Hybrid Space: Re-thinking Space and the Museum Experience

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doctoral thesis

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Hybrid Space: Re-thinking Space and the Museum Experience

by

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A THESIS
SUBMITTED TO THE FACULTY OF GRADUATE STUDIES
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Abstract

Development of this manuscript-based dissertation was prompted by identification of a knowledge gap between the application of hybrid space, human behavior, and harnessing playful activities for museums. Hybrid space has been explored and conceptualized in the literature, but it has yet to reach its potential as an effective medium in museums.

A museum hybrid space combines physical artifacts co-located with virtual and augmented reality displays. Hybrid space borrows the power of information to empower the physical space around us using technologies such as augmented reality (AR), virtual reality (VR), and augmented virtuality (AV). This research provides a new way of enhancing the quality of museum experience for audiences by adopting immersive, interactive virtual reality technology. This research demonstrates that experiencing a hybrid space, namely, VR-enhanced environment, as part of a museum exhibit, can effectively increase learning and enjoyment when compared with traditional museum exhibitions. This research builds on the prior studies on the concept of hybrid space and explores its potential as an effective medium in museums (Chapter 2). For this purpose, a model was developed in this research to enhance the quality of spatial experiences in the built environments (Chapter 3). Using this model and a history-based video game that simulates a real environment from the past (Chapter 4), a faux exhibit was set up for empirical studies (Chapter 5).

Through the empirical studies, it was demonstrated that a VR-enhanced exhibition (hybrid space) can perform better to improve the museum experience for the audience in terms of learning and enjoyment when compared with traditional exhibitions (i.e. actual space), that rely on labels, photos, and videos.
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Dedication

This dissertation is dedicated to you, my very special autumn.
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Chapter 1

Introduction
1.1. Introduction

A museum hybrid space combines physical artifacts co-located with virtual and augmented reality displays. Hybrid space borrows the power of information to empower the physical space around us using technologies such as augmented reality (AR), virtual reality (VR), and augmented virtuality (AV). This research provides a new way of enhancing the quality of museum experience for audiences by adopting immersive, interactive virtual reality technology. This research demonstrates that experiencing a hybrid space, namely, VR-enhanced environment, as part of a museum exhibit, can effectively increase learning and enjoyment when compared with traditional museum exhibitions. The present interdisciplinary work integrates knowledge and methods from different disciplines (e.g., architecture, design, education, museology, game studies, cognitive ergonomics, and technology studies) using a real synthesis of approaches. This research builds on the prior studies on the concept of hybrid space and explores its potential as an effective medium in museums (Chapter 2). For this purpose, a model was developed in this research to enhance the quality of spatial experiences in the built environments (Chapter 3). Using this model and a history-based video game that simulates a real environment from the past (Chapter 4), a faux exhibit was set up for empirical studies (Chapter 5).

Visits to museums have been steadily decreasing over recent decades in many parts of the globe. For example, as Burton and Scott (2003) mention, museum attendance dropped 15.6% in Scotland, 12% in Australia, 9% in Germany, and 7% in Denmark over past decades. In contrast, socializing on the World Wide Web, learning through digital media, and engaging in computer-related activities such as video gaming are all on the increase (Burton & Scott, 2003). Today, more than
half of Canadians are gamers\(^1\) and the average age of gamers in Canada is 33 years old (52% male and 48% female). Energy and enthusiasm for games not only as a leisure medium but also as a means of education has been growing over the past 40 years (Connolly et al., 2012). This enthusiasm for game and play is promising new horizons to the museum experience. Dutch historian Johan Huizinga, as cited by Walker and Fróes (2011), suggested that “[p]lay is a key element in cultural development” (p.1). Yet, there still exists a gap; as Walker and Fróes (2011) mention, “harnessing playful activities for museum learning is mostly undeveloped” (p.1).

To bridge this gap, the present research investigates the idea of a new museum that takes advantage of hybrid spaces and playful activities such as gaming and VR to enhance the audience experience. As a collection of works aimed at building knowledge that addresses this gap, this interdisciplinary dissertation is comprised of four distinct yet interrelated manuscripts. Each manuscript has been developed to meet the publication standards of reputable peer-reviewed journals relevant to the fields of design, ergonomics, and museum studies. The process for development of each manuscript was iterative and overlapping throughout the Ph.D. program and thus the sequence presented does not represent temporality with respect to the evolution of each component piece. However, the order in which the manuscripts are presented, as successive chapters of the dissertation, does serve to highlight a progression of ideas that connect each unique part.

