

# Towards Designs for Virtual Interconnected Curation Spaces of Heritage Artefacts, Experiences and Histories

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**Where immersive museum and digital heritage experiences exist, they are often only available for limited project timespans and they do not generally connect to other similar experiences and artefacts, nor connect to physical museums or heritage locations. This paper presents work in progress toward the design of a prototype virtual interconnected curation space for improving the connectedness of different heritage experiences and engagements with different cultural artefacts and histories. A 'vintage' Mesopotamian serious game is explored as an exemplar interaction and candidate engagement. Experience and usability evaluations are identified and filtered to create a tractable assessment for participant testing that also aims to estimate heritage engagement.**

*Virtual Reality, Digital Heritage, Requirements Elicitation, Interconnected Experiences*

## 1. INTRODUCTION

There are long-standing ambitions to sustainably widen access to cultural artefacts and heritage sites, and, in so doing, enhance public engagement in their histories. Technological enablers such as 3D digitisation, Virtual Reality (VR), Augmented Reality (AR), and 'serious' computer games create such opportunities to both widen (digital) access and support engagement (Mortara, et al. 2014), and this can be particularly attractive for some important artefacts and histories that for reasons of size, form or geography etc., may be overlooked or otherwise neglected (Woolley et al., 2020).

With few exceptions, heritage sector projects are generally resource-constrained, and, with increasing pressures on budgets (Adams 2023), little in the way of funds, staff time and floor space etc., can be invested in the development, adoption or maintenance of new technological engagements whether physically or virtually available in museums, heritage sites or elsewhere. Though, of course, more generally there has been slow progress in VR/AR technology adoption (Hall et al., 2019; Marks and Thomas, 2022).

There are also challenges relating to lack of an interconnecting 'fabric' between heritage experiences, artefacts and histories (Woolley et al., 2021) and between individuals who might socially interact in these spaces (Li, 2018).

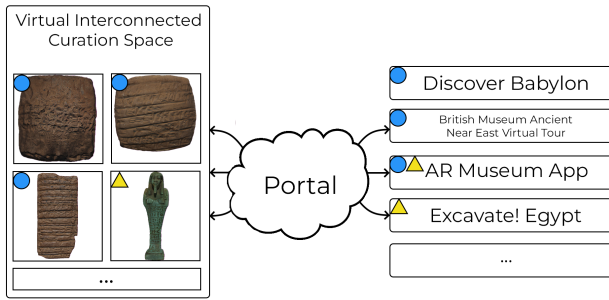
### 1.1. Research Aim

The overarching ambition of the research relevant to the study was to improve engagements for Mesopotamian history and cuneiform tablets, small clay tablets inscribed with humankind's earliest writing.

Figure 1 illustrates the concept of a Virtual Interconnected Curation Space, which itself is a virtual environment in which users can curate and engage with different collections of virtual heritage artefacts and different connected experiences, and where they can selectively share these engagements with others.

### 1.2. But what is engagement?

Engagement itself is something of an elusive concept. The word 'engagement' has several homonyms. Specific to the context of this work, 'engagement' is defined in the Collins dictionary



**Figure 1:** Concept diagram for a Virtual Interconnected Curation Space for selected and shared artefacts (left) and experiences (right). (Key: Circle and triangle icons indicate connections from artefacts to experiences)

as “the act of engaging or the condition of being engaged” where engage is defined as “to attract”.

Given the importance of online retail, customer engagement in the context of business analytics has, of course, received much interest in recent years. In ‘Measuring the immeasurable: Visitor engagement’, Peterson and Carrabis (2008) discussed the difficulty of defining and quantifying engagement, preferring the more open definition of engagement as “the demonstration of attention via psychomotor activity that serves to focus an individual’s attention”, where attention was defined as “a behaviour that demonstrated that specific neural activity is taking place”. Their pragmatic approach to estimating engagement involved the summation of metrics including click depth, duration of stay, and recency, etc.

