-activity) + 4 h	Zoom, Miro, YouTube	Whiteboard, Prototype, Presentation

#### 3.1. Recruitment

Participants were recruited via the snowballing method, resulting in 26 participants (18 females, 8 males) in the age range of 23–31 years. They were recruited from art/design colleges/universities to participate in the three-stage design activities. All participants described themselves as highly interested in heritage studies and digital heritage; those specialising in Heritage Visualisation considered themselves heritage experts. Table 2 presents information on the participants’ gender and academic and cultural backgrounds. Each participant was asked to sign a consent form and notified about the activity schedule. Through this representative sample of individuals interested in heritage (however, not necessarily experts in emerging technology in the field of heritage studies), it was hoped that participants from different artistic and design backgrounds could be analysed, who were particularly interested in the issues at hand and could therefore provide valuable critical accounts for the study.

#### 3.2. Activity 1: Peer Sharing

The first activity familiarised the participants with each other, while briefly outlining their relevant design skills. This activity was conducted on Zoom and Miro. Zoom provided a platform for communication, and Miro supported participants’ interaction and demonstration of ideas. They were all given 30 min to work on a Miro board to present themselves on five parameters: cultural background, academic background, current subject of study, design skills, and their personal understanding of cultural heritage (Figure 1). This was followed by a 5–10 min talk by each participant, wherein they summarised their notes from Miro to talk about themselves. Figure 2 presents the keywords used by

the participants to clearly explain their thoughts on the key parameters. Based on their personal design skills and particular interests in cultural heritage (as mentioned by them), the author, in the capacity of a design facilitator, divided the participants into six groups for the second activity.

**Table 2.** Distribution of participants' gender and academic and cultural backgrounds.

No.	Gender	Academic Background	Cultural Background
1	F	Interaction Design	UK
2	M	Interaction Design	China
3	F	Interaction Design	China
4	F	Interaction Design	China
5	F	Interaction Design	India
6	F	Interaction Design	UK
7	F	Service Design	UK
8	M	Service Design	China
9	F	Service Design	India
10	F	Service Design	Pakistan
11	F	Service Design	Greece
12	M	Interior Design	UK
13	M	Interior Design	China
14	F	Interior Design	India
15	F	Interior Design	India
16	F	Interior Design	China
17	M	Interior Design	Italy
18	M	Graphic Design	China
19	F	Graphic Design	UK
20	F	Graphic Design	UK
21	F	Heritage Visualisation	Pakistan
22	F	Heritage Visualisation	India
23	M	Heritage Visualisation	UK
24	F	Product Design	UK
25	M	Product Design	UK
26	F	Curatorial Practice	France

### 3.3. Activity 2: Literature-Based Seminar

Most participants had neither direct professional knowledge nor experience of heritage studies or digital cultural heritage; therefore, the second activity intended to build upon and expand their understanding of both cultural heritage and relevant emerging technologies. The participants were divided into six groups (Daiyu, Yuanchun, Xichun, Baochai, Tanchun, and Yingchun) to enable the seminar to be conducted based on the reading of six research topics/papers (one per group), in order to explore emerging technologies within cultural heritage. The papers included in the seminar were collected prior to the seminar by the author using three major databases: ACM, Scopus, and Web of Science. These papers were chosen as they discussed and illustrated various types of emerging technologies, which are highly resourceful in enabling the participants to comprehend current technological developments as well as case studies and research in academia, thus enabling them to speculate on the future of heritage. Additionally, they were of high research impact and had



gathered a significant number of citations within the field. Each research paper represents a specific topic that includes tangible interaction [20], live streaming [21], oral history archive [19], museum collections [35], migrant communities [36], and mixed reality [18]. A week before the seminar, each participant was provided randomly with one of the six papers and given a week to read it and make individual notes. During the seminar, each group was allocated an hour to share their understanding of the paper within their groups. Figure 3 presents the basic instructions and guidance for this seminar, which were conveyed through Miro. In addition, the groups were asked to base their discussion on three specific aspects: research questions, field and subject, and design methods and technology. The use of the Miro board allowed participants to record notes to supplement their discussion and document relevant findings. Figure 4 presents the three questions that inaugurated the group discussions and notes taken by each group. These three questions were: (1) “What are the main research questions of this paper?” (2) “What is the primary field and subject of discussion?” and (3) “Which design methods and technologies have been mainly utilised?” After the groups had finished their discussions, each group was allocated 20 min to share their understanding and findings of the specified topics, after which the other groups could raise questions about the topics discussed.