### 1.2. Research questions

The following overarching research question and sub-questions guided the inquiry:

Can the use of VR and the resulting VR-enhanced space (i.e. hybrid space) improve learning and enjoyment in museums?

1. How can the concept of hybrid space develop and be applied to the museums and exhibitions?

2. Is it possible to suggest a model for enhancing the quality of spatial experience in the built environment and apply it to a hybrid space exhibition?

3. Is it possible to provide a systematic way for recognizing the learning opportunities that history-based video games may have for users such as museum audiences?

4. How can a history-based video game be used as a platform for hybrid space experience in an exhibition?

1.3. Research goals

The main goal of this research is to demonstrate that, certain museum experiences that are based on VR-enhanced environments (i.e. hybrid space) are more effective than a traditional display, a gallery filled with objects and posted written descriptions. The aspiration is to demonstrate that some commercial games can be used as an informal educational platform for museum experience.

1.4. Research design overview

To answer the overarching research question, this research took an experimental approach to measure the enjoyment and learning (dependent variables) of participants in response to selected environments (independent variables). To control the environments, three scenarios were designed:

1. Traditional museum environment (an exhibition based on labels and pictures)
2. Traditional museum environment (an exhibition based on video clips and pictures)
3. Hybrid museum environment (an exhibition based on VR-enhanced experience and pictures)
Each scenario – that is called a condition in the rest of this research – was a thematic exhibition about Los Angeles in the 1940s. Scenarios were designed with regards to the model for enhancing the quality of spatial experiences in the built environment (Chapter 3). In each scenario, enjoyment and learning were studied. Enjoyment was measured with following variables:

- Approach
- Avoidance
- Time perception

Learning was measured with following variables:

- Retention
- Recognition

To measure variables a questionnaire was designed measuring approach/avoidance, and time perception. Moreover, time was recorded for each participant by the researcher to be compared with the time participants estimated spending at the exhibition. Retention was measured by a separate questionnaire through open- and close-ended questions.

To answer the first sub-question of this research, chapter two investigates the concept of hybrid space and positions it in a continuum of space based on qualitative content analysis. The objective was to develop concepts on a plausible space continuum, hybrid space, and the role of existing alternative reality technologies to stimulate the experience in the museums. An inductive approach to content analysis appeared to be appropriate for this study since there is not enough former knowledge about the hybrid space and existing knowledge is fragmented in this regard (Elo & Kyngäs, 2008).
To answer the second sub-question of this research, chapter three took an interdisciplinary approach to identify and define essential components, dimensions, and elements of experience based on a literature review. To suggest a model to enhance the quality of spatial experiences conceptualizing the relationships between essential components, dimensions, and elements, analytic hierarchy process (AHP) was applied in chapter three. To setup the model, brain-writing approach (Van Gundy, 1984) was then applied in chapter three.

To answer the third sub-question of this research, first a plot for history-based video games was developed in chapter four based on literature review. Then, open coding as well as qualitative data analysis was used to study players’ comments on the web-based communication services. The aspiration was to investigate how game players, engage in online conversations about historical aspects of the games.

To answer the fourth sub-question and the last part of the of the second sub-question of this research, in chapter five a history-based video game (LA Noire) was considered as a platform for a hybrid space exhibition based on the findings of chapter four. Moreover, the concepts and the model developed in chapters two and three were used to setup the hybrid space exhibition. This hybrid space exhibition was then used for the experimentation and empirical study.

1.5. Integrated overview of dissertation manuscripts

Consistent with the interconnected relationships that exist between the ideas in this manuscript-based dissertation, this section presents an integrated overview of the central themes that emerged from the four manuscripts.

https://doi.org/10.1177/1206331218793065

The objective of this manuscript was to develop the concept of hybrid space and apply it to museums. To reach this objective, this theoretically oriented manuscript reviews literature and applies qualitative content analysis to a sample of publications to conceptualize hybrid space and position it in a suggested continuum of space. Moreover, the role of technology and considerations about the museum content in a hybrid space are explored. Plus, several suggestions have been made for the museums to make use of augmented reality (AR), augmented virtuality (AV), and virtual reality (VR) technologies and provide audiences with certain types of hybrid spaces, namely, AR-enhanced, AV-enhanced, and VR-enhanced environments. Later, based on the scope of the dissertation one of the variations of the hybrid space in museums, VR-enhanced environment, is selected for further studies in chapter five.