In fact, the most common approach to estimating such engagement is via behavioural proxies, including clicks, queries, and scrolls, etc. In heritage research (as in other domains such as pedagogy) similar engagements have been estimated by proxies such as number of visits/attendances, recency of visits, duration of visits and numbers of interactions, etc. Additionally, engagement can also be estimated by learning, e.g., by fact recall and longer-term fact retention (Hanes, 2020).

Engagement is also intertwined with presence and immersion that, together with flow and usability, are themselves fundamental to assessments of VR/AR, immersive environments and game experiences. Indeed, the complexity and entanglement of experiences and experiential factors, and the multiplicity of assessment criteria, leads quickly to practical challenges in identifying assessments for user studies that do not tire participants, nor stretch their patience. In this regard, valid composite questionnaires that select relevant items from multiple questionnaires can substantially reduce participant burdens. For example, the Tcha-Tokey (2016) questionnaire

for assessing user experience in immersive virtual environments, selects ‘only’ 87 items from nine different questionnaires.

### 1.3. Serious games and ‘Discover Babylon’

Although ‘serious games’ have evolved to support many applications (Kara, 2021), games to support cultural heritage have been “less well considered” (Anderson et al., 2010). Indeed, very few ancient Mesopotamian and cuneiform-specific heritage VR/AR and immersive experiences have been developed (Hanes, 2020; Rhodes, 2022) and none of these connect with one another or to other external resources.

The earliest and most evolved Mesopotamian serious game was “Discover Babylon”. Now a ‘vintage’ serious game, Discover Babylon was originally developed in 2006 as a part of a \$500,000 US Institute of Museum of Library Services (IMLS) project, involving UCLA’s Cuneiform Digital Library Initiative (CDLI), the Federation of American Scientists (FAS), and the Walters Art Museum (WAM). The ambition was to create a game, for a target demographic aged 8-14 years (Discover Babylon Website, 2007), that could rival commercial games in the quality of graphics, storyline, pacing, and character animation. Though as was observed at the time: “commercial video games typically cost between \$5-\$20 million to create, while federal grants to cultural institutions rarely reach beyond the \$1 million level” (Lucey-Roper, 2006).

Two Discover Babylon games were developed, i) “a shorter kiosk game” for the Near Eastern Art collection of Walters Art Museum, Baltimore and ii) “an extended game for use outside the museum” (ibid.). The aim for the ‘long’ game was to explore three different Mesopotamian time periods, after a first level in a virtual recreation of the Near East galleries of the Walters Art Museum. The player experiences a day in the life of a historical character while gathering information to complete the game’s story.

Unfortunately, ‘technical issues’ prevented open-source development of the game and the ‘Vicious Game Engine’ used to create Discover Babylon is now long deprecated.

## 2. METHODOLOGY

With the ultimate aim of designing an innovative ‘Virtual Interconnected Curation Space’ for heritage artefacts and experiences, we performed the following:

- (i) a game content analysis of ‘Discover Babylon’ as an exemplar Mesopotamian serious game experience.
- (ii) an evaluation selection process: First identifying relevant questionnaires then sifting for relevance within individual sets of questionnaires and, subsequently, sifting across all questions and questionnaires to reduce redundancy.
- (iii) a definition of a pilot experimental design.

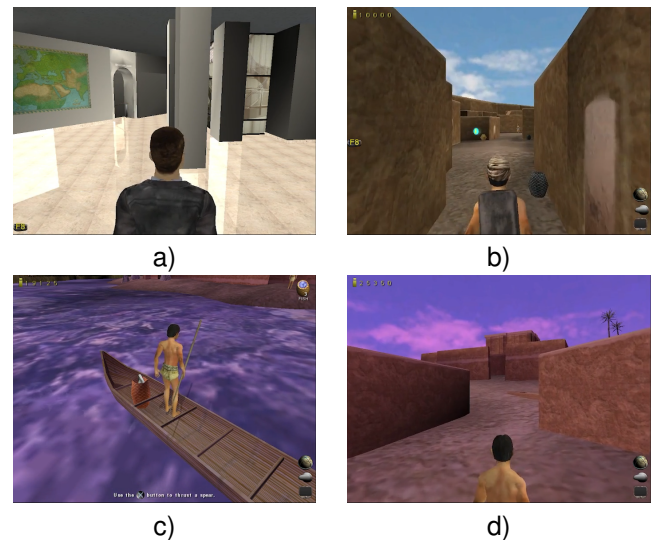
**Table 1:** ‘Discover Babylon’ scenes and tasks