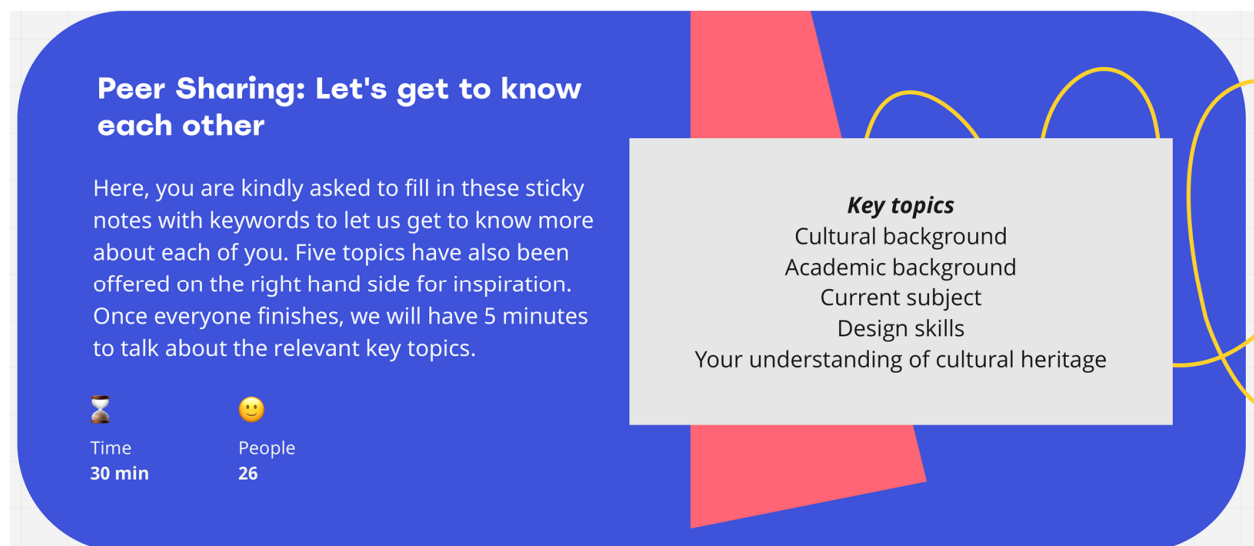


Figure 1. Miro Board.

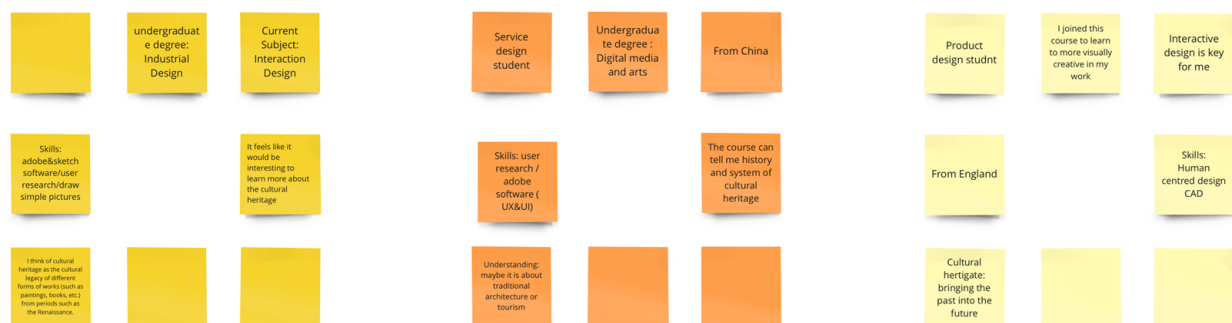


Figure 2. An example of the notes generated from the participants during the first activity.



# Group-based Seminar

## Instructions

In this seminar, each group will read an academic paper that focuses on a specific research area in digital heritage.

Based on your group reading and discussion, you will have 20 mins to share and introduce some interesting findings of the study for us.

Then we will have a brief session to ask some questions and to have a further discussion of the topics.

**Figure 3.** An outline of the second activity.

#### *3.4. Activity 3: Future Heritage Design Workshop*

The third activity was a workshop on the application of design fiction in a co-design work setting, through the engagement of participants in the discussion and exploration of the complex relationships and intersections of futuristic heritage experience and engagement, and societal and technological issues in a digital heritage setting. Before the workshop began, three briefs were sent to each group. These briefs covered topics such as mixed reality, co-design for community-based heritage, and the post COVID-19 era. At the start of the workshop, participants were introduced to design fiction and speculative design as the facilitator's chosen methods for application, as well as to the workshop schedule. Figure 5 presents the workshop's schedule and instructions. During the workshop, participants were asked to utilise 'if/then' statements for discussing certain key areas in design and future heritage. The discussion mainly focused on the following questions: (1) "What would heritage look like in the future?" (2) "How would people understand heritage in the future?" (3) "What kind of designs should be created for futuristic heritage experiences?" In the workshop, the 'if/then' statements were interpreted as follows: the hypothesis is the first, or 'if', part of a conditional statement, while the conclusion is its second, or 'then', part. The conclusion is the result of a hypothesis.