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As the experience of hybrid space in museums unfold in the built environment of the museum, it is still a spatial experience. The objective of this manuscript is to provide a model for enhancing the quality of spatial experiences in the built environment. To reach this objective, an interdisciplinary literature review have been conducted in this manuscript to identify and define essential components, dimensions, and elements of experience. Next step was deciding on the priority of the experience's elements through a heuristic approach.
Finally, selected elements were employed to propose the model and exemplify its practical use. Later in chapter five, this model is applied to the hybrid space as a roadmap for providing a VR-enhanced museum experience.


As the experience of hybrid space in museums needs a platform for the virtual part of the experience, the potentials of commercial videos games have been explored in this manuscript. The goal is to implement a tool for understanding learning potentials of history-based video games for users such as museum audiences. To reach this objective, open coding as well as qualitative data analysis of players’ comments on the web-based communication services are conducted. Building on the literature and based on the results of the analysis a tool (plot) is then suggested for understanding learning potentials of history-based video games for users such as museum audiences. Later in chapter five, one of the history-based video games that is studied in this chapter is applied as a platform for experiencing the hybrid museum experience.


Chapter five is the largest chapter of the dissertation and different pieces from previous chapters (i.e., two, three, and four) are coming together as a single piece (Figure 1-1). The objective of this manuscript is to answer the overarching question of this dissertation. Can the use of VR and the resulting VR-enhanced space (i.e. hybrid space) improve learning and enjoyment in museums?
To answer this question, I went back to the concept of hybrid space developed in chapter two. Based on the scope of this research, I selected one of the variations of the hybrid space in museums, VR-enhanced environment. As the experience of hybrid space in museums is still a spatial experience, I applied the model that I developed in chapter three to the hybrid space as a road map to provide the VR-enhanced museum experience for my research. Moreover, as the experience of hybrid space in museums needs a platform for virtual part of the experience, a history-based video game that I studied in this chapter is selected as the platform for the VR-enhanced museum experience. Therefore, all the necessary pieces (i.e., VR-enhanced museum experience and a platform for such an experience) to run and experiment, answer the overarching question of the dissertation and address the following experimental objectives:

- Setting up a sample hybrid space, namely, the VR-enhanced exhibit, based on the findings of chapters two and three.
- Using a commercial game for implementing platform for the hybrid space exhibition based on the findings of chapter four.
- Measuring approach, avoidance, and time perception along with retention and recognition.
• Testing the hybrid space (VR-enhanced exhibition) with control and experimental groups to assess if it enhances the audience experience in term of learning and enjoyment against the traditional exhibitions.

Results showed that the VR-enhanced exhibition was able to improve the museum experience for audience in terms of learning and enjoyment.

1.6. Statement of contribution

The following information is a demonstration that I have done most of the writing, and am the primary contributor to the research, of all papers included in this dissertation. Pursuant to the standards set by the International Committee of Medical Journal Editors (ICMJE), authorship implies responsibility and accountability for published work (ICMJE, 2017). While I acknowledge the time and value of the work of my supervisory committee, the following criteria have been generally applied in determining authorship of the manuscripts in this dissertation:

• Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; AND
• Drafting the work or revising it critically for important intellectual content; AND
• Final approval of the version to be published; AND
• Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. (ICMJE, 2017)

Hybrid space: an emerging opportunity that alternative reality technologies offer to the museums.
Farzan Baradaran Rahimi (Author 1), contributed to the conception, design of the work, analysis, interpretation, drafting, revising, final agreement for the publication. Richard M. Levy (Author 2) and Jeffrey E. Boyd (Author 3) contributed to the paper by critically and insightfully reviewing the manuscript and providing comments for improving the quality of the manuscript before and after peer-review process.

**Human behaviour and cognition of spatial experience; a model for enhancing the quality of spatial experiences in the built environment.**

Farzan Baradaran Rahimi (Author 1), contributed to the conception, design of the work, analysis, interpretation, drafting, revising, final agreement for the publication. Richard M. Levy (Author 2) and Jeffrey E. Boyd (Author 3) contributed to the paper by critically and insightfully reviewing the manuscript and providing comments for improving the quality of the manuscript before and after peer-review process. Shima Dadkhahfard (Author 4), contributed to design of the visualizations and refine of the illustrations.