Level/ Scene	Location	Tasks, Information, and Questions
1	Museum (Present day)	4 Information Points 2 Multichoice Questions <b>Tasks:</b> Find PDA and Translator Find Dex’s Office Find books Go to Near East Gallery Match Seals
2	Uruk (3100 BCE)	10 Information Points <b>Tasks:</b> Go to scribe school Go to market Trade at market Go back to scribe school Find tablet Decode tablet
3	Ur (2100 BCE)	<b>Tasks:</b> Catch fish Write tablet
4	Ur (2100 BCE)	10 Information Points <b>Tasks:</b> Follow Ea-Malik Get tablet from temple Identify older tablet Return to Ea-Malik Find Dex

### 3. RESULTS

#### 3.1. Game content analysis

As summarised in Table 1, a detailed content analysis of Discover Babylon was performed which identified and located all levels, historical eras, tasks, information points and multichoice questions within the game. Screenshots from each of the four locations and eras are provided in Figure 2. Players proceed through levels receiving points for collecting information points and correctly answering multichoice questions. Examples of a multichoice question and an information point are provided in Figure 3.



**Figure 2:** ‘Discover Babylon’ scenes: a) museum, b) Uruk, 3,100 BCE scribe school c) Ur 2,100 BCE fishing d) Ur 2,1000 Ur temple and return

As outlined in Table 1; players start in the present-day museum with the ultimate challenge of finding ‘Dex’ who is missing. They complete tasks and collect information points and answer questions about Mesopotamian history and artefacts. Players then travel back in time to Uruk in Ancient Mesopotamia, becoming a student at scribe school whose mentor falls ill and needs supplies from the market. Players then learn how to decode a cuneiform tablet before being transported to a fishing challenge in Ur, then learning how to write a cuneiform tablet and completing further tasks that enable the return of the missing ‘Dex’.

Despite having aged in terms of mechanics, dynamics and aesthetics, the game and its narrative were assessed as sufficient for use as an exemplar connected experience to explore Mesopotamian artefact engagement and inform the requirements elicitation for the Virtual Interconnected Curation Space design.

#### 3.2. Evaluation selection process

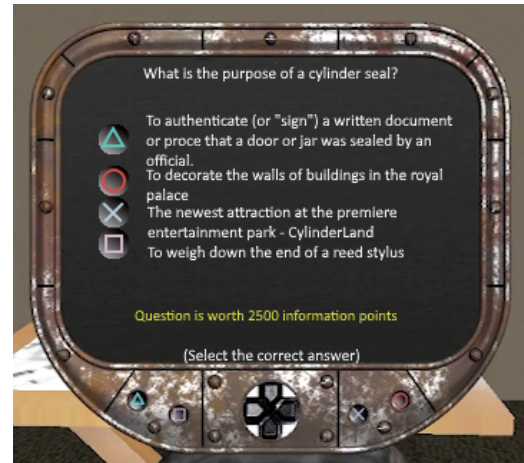
Game and user experience evaluations with relevance to engagement were identified and compiled. As summarised in Table 2, these comprised a light-touch MDA Framework assessment (Mechanics, Dynamics and Aesthetics Frameworks) (Hunicke et al., 2004), the multi-faceted composite questionnaires of i) Tcha-Tokey (2016) for immersive environment evaluations and ii) Hanes (2020) for serious heritage games, and Nielsen-Norman group (NNG) usability heuristics applied to computer games (Joyce, 2019).