Group	Theme	Question What are the main research questions of this paper?	Field & Subject What is the primary field and subject of discussion?	Design Method & Technology Which design methods and technologies have been mainly utilised?
	Museum collections	<p>how to collect, preserve, study, interpret, exhibit and enhance understanding of the world</p> <p>how to help user better engage into the museum</p> <p>how to explore ICH interaction with digital technology to enhance the connection between the objects of an exhibition</p> <p>make more evident the logical connections between different elements</p> <p>how to connect multiple museum pieces through shared intangible elements</p>	<p>Digitisation</p> <p>Transmedia storytelling</p> <p>Multi Media Interaction Application</p> <p>intangible cultural heritage</p> <p>Complex Collection</p> <p>the design framework for making such technologies effective</p>	<p>CT Scanning</p> <p>multi media user interaction</p> <p>Digital photogrammetry technology</p> <p>Digital Interaction with CMCs</p> <p>Mixed Reality</p>
	Migrant communities	<p>How can we explore and enable discussions surrounding the various perceptions of ICH</p> <p>Communities at risk of exclusion</p> <p>Intangible Cultural Heritage</p> <p>what recommendations can be made for interactive DS platforms that address CHs' interest</p> <p>challenges and pitfalls encountered along the way are reflected upon and the ethical complexities</p>	<p>Digital Storytelling (DS)</p> <p>Migrants</p> <p>Culture, Customs, identity, traditions, values etc (Immaterial Heritage)</p> <p>Interactive Experiences</p> <p>Expression and understanding of the associated objects and environment...</p> <p>Learning more about the first and second generations of that community and learn about how they have heritage</p> <p>Learn more about their Art and Culture, music etc</p>	<p>DS- By capturing their lives with pictures and videos</p> <p>VR videos can help immerse people into their world</p> <p>field study Personas and scenarios</p> <p>booklets about places that they had visited, safeguarding the impressions and memories that they had had in those places</p> <p>empathy mapping framework</p> <p>focus group</p> <p>Adoption and Promotion of the app</p> <p>thematic coding by one of the first authors (by using nvivo software)</p> <p>immersive technologies such as VR, AR and Mixed Reality VR experiences to enhance the specific characteristics</p>
	Mixed reality	<p>surveys the state of the world in migration, urban, and rural reality systems as a whole and from a cultural heritage perspective</p> <p>A review of these technologies from a cultural heritage perspective</p> <p>looking and representing intangible cultural heritage through digital technology, such as VR, AR, MR, etc. to enhance the connection between the objects of an exhibition</p> <p>cultural heritage sites and artefacts</p> <p>different examples in a variety of areas</p> <p>Understanding the use of technology to preserve information</p>	<p>Cultural Computing</p> <p>Augmented Reality (AR) and Virtual Reality (VR)</p> <p>A number of studies demonstrate the value of augmented virtual, and mixed reality systems for ancient education sites in CH</p> <p>education, exhibition enhancement, reconstruction, and virtual museums</p> <p>Virtual Environment Modelling</p> <p>relationship</p> <p>digitalization and its varied use</p> <p>Commercial and Open Source Development Tools</p>	<p>AR &amp; AV</p> <p>virtual reality</p> <p>Mixed Reality</p> <p>3D data acquisition techniques &amp; 3D model</p> <p>Tangible User Interfaces (TUI)</p> <p>digital media</p>
Group	Theme	Question What are the main research questions of this paper?	Field & Subject What is the primary field and subject of discussion?	Design Method & Technology Which design methods and technologies have been mainly utilised?
	Live streaming	<p>What are the practices and motivations for sharing and watching ICH-related livestreams in China?</p> <p>How do ICH streamers interact with, and engage, viewers?</p> <p>What are the perceived benefits, drawbacks, and obstacles and how do they affect the ICH streamers and viewers?</p> <p>The significance of live streaming for intangible cultural heritage</p> <p>The benefits of direct broadcasting of intangible cultural heritage</p> <p>Is the live broadcast approach conducive to the dissemination of intangible cultural heritage</p>	<p>The practices and motivations for sharing and watching ICH-related livestreams in China</p> <p>how to improve social interactions Beyond Livestreams</p> <p>analysing ICH streaming challenges</p> <p>how streamers engage viewers with ICH-related content through different media</p> <p>design implications to improve the software and tools available to ICH streamers and viewers</p> <p>insights into other practitioners in China or in other countries can learn from Chinese ICH livestreaming practices</p>	<p>Semi-structured interviews</p> <p>Open coding method (affinity diagram)</p> <p>multi-camera or VR systems</p> <p>live video, pre-recorded video, photographs, chat groups, e-commerce</p>
	Tangible interaction	<p>How to design tools that can be adopted to different experiences to explore and interact with cultural heritage environments?</p> <p>What is the potential and transformation of cultural heritage through tools like toolkits?</p> <p>The current status of exhibition design practice and how to improve it with technology</p> <p>how does tangible interaction act as a tool to use in exhibition/museum to make people have better observation?</p> <p>How to use interactive technology to make people have a better understanding of cultural heritage</p> <p>How to use interactive tools to let visitors have a deeper understanding of heritage</p>	<p>How to evaluate the impact of this interactive toolkit on future heritage</p> <p>How does the open toolkit support the creation of cultural heritage by various users in different environments</p> <p>An introduction to the toolkit and methods for evaluating workshops</p> <p>how the toolkit helps and benefits people to explore and interact with the cultural heritage</p> <p>How to use tools to make visitors interact with the exhibits</p> <p>This paper introduces the practical cases and forms of cultural heritage exhibition design in the field of HCI</p>	<p>The meSch tangible interaction toolkit</p> <p>workshop in HCI projects</p> <p>CHPs</p>
	Oral history archive	<p>How can digital technologies be used to enhance the connection between the objects of an exhibition</p> <p>How can digital technologies be used to enhance the connection between the objects of an exhibition</p> <p>How can digital technologies be used to enhance the connection between the objects of an exhibition</p> <p>How can digital technologies be used to enhance the connection between the objects of an exhibition</p> <p>How can digital technologies be used to enhance the connection between the objects of an exhibition</p> <p>How can digital technologies be used to enhance the connection between the objects of an exhibition</p>	<p>Oral History</p> <p>Media History</p> <p>Digital Humanities methods</p> <p>Metadata(?)</p> <p>Information Science</p> <p>Computational Archival Science</p>	<p>web design and user journeys</p> <p>Data modelling and information unit definition</p> <p>Metadata and structuring</p>

Figure 4. An example of the discussion notes that were taken by each group during the second activity.