**A game design plot: exploring the educational potentials of history-based video games.**

Farzan Baradaran Rahimi (Author 1), contributed to the conception, design of the work, analysis, interpretation, drafting, revising the paper critically. Beaumie Kim (Author 2), Richard M. Levy (Author 3), and Jeffrey E. Boyd (Author 4) contributed to the paper by critically and insightfully reviewing the manuscript and providing comments for improving the quality of the manuscript.

**Learning and enjoyment through museum hybrid spaces: an empirical study.**

Farzan Baradaran Rahimi (Author 1), contributed to the conception, design of the work, analysis, interpretation, drafting, revising the paper critically. Jeffrey E. Boyd (Author 2),
Richard M. Levy (Author 3), Jennifer Eiserman (Author 4), and Beaumie Kim (Author 5) contributed to the paper by critically and insightfully reviewing the manuscript and providing comments for improving the quality of the manuscript.

1.7. Ethical considerations

It was necessary that the research plan addressed important ethical practices such as gaining informed consent, protecting participants from harm, avoiding the use of deception, and protecting the privacy and confidentiality of participants (Yin, 2009). Before the research began, formal approval of the research plan was provided by the research ethics boards (REB) of the University of Calgary. An important risk inherent in any study relates to the potential for breaches in confidentiality with respect to the individually expressed attitudes and perceptions of participants. This risk includes unauthorized (both internal and external) access to participant identifying information during data collection, analysis and storage, and through publication of results. These risks were mitigated using stringent identity preserving and privacy protecting measures. Only my co-supervisors and I had access to collected and analyzed data. Unauthorized access to identifying information was safeguarded through the application of password access to the data collection system/software. A unique study code was assigned to ensure participant confidentiality and protect the anonymity the data elements recorded/transcribed. This code did not contain any elements that could identify individuals in this study. The key to this study code was be maintained separately from the main electronic transcript database. Furthermore, all reports emanating from the study have been developed in a manner such that no single case can be traced back to an identifiable individual.

In this study, participants who responded to recruitment materials were informed of the aims and objectives of the study and were invited to participate. Participants were first provided with an
Information and Consent Form by the researcher, and questions they had about the study were answered to ensure that they adequately understood the purpose of the research study, the nature and extent of his or her participation, and the risks involved. Participants were informed both verbally and through the Information and Consent Form that their involvement was voluntary, they were free to withdraw at any time, and that their participation or withdrawal would have no repercussions and would not be disclosed to their school/workplace, to the University of Calgary, or anyone not identified as a researcher.

1.8. Operational Definitions

Several terms appear throughout this work for which a common meaning may not yet have been established, or for which contention exists in the field over their meaning. Bloomberg and Volpe (2012) suggest that such terms be operationally defined as to their usage. The following is a list of working definitions of terms of central importance to the study in order to disambiguate their use and ensure clarity.

1.8.1. Actual space

An actual space is the space wherein people experience the material world around them, which is tangible and physical. Actual space is recognized by the human from the very beginning in private (e.g. home) or in public (e.g. museum space).

1.8.2. Virtual space

A virtual space is the intangible and dematerialized world of virtuality, from the cyber space of information to the mental space of mind. One of the best ways to experience virtual space might be through VR equipment offering immersive and interactive capabilities to users.
1.8.3. **Hybrid space**

A hybrid space is the tangible world of reality integrated with the intangible world of virtuality (Silva, 2006). It is ambivalent and at the same time analog and digital, virtual and actual, local and global, tactile and abstract (Sikiaridi & Vogelaar, 2000).

1.8.4. **Alternative reality technology**

Alternative reality technology is a term referring to all real-and-virtual combined environments and human-machine interactions generated by computer technology and wearables. It includes representative forms such as augmented reality (AR), augmented virtuality (AV), and virtual reality (VR).

1.8.5. **General level of hybrid museum experience**

The experience of museum hybrid space is still a spatial experience in a general sense as it takes place in the physical space. The behavioral model developed in chapter 3 is applied to support the audience experience at the “general level” where it focused on the spatial experience of a hybrid space.

