

Towards Design 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 are not generally connected to similar experiences nor connected to the physical museums or heritage spaces themselves. This paper presents work in progress toward the design of a prototype virtual interconnected curation space for improving the interconnectedness of heritage experiences and engagements with cultural artefacts and histories. A 'vintage' Mesopotamian serious game is explored as an exemplar interaction and candidate engagement. Experience and usability evaluations are then identified and filtered to create a tractable assessment for participant testing.

Keywords: 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 digitization, 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 significant 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 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). Of the few heritage-relevant VR/AR and immersive experiences that have been developed, none connect with similar experiences or with their physical artefacts (Woolley et al. 2021, Rhodes 2022).

So not only is there a lack of engaging heritage experiences, but there is also a lack of an interconnecting 'fabric' between the experiences, artefacts and histories (and between individuals who might socially interact in these spaces (Li 2018)) which presents additional barriers to adoption.

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 collections of virtual heritage artefacts and connected experiences, and where they can selectively share these engagements with others.

1.1. 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 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

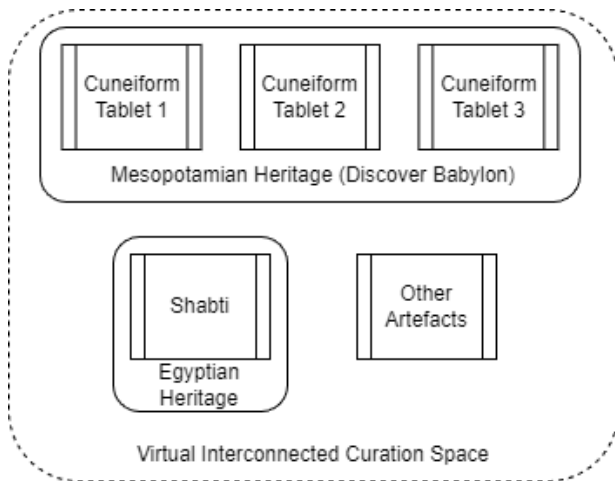


Figure 1: Concept diagram for a Virtual Interconnected Curation Space for selected and shared artefacts and experiences

demonstration of attention via psychomotor activity that serves to focus an individual's attention", where attention is "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.

Indeed, 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 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 questionnaires.

1.2. Serious games and Discover Babylon

Serious games for cultural heritage are not new. Anderson et. al. (2009)'s 'Serious Games in Cultural Heritage' describes the potential of games technology to be used for cultural heritage. However, as noted by Rhodes (2023), there are few examples that directly relate to Mesopotamian heritage.

Discover Babylon is a vintage Mesopotamian-themed serious game 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 goal at the time was to create a game 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 archived project website (Discover Babylon Website, 2007) explains that the game's target demographic was children aged 8-14.

The aims for the 'long' game were to explore three different Mesopotamian time periods, after an first level in a virtual recreation of the Near East galleries of the Walters Art Museum. The player will live 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 and the 'Vicious Game Engine' used to create Discover Babylon is long deprecated.

2. METHODOLOGY

With the aim of designing a requirements elicitation study for an innovative 'Virtual Interconnected Curation Space' for Heritage artefacts and experiences, we completed the following.

- (i) Content Analysis of the serious game 'Discover Babylon'
- (ii) Evaluation selection
First sifting for relevance within individual sets of questionnaires and subsequently sifting across all questions and questionnaires to reduce redundancy.
- (iii) Identified a pilot experimental design

3. RESULTS

3.1. Content Analysis

As summarised in Table 1, a detailed content analysis of Discover Babylon was performed which identified and located all levels, eras, tasks, information points and multichoice questions within the game. Screenshots from each of the four locations 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.

In summary, as outlined in Table 1, players start in the preset 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 and 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, before 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 artefact engagement and inform the requirements elicitation for a Virtual Interconnected Curation Space design.