# Future Heritage Design Workshop

## Instructions

1. Get familiar with **Speculative Design & Design Fiction**
2. **Discuss** 3 key areas regarding design and future heritage by using **if/then statements**
3. Think about what we will design by considering subjects, topics, quotes and conditions - these will be presented on a **Narrative Design Board**
4. Work with your group to fill the Narrative Design Board (stage 1-3) and its **4 components**

**40 min** to complete each stage of the Narrative Design Board

**15 min** to present your design process and outcome

**Figure 5.** An outline of the workshop's schedule and instructions.

For the workshop, participants were placed in the same groups as in the previous stage (Activity 2: Literature-Based Seminar). The design activity required making a 'narrative design board', as shown in Figure 6. This board consisted of four key components: heritage subjects, topics, clips with quotes, and conditions. Each group could select one or more heritage subjects for further discussion and exploration; participants discussed the specific topics they wished to focus on with their group members (e.g., community-based or cultural education). To further facilitate the participants' development of ideas regarding futuristic heritage design, the author provided ideational materials; these materials took the form of science fiction short films gathered from the popular YouTube channel 'DUST' (<https://www.youtube.com/c/watchdust>, accessed on 8 August 2022), which publishes thought-provoking science fiction short films through the lens of science and technology's

impact on the future of humanity. Each video allocated to the groups was 10–15 min long. Each group was provided with a random video link to one of the short films; the chosen films did not have any connection with the briefs. This was to avoid creating any subjective perspectives or barriers to restrict speculation. The films' dialogues, plots, stories, and references to any emerging technology would have to be incorporated into their discussions and ideations. Figure 7 presents the briefs given to each group, alongside a detailed introduction. Finally, the participants could select additional key words (e.g., ethical, experiential, systemic, infrastructural, behavioural) for describing the conditions they identified and specified with their design ideation. In addition, a series of supplementary documents were provided, so that participants could better understand how to engage in the workshop, as presented in Figure 8 (these included resources and webpages for an in-depth understanding of heritage categories, and the use of clips from the science fiction short films to support their design ideations). It is worth noting here that the author has not defined heritage within this study. Supplementary materials around heritage itself were provided to the participants in order for them to form their individual and group understandings of heritage, exclusively.

## What we will discuss

'Creative provocations, raising questions, innovations, and exploration...[it] makes an effort to explore new kinds of social interaction rituals.'

1. What does heritage look like in the future?
2. How are we going to understand heritage in the future?
3. How are we going to design for experiencing futuristic heritage?

Potential Thinking (way): if...then statements

## What we will design - Narrative Design Board

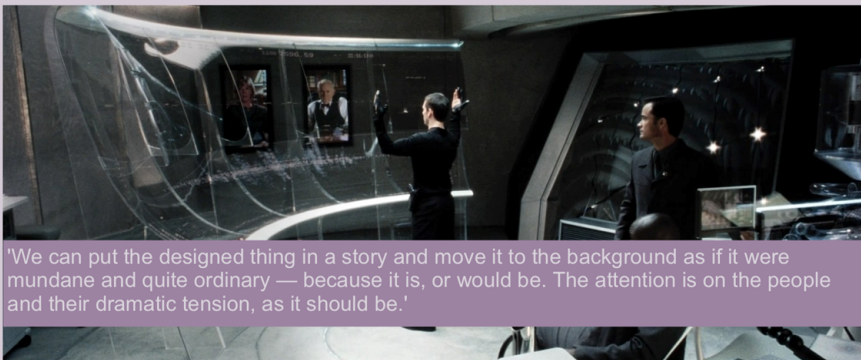
Heritage Subjects + Topics + Clips with Quotes + Conditions = **Narrative Design Board**

You will find keywords of each component down below, and you can put them on sticky notes and place them on the narrative design board.

## What we will focus

dialogue; plot rationalisations; character interactions; narrative structure

It's not only about future technology!



'We can put the designed thing in a story and move it to the background as if it were mundane and quite ordinary — because it is, or would be. The attention is on the people and their dramatic tension, as it should be.'

**Figure 6.** An example of a narrative design board.





Figure 7. An example of the briefs provided to each group, alongside a detailed introduction.