1.8.6. **Special level of museum experience**

The experience of museum hybrid space aims to entertain and educate the audience by facilitating their enjoyment and learning. Therefore, “special level” in this research focuses on facilitating learning and enjoyment.
Chapter 2

Hybrid space: an emerging opportunity that alternative reality technologies offer to museums
2.1. Abstract

In addition to actual space and virtual space, there seems to be a third type that can be called hybrid space. Hybrid space borrows the power of information to empower the physical space around us using technologies such as augmented reality, virtual reality, and augmented virtuality. Hybrid space has been explored and conceptualized in the literature, but it has yet to reach its potential as an effective medium in museums. However, it seems to have quite a few advantages to be employed in museums to attract more people, motivate a higher participation, and change the existing paradigms by reinventing museums. This article applies a qualitative content analysis to a sample of publications to conceptualize hybrid space and position it in a suggested continuum of space. Moreover, the role of technology and considerations of the museum content in a hybrid space are explored. The aim of this theoretically and technologically oriented article is to promote the professional use of the hybrid space in museums.

2.2. Keywords

hybrid space, museum, virtual reality, mixed reality, space continuum

2.3. Introduction

The rate of visits to museums has been increasingly diminishing over the past decades in many parts of the world. For example, as Burton and Scott (2003) delineated, museum attendance dropped 15.6% in Scotland, 12% in Australia, 9% in Germany, and 7% in Denmark over the past few decades. In contrast, socializing on the World Wide Web, learning through digital media, and engaging in computer-related activities such as video gaming are all on the increase (Burton & Scott, 2003). This enthusiasm about digital technologies is promising new horizons to the world and industry of museums. What if museums could take advantage of digital technology and
combine it with the experience of actual space? What kind of space will it be and how will it relate to actual and virtual realms?

Recent advances in virtual reality (VR), augmented reality (AR), and augmented virtuality (AV) technology made it possible to experience alternative versions of reality using digital machines. This possibility provides an exceptional opportunity for architects and museum designers to think about hybrid spaces. Hybrid space has been conceptualized by architects (e.g., Frans Vogelaar and Elizabeth Sikiaridi) and defined as the mutual presence of different spatial logics (Kluitenberg, 2015). Although a hybrid space is not necessarily characterized by technology (Kluitenberg, 2015), advances in technology offer interesting opportunities to experience such a space. Hybrid space can be defined as the tangible world of reality mixed with the intangible world of virtuality in a single environment (Silva, 2006). Such a space may enhance the individual and collaborative visitor experiences in museums or change the current paradigms of museums. Several researchers explored the concept of hybrid space within the context of VR and AR studies (e.g., Manovich, 2006; Silva, 2006; Zellner, 1999). The problem of such research is that each technology offers a different level of immersive and interactive capabilities providing distinct properties for a hybrid space. For instance, a more immersive and interactive technology can lead to an immersive and interactive hybrid space providing people with a VR-like experience. In contrast, a less immersive and interactive technology can lead to a hybrid space providing AR-like experiences.

There still exists a growing need for a deeper understanding of and studies on hybrid spaces (Sikiaridi & Vogelaar, 2000). Expanding on these studies on the application of hybrid spaces in museums can shed light on ways museums can reinvent themselves. This research investigates the concept of hybrid spaces and positions it in a continuum of space based on qualitative content analysis. According to Kaivo-oja (2017), “shaping of tomorrow is not possible without qualitative
analysis” (p. 94). Moreover, as technology can facilitate the experience of hybrid spaces in new ways, the use of alternative reality technology (i.e., VR, AR, and AV) to experience hybrid spaces will be studied in this article.

2.4. Background

Dutch historian Johan Huizinga, as cited by Walker and Fröes (2011), suggested that “play is a key element in cultural development” (p. 1). Yet, as Walker and Fröes (2011) mentioned, “harnessing playful activities for museum learning is mostly undeveloped” (p. 86). Now, imagine a museum where people can experience a digitally replicated environment and an atmosphere of a historic event using an alternative reality technology. Instead of reading labels, using audio guides, and watching videos about the historical events, such a museum would provide an immersive, interactive, and game-like environment in which visitors could interact with people of an ancient era and sensually immerse themselves in history using digital interfaces.