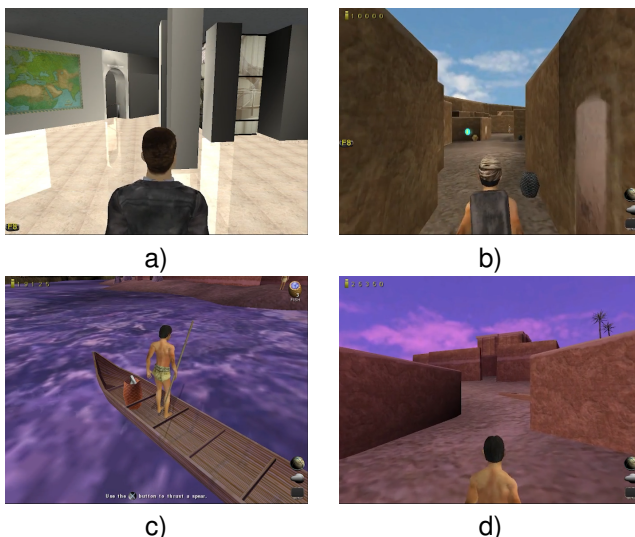


Figure 2: 'Discover Babylon' scenes: a) museum, b) Uruk, 3,100 BCE scribe school c) Ur 2,100 BCE fishing d) Ur 2,1000 Ur temple and return

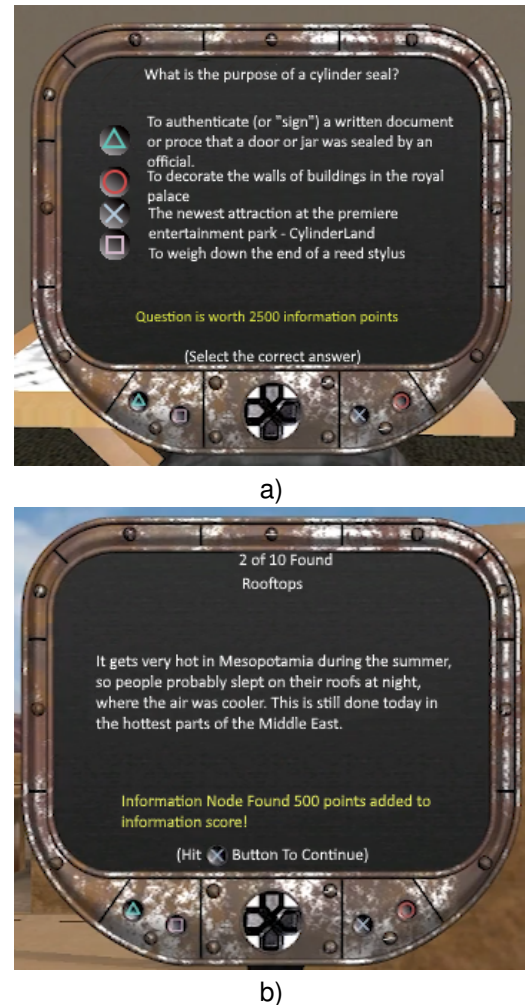


Figure 3: Discover Babylon a) Multichoice Question and b) Information Point Examples

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

Table 1: 'Discover Babylon' scenes and tasks

3.2. Evaluation

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 2021).

Including demographic questions (but excluding short post-participation elicitations of opinions) the number of items 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. Half of the 6 the questions will be asked twice, and half will be chosen from the 24 questions for each quiz. The purpose of this is to test if participants are simply remembering the

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	D
	Engagement (PQ)		3	2	D
	Immersion (ITQ)		7	6	6
	Flow (Flow4D16)		11	8	8
	Usability (SUS)		3	3	3
	Skill (CSE)		6	6	D
	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*
	Heuristic Evaluation		10	10	10
	Total			207	99

Table 2: Candidate Participant Evaluations

KEY: 'D' 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.

answers to questions that were asked, or if they can accurately recall the facts from the game.

4. DISCUSSION

The Discover Babylon game is 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. It is certainly the case that the majority of digital heritage resources and interactions are short-lived, and not usually available beyond the three or so years of their funding.

This being the case, and with the limited resources available in the sector, it would be beneficial if reuse and maintained use could be made more achievable. For example, for software and 3D assets etc. to be made publicly available and open source.

5. FUTURE WORK & CONCLUSIONS

Piloting of the study is ongoing. In the next phase of work participants will be recruited to play the game as a connected experience in a Virtual Interconnected Curation Space setting.

6. ACKNOWLEDGEMENTS

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