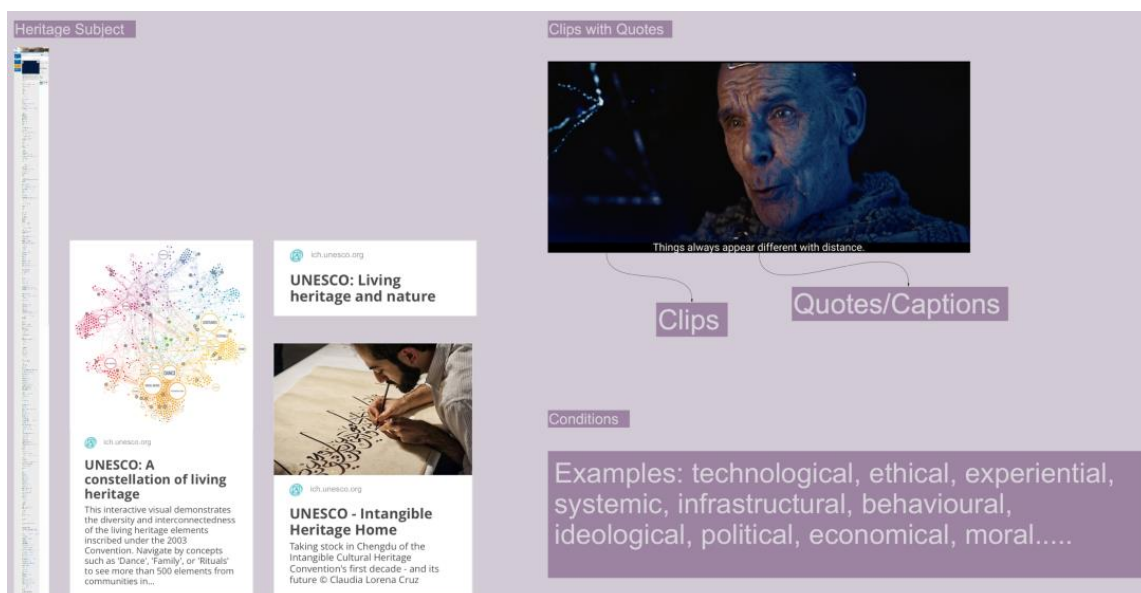


Figure 8. An example of the supplementary documents the participants were provided.

## 4. Results

This section summarises key findings from the design outcomes of participants and their respective groups.

### 4.1. Narrative Experiences and Role-Play Gaming

For this design outcome, two groups (Daiyu and Baochai) probed into the potential engagement of visitors with heritage-based locations through historical stories, using



a heritage narrative. This outcome resulted from thinking about how to improve the heritage experience; in response to this, participants had referred to different games (e.g., murder mystery and role playing). Specifically, the participants created short stories. These stories depicted a series of forecasting features through a descriptive experience, for instance, overcoming language barriers, experiencing immersive bodily feelings, entering a parallel universe, time travelling, etc. The following is an extract from a short story created by group Baochai: *'Jake, Emily and I stepped into a portal and were sent back in time, taken away from our present-day world set in the year 2061 and propelled into the historical event of the Nanjing Massacre, in 1937. Upon travelling back in time, between the two years, words were visible across the sky notifying us that time was shifting and we were being sent back 124 years into the past. These words also notified us that within this experience, one minute equated one day in the historical event, and just like that, our feet hit the ground! We landed on what appeared to be the remains of a town square, the floor had an uneven surface covered in shrapnel and debris—we were in Nanjing and the day was the 14th of December 1937. Realising that we had actually travelled back in time, panic sank in, exacerbated by the fact that citizens around us were screaming, falling, running, and bumping into us. Then it hit. The sound of a grenade exploding just 15 meters away from us resounded. We joined the crowd and ran for our lives. Emily screamed, but the words that came out of her mouth were not English; they were Chinese. This is when we realised that not only had we travelled back in time, but also our mother tongue and appearance had changed. We could communicate with the locals without any language barrier at all. Our appearance and clothing were also different; we were clothed in Chinese garb. A Chinese guy running beside us shouted that Japanese soldiers were killing any civilian in sight. He insisted we follow him to a hideout, a safe space. On our way, we witnessed the unthinkable. Storefronts, homes, and civilians were burning as arson attacks ripped through the streets. Looting was taking place as storeowners fled for their safety. Women were being dragged away as mass rape took place in the rubble-ridden alleyways. Arriving at what appeared to be a small clearing, Jake looked at my legs in worry. Due to nervousness, I had not realised that my knee was bleeding, and that is when the pain kicked in. Emily's arms were also deeply grazed and bleeding through the Chinese outfit she was wearing. We had been running for 2 hours by then and exhaustion was well in place as we kept dipping in and out of cover under subways or basements to escape from the plane-ridden sky. On our way to safety, we witnessed the remains of many civilians scattered across the ground. The sound of crying and screaming crippled our ears and began to muffle out the distant sound of bullets penetrating anything in sight, grenades exploding left, right, and centre. We were in a state of panic and drowning in intense hopelessness brought on by this experience.'* In doing so, they outlined the prospects of visitors' transformation into historical characters within a heritage setting or exhibition, and their subsequent exploration and experience, by giving them a 'real' cinematic feel through the characters, environments, and improvisation in the moment. This would allow visitors a profound immersion into, and memory of, what cultural heritage offers. The participants who developed this scenario recorded it as *'In our vision, users can wear a device and enter a world of ruins designed by us. The whole experience unfolds in the form of a game, wherein users play the roles of ancient characters and search freely for treasures in the restored relics, i.e., the relevant museum collection. While doing so, they live through plots based on folklore or historical stories, which provides them insight into the background.'* In addition, this sort of gaming experience would allow visitors to interact or collaborate creatively during the heritage experience.