Including demographic questions (but excluding short post-participation elicitation of opinions) the

**Table 2:** Candidate participant evaluations

Source	Candidate Evaluation (Questionnaires)	Evaluations (no.items)			
		Total	Sift	Final	
MDA (2004)	Mechanics	1	1	1	
	Dynamics	1	1	1	
	Aesthetics	1	1	1	
Tcha-Tokey (2016)	Presence (PQ)	12	9	DUP	
	Engagement (PQ)	3	2	DUP	
	Immersion (ITQ)	7	6	6	
	Flow (Flow4D16)	11	8	8	
	Usability (SUS)	3	3	3	
	Skill (CSE)	6	6	DUP	
	Emotion (AEQ)	15	0	0	
	Experience Consequence (SSQ)	9	0	0	
	Technology Adoption (UTAUT)	9	7	0	
Judgement (AttracDiff2)	12	9	5		
Hanes (2020)	Pre-	Demographics	14	10	10
		Pre-game Quiz	23	0	0
	Post-	Game Experience	12	7	7
		Presence/Engagement	6	6	6
		Fact Recall	24	6	6*
	Long-	Game Experience	4	4	4
Fact Recall		24	6	6*	
Joyce (2019)	Heuristic Evaluation	10	10	10	
<b>Total</b>		<b>207</b>	<b>99</b>	<b>74</b>	

KEY: 'DUP' indicates removed as duplicate. **PQ** (Presence Questionnaire) (Witmer and Singer 1998). **ITQ** (Immersive Tendency Questionnaire) (Witmer and Singer 1998). **Flow4D16** (Heutte 2011). **SUS** (System Usability Scale) (Brooke 1996). **CSE** (Computer Self Efficacy) (Murphy et al. 1989) **AEQ** (Achievement Emotions Questionnaire) (Pekrun. et al. 2011) **SSQ** (Simulator Sickness Questionnaire) (Kennedy. et al. 1993) **AttracDiff2** (Hassenzahl et al. 2003). **UTAUT** (Unified Technology Acceptance and Use of Technology) (Venkatesh et al. 2003). **Pre-**, pre-game questionnaire. **Post-**, post-game questionnaire. **Long-**, long term questionnaire, sent to participants one week after participation.



a)



b)

**Figure 3:** Discover Babylon a) Multichoice question and b) Information point examples

number of items for the above totalled 207. A first sift of items within each questionnaire source based on study relevance reduced this number to 99. A further sift was then performed to remove duplicate items between sources which reduced the number of items to 74.

The post-game and long-term fact recall questions will be partially repeated. Of the six fact recall questions that will be asked pre and post game, three will be chosen to be asked twice, and the other three for each will be chosen from the 24 questions for each quiz. The purpose of this is to test if participants are simply remembering the answers to questions that were already asked, or if they can accurately recall facts from the game.

### 3.3. Pilot experimental design

By bringing the components together, we have defined a pilot experimental design, comprising the Discover Babylon game as an exemplar engagement experience and delivering it via a 'Wizard of

Oz' portal connection to a 'Virtual Interconnected Curation Space' prototype (provided by a Unity virtual museum created in prior research). Pilot participants will explore the space and complete the evaluations.

#### 4. DISCUSSION

The Discover Babylon game was interesting in several respects. It shines a light on the rapid and substantial changes in interfaces and technologies over relatively short periods of time, such that technology-enabled heritage experiences themselves quite quickly become historical artefacts.

The challenge of finding the game (when the Way Back Machine project link was non-functional) also highlights the challenges of maintaining software, technologies and repositories. It is certainly the case that, like Discover Babylon, many innovative AR/VR digital heritage projects are short-lived, and their software resources are often not maintained beyond the duration of their funding (Tait et al., 2013; Champion and Rahaman, 2020). This being the case, and with the limited resources available in the sector (Heritage Alliance Insight Report, 2024), it would be beneficial if software and digital resources could themselves be preserved (Champion and Emery, 2024), maintained (Lombardi, 2023) and reused. It would also be helpful if any future developed serious games were made open source to encourage their evolution and long-term support.

#### 5. CONCLUSIONS AND FUTURE WORK

From a content analysis of the legacy serious game (Discover Babylon) we determined that it could provide a useful exemplar experience for testing of novel virtual interconnected curation space. Also, through a systematic filtering process, we identified a tractable user evaluation framework and a pilot experimental design.

The next phase of work will involve piloting the experimental design and we will examine preliminary feedback to better understand the intertwining of engagement with the heritage content and with the technological context.

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