The groups also discussed how to deliver this heritage experience and the relevant emerging technologies that would be utilised. Accordingly, two plans (a 5-year plan and 10-year plan) were charted to demonstrate their ideation. Since immersion and presence are two important elements for an effective VR experience [37], these were further interpreted and delivered in the two plans. Thus, the participants suggested that, in the 5-year plan, museums could take appointments in advance and customise their services on the basis of information and preferences collected through social media and surveys. The use of VR devices, such as Oculus Quest, could be incorporated into the game design for engaging visitors in a virtual historical environment with replicable heritage collections or events. For

example, VR could place a visitor into the scenery of a historic event, such as the Nanjing Massacre mentioned earlier by group Baochai, or onto another planet to explore its surface. Another point of discussion was the virtual demonstration of intangible heritage. The role-playing game would help visitors understand and experience the intangibility of heritage by, for instance, involving them in representative stories of crafting skills, or storytelling of oral history. The participants also considered the necessity of the cross-cultural understanding of the heritage setting, as conveying the historical significance would have to overcome any linguistic or cultural barriers that could exist. Based on this, it would be beneficial to target museums and cultural landmarks within these projects to expand the capabilities of experiencing heritage through digital technology. The 10-year plan was similar to an advanced version of the 5-year plan. For example, the 10-year plan delved further into utilising technologies such as holographic laser projection (supported by 6G or 7G) in heritage experiences. This would enable visitors to immerse more deeply in an exhibition. Museums would be able to share their collections virtually with other museums, thereby promoting the co-creation of comprehensive narratives to enliven the virtual heritage domain. Additionally, visitors could travel through different historical periods across various countries; this would allow them to know different historical episodes by engaging with and playing through different historical characters or reading historical material.

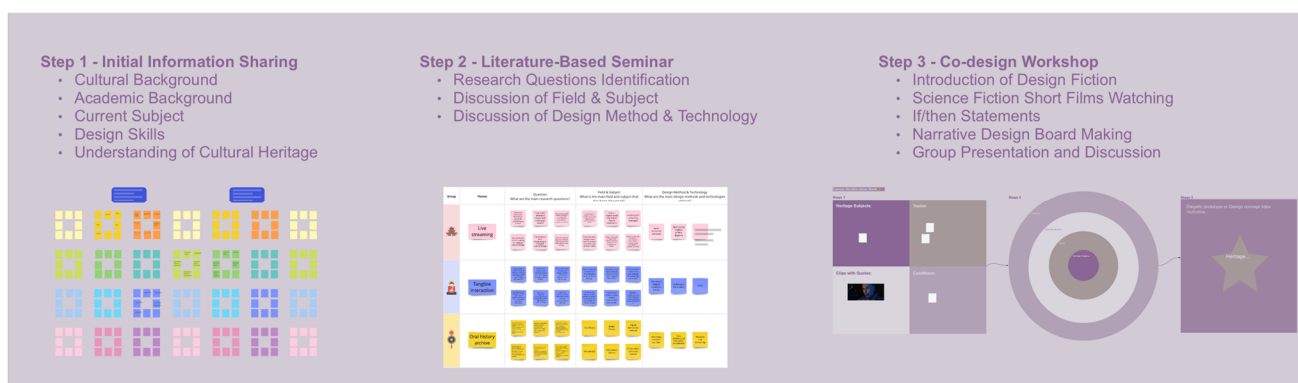
#### 4.2. Dystopian Heritage Experience

The aftermath of COVID-19 has posed several challenges for heritage experiences and museum visitors; thus, participants developed scenarios with specifically this in mind. While many put forth dystopia-based scenarios, others developed scenarios for safeguarding and preserving heritage (especially the common heritage of mankind). One of the groups (Xichun) discussed a possible future scenario wherein humans would be unable to perform outdoor activities, thus raising questions on the safeguarding and preservation of intangible and natural heritage. Their discussion was centred on how heritage stakeholders and designers could work together (in a virtual working environment) to digitally safeguard mankind's common heritage, so that it could be passed on to future generations. The short story written by group Tanchun was detailed and integrated their critical thinking with speculative descriptions of a future museum experience. It also mentioned some interesting technical features (e.g., time travel by holographic laser projection). The story is as follows. *'In 2066, we arrived at the British Museum as our starting location. Four of us (Tom, Sarah, Matt, Kate) travelled on this fascinating trip together. Before we set off, we chose a series of periods, historical curators, and durations on an interactive interface that was placed in front of us. The interface appeared to be the key to unlocking the way forward. We then felt as though we were in a narrow rotating tunnel with heavy concrete walls and a ceiling that looked like it could collapse at any moment. Seconds later, we arrived just outside of the British Museum. The year was 1911. As I glanced around, I could see the entrance hall and Emil Torday working peacefully on his collections with his colleagues. We were spotted and I was approached and asked by a tall, skinny figure to help carry the collections into the museum. After lifting what felt like 25 dusty, large, rough, and splinter-riddled wooden crates, Emil shared his experience of exploring the Kwango River Basin in the Belgian Congo with us. Tom told me he met Aurel Stein, and that they had an in-depth and insightful discussion about the collections from Central Asia. However, our experiences seemed to be coming to an end. A strong wind ripped through the concrete floor beneath our feet and sucked us into a dark narrow tunnel with an approaching light at its end. As we reached the light, we landed in a spectacularly large glass building. Sarah said 'Oh my god, we are in the middle of an ocean! Look outside, you can hear the movement of water against the glass and wild fish crashing into the transparent walls ...'. Then we saw a burst of words pop up before our faces and notifying us that we were in the year 2083 and as a result of climate change, the museum had sunk into the sea. However, the museum was intact and functional regardless of the environment; thus, we continued our trip. We found out that the majority of sections in the museum had closed down, for example, sections with heritage and experiences belonging to Egypt, Sudan, and India. Due to the colonial history of these collections, UNESCO banned museums from*

*further displaying these collections, yet the museum still refused to return them.'* Another group (Yingchun) discussed designing a virtual heritage experience in a dystopia-based scenario and creating a sense of 'threat' in order to provide people with an immersive experience of a relevant storyline. Specifically, they put forth how visitors in a heritage setting could be made to feel uncertain, alienated, or uncanny for an assumed duration, so that greater empathy and critical thinking could be induced. They explained one possible scenario as *'The cultural heritage we focus on is the Sanxingdui or Loulan ruins, as they are replete with mystery and folklore, and provide great scope for exploration. We could use technology to completely immerse the user in the adventures. They would experience the weather, specific temperature at a certain time, and mystery, as well as the uncanniness of the sacrificial environment.'* The participants used an interesting term, 'future present', for describing their thoughts about building upon and safeguarding the community-based heritage and stories during COVID-19, and ensuring that they are demonstrated vividly and delivered correctly to future generations. It also captures the feelings of uncertainty, alienation, and the uncanniness of the history during that specific time.

## 5. Methodological Refection

This section reflects upon the adoption of design fiction and co-design in a future heritage setting. The online design activity was set in a collaborative environment that required participants to contribute with their diverse range of expertise in design knowledge and heritage exploration. Figure 9 presents an overview of the three conducted activities with detailed components.



**Figure 9.** An overview of the three conducted activities.

### 5.1. The Importance of Skill Exchange

Peer sharing had played a significant role in familiarising participants with each other, as well as with their design expertise/skills, and specific interests in heritage (e.g., tangible or intangible heritage) and emerging technologies (e.g., VR, AI). Currently, peer sharing has not been specifically discussed in the majority of design fiction literature or studies [38], however, peer sharing as an experimental activity achieved some positive results. The first activity not only provided a space that supported participants in exchanging design skills, but also supported them in forming their initial understanding of cultural heritage and the relevant emerging technologies from their mixed design background/perspective. In addition, after all design activities had finished, some of the participants mentioned that the peer sharing activity (starting from a design-based discussion) helped them build up a comfortable environment for discussion, enabling them to discuss various relevant topics, rather than going straight to exploring the futuristic perspectives which may have confused their understanding. It also gave the facilitator an explicit idea about how to allocate the participants to different groups and enhance their in-depth knowledge of heritage studies and digital heritage. Kinch et al. [38] mentioned that creating a comfortable and collaborative environment would support participants and stakeholders in familiarising themselves with and immersing themselves into a certain topic [39]. Furthermore, the preparation

behind creating this immersive environment in a fiction-based design research project is also necessary and significant, especially as most of the participants were not familiar with a fictional co-design working environment. Specifically, Step 1 in Figure 1 outlines that this study adopted five components (cultural background, academic background, current subject, design skills, understanding of cultural heritage) to expand the exchanging of skills step by step. The graphic demonstration on Miro also visually illustrated every process within the discussion between the participants.

### 5.2. Studying Together and Knowledge Sharing

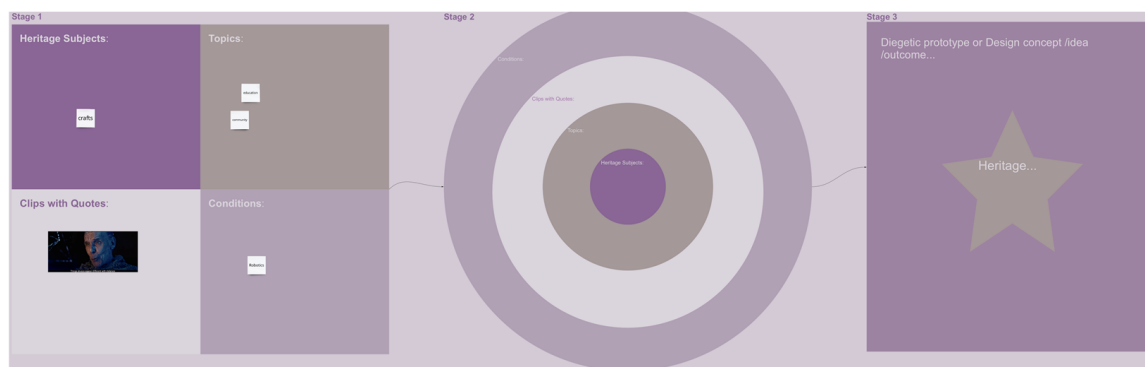
The literature-based seminar took a research-based approach (by drawing on the literature from digital heritage, heritage studies, and computer science), and utilised academic papers to encourage participants to expand their understanding of cultural heritage and relevant emerging technologies. This method has been utilised frequently in interdisciplinary academic projects and research-based teaching practice within digital civics to help researchers/designers from different disciplines work together on the same topics [40,41]. As an advanced and secondary step, the literature-based seminar further creates a pre-co-design context that enhances the relevant knowledge of emerging technology for the participants. Instead of using a tutorial or lecture-based seminar, this method offers more flexibility and autonomy for participants to actively explore the potential of relevant case studies, which in turn can build up their inclusive understanding of cultural heritage and emerging technologies [42]. More importantly, it provides a knowledge-sharing context that benefits all the participants. The various themes of these papers meant that participants from different groups were provided with the space to exchange their findings and understandings of a certain technology or heritage subjects. Furthermore, it is important to bridge actual and possible worlds with real and fictional worlds in design fiction [1,43]. Thus, this seminar was broken down into and delivered through three components to engage and help participants gain a comprehensive understanding of the relevant literature. Specifically, these components summarise research questions to help the participants grasp the focus of the literature, identify research fields and subjects to enhance the conceptualisation of potential research findings, and discuss the relevant design methods and techniques to build their own understanding of certain topics. More importantly, the seminar provided an in-depth knowledge-sharing space wherein participants could share their group findings gained from a certain topic and hold critical discussions with other group members to further explore and exchange relevant methods and technologies from different topics. From this study, one of the potential ways to progress or push the development of this bridging is to further improve or enhance the forecasting of a certain subject (in this study the subject is focusing on future heritage design), especially as most participants were not heritage specialists [44,45]. However, the process of group-based knowledge sharing was impacted to a certain extent owing to the paucity of time; not all participants could read all the papers, which kept them from acquiring comprehensive insights and robust findings. However, feedback from the participants revealed that if the academic papers were shorter or if posters were used instead, those whose first language was not English and struggled to finish reading within the allocated time would understand the key findings of some papers easily.

### 5.3. Co-Design the Experience

Future Heritage Design Workshop was the main component of this design study, as it intended to develop the participants' performance in co-design activities, for exploring futuristic heritage design. The workshop utilised five components to support participants in exploring the future heritage experience. At this stage, design fiction was introduced to the participants by interpreting its concept and a series of open-ended questions were presented. These questions included (1) "What does heritage look like in the future?" (2) "How are we going to understand heritage in the future?" (3) "How are we going to design future heritage experiences?" These questions can potentially help participants to

form an initial understanding of design fiction and think further about how to conduct creative provocations as well as raise research questions, innovations, and explorations of further heritage experiences. Moreover, the 'if/then' statements and 'narrative design board' could also construct a framework of how to practically adopt design fiction into the design activities [46]. The narrative design board effectively guided the participants into thinking about futuristic heritage design from multiple perspectives (e.g., heritage subject, topics, clips with quotes, and conditions). It was also a good medium for reflecting their understanding of the previous two activities and integrating them with the co-design phases. Meanwhile, the digital supplementary materials also played a significant role in supporting the participants in gaining relevant knowledge from their design activities [47]. The narrative design board includes three key stages as a process of unpacking and synthesising what participants found from their understanding (see Figure 10). The first stage was to map out their initial findings into four different areas (Heritage Subjects, Topics, Clips with Quotes, and Conditions). From this stage, they could then later synthesise through stage two by utilising the target board to narrow down their key findings to generate a logical direction. The final stage was to then document their design outcomes, which could range from anthropological short stories, imaginary video clips, or rapid user interfaces. This process specifically helped participants to shape their ideas from multiple dimensions as well as allowing them to demonstrate their design ideas visually from a design fiction perspective. The narrative design board is just one of the interpretations of utilising design fiction in co-design activities which will be beneficial and adaptable to future researchers in a heritage setting. During the workshop, particularly when the participants were discussing the heritage subjects, digital materials were frequently being utilised. Moreover, science fiction short films imparted knowledge of certain emerging technologies, and also inspired the ethical, behavioural, and ideological thinking necessary for designing futuristic work. Design fiction is not only limited to simple speculation of what is going to happen tomorrow, but also facilitates and affects the collaborative creation of a specific topic or theme and potentially shapes a futuristic trend of technologies. Supporting and enhancing the participants' ability to gain insights is also vital, especially in the context of the crossroads of heritage studies and human–computer interaction. In this study, design fiction was integrated into a co-design working context to depict imaginary technological tools, as well as offer narrative critical perspectives with emerging technologies regarding how to design the heritage experience in the future. It also provided a space for participants to co-think, explore, and design sustainable future experiences using technology in a heritage-based context. More importantly, the uncertainty and ambiguity of human heritage and social values would also be discussed and developed in this space. The potential design outcome could be embodied as anthropological short stories, imaginary video clips, or rapid user interfaces. On the other hand, the usage and duration of the selected science fiction short films could be further adjusted. Some participants reflected that these films had in turn limited their thoughts by restricting it to the use of few technologies only. Thus, the use of science fiction short films in the future would require a more detailed introduction and specific practices to overcome this challenge. To summarise, all three activities demonstrate the necessity of the constant re-evaluation, amendment, and critique of ways of exploring speculative, experiential, and immersive futuristic thinking.





**Figure 10.** Narrative Design Board.

## 6. Conclusions

This study adopted design fiction and co-design as the two main methodological approaches for designers and artists to explore the complex relationships and intersections of futuristic heritage experience and engagement. Three activities were conducted with 26 participants from multidisciplinary backgrounds to specifically explore futuristic thinking in the field of heritage design. The participants developed 5-year and 10-year plans that included possible design outcomes that incorporated different ways of designing narrative-based experiences and role-play gaming for enhancing heritage experiences. In addition, dystopian heritage experience was discussed to further understand ways of building upon and safeguarding community-based heritage and stories during COVID-19. This would allow for vivid demonstrations to future generations, while understanding how to best address feelings of uncertainty, alienation, and uncanniness that are related to the history of that specific time. Most importantly, by adopting an experiential approach, this study put forth valuable new research perspectives for incorporating design fiction into co-design activities in a heritage setting. However, while the design outcomes answered some of our initial questions, they also generated multiple new ones regarding not only the technology itself but also its futuristic thinking and heritage development. To expand the diversity of the participants with multi-disciplinary involvement, the study will be continued focusing on exploiting critical thinking and decision making within the narratives, as well as continuing to speculate in a more participatory manner.

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