In 2012, the Royal Ontario Museum (ROM) launched the world premiere of “Ultimate Dinosaurs: Giants From Gondwana.” This exhibition was based on the use of AR technology, but there was something special about it; the exhibit integrated actual and virtual spaces in an immersive, interactive, and game-like environment. Several AR markers were designed and placed on the exhibit’s floor. A visitor could look at a virtual dinosaur in its original size roaring dreadfully by simply pointing an iPad or iPhone on these markers. It was impossible to see a virtual dinosaur in a glance, and the visitor had to move around it to have a complete understanding of the enormous creature. The experience also included virtually fleshing out a dinosaur skeleton (Elshafie, 2015). It was possible to have immediate interactions with other visitors in the actual space of the exhibit. It was also possible to have interactions with the virtual creatures through the digital interface. The
exhibit attracted many visitors’ attention to this experience in the museum space (Elshafie, 2015). How can we define this space? Was it an actual space, a virtual one, or both?

This was a trigger to investigate a type of space that combines the tangible world of reality with the intangible world of virtuality in a single environment: the concept of hybrid space.

2.5. Method

According to Kaivo-oja (2017), “the use of qualitative methods can help us understand the futures of technological developments and social changes” (p. 104). However, in many cases these methods are not paid enough attention to (Kaivo-oja, 2017). The present investigation makes use of qualitative methods and applies an unobtrusive approach to develop concepts based on relevant publications. Multiple database searches (e.g., Scopus, Science Direct, and ACM Digital Library) were conducted to identify recent publications on actual space, virtual space, mixed reality (MR; including both AR and AV), and VR. Search terms were limited to publication dates ranging from 2001 to 2015. Identified documents were examined, and the relevant ones were retrieved for inclusion in the qualitative content analysis. Reference lists of retrieved documents were closely scrutinized to identify additional publications of interest.

A qualitative content analysis of the publications was then conducted in three stages, namely, preparing, organizing, and reporting. The goal was to develop concepts on a plausible space continuum, hybrid space, and the role of existing alternative reality technologies to stimulate the experience in the museums. Qualitative content analysis helps developing concepts based on inferences from the text (Weber, 1990). The major benefits of the qualitative content analysis include content sensitivity (Krippendorff, 1980) and flexibility in terms of research design (Harwood & Garry, 2003). An inductive approach to content analysis appeared to be appropriate.
for this study since there is not enough former knowledge about the hybrid space and existing knowledge is fragmented in this regard (Elo & Kyngäs, 2008).

To prepare the stage, many words of the analyzed texts were classified into much smaller content categories (Burnard, 1996; Elo & Kyngäs, 2008; Weber, 1990). Themes such as space type, alternative reality technology, and museum content were selected as units of analysis. For the organizing stage, open coding, creating categories, and abstraction were the main tasks (Elo & Kyngäs, 2008). Open coding included writing notes and headings in the texts as the identified publications of interest were being read. As suggested by Hsieh and Shannon (2005), the texts were looked into several times and additional headings were made to describe all aspects of the content. Then, headings were collected onto coding spreadsheets and visualized (Figure 2-1).

![Diagram](image)

**Figure 2-1.** Abstracting and organizing subcategories, generic categories, and the main category.

For the reporting stage, lists of categories were grouped under the higher order headings to reduce the number of categories. As suggested by Dey (1993), comparisons between information that do not belong to a same category (e.g., AR and VR) were made. Authors of this article then provided
an interpretation of the categorized information followed by developing concepts based on the topic of research.

2.6. Results and Interpretation Based on the Categorized Information

To interpret the contents on the subject of this study, authors described, compared, and connected generic categories and subcategories. For example, alternative reality technology generic category (AR, AV, and VR) was connected to the notion of reality and interpreted closely with the space type. The interpretation was then reported as reality and technological alternatives in this article. Moreover, a part of inferences and interpretations, especially about the space type, were adopted for discussing and developing the concepts of hybrid space and space continuum in a later section of this article.

2.6.1. Reality and Technological Alternatives

According to The Stanford Encyclopedia of Philosophy (Newman, 2016), several centuries ago, René Descartes suggested the idea of an “Evil Genius” who is capable of deceiving people about absolutely understanding and the cognition they might have. Building on Descartes’ idea, the contemporary philosopher, David Chalmers, raises a question in an interview\(^2\), “Could we right now be in a virtual reality?” (Chalmers, personal interview, 2015, at 1:14). In a panel discussion held in 2016 at the American Museum of Natural History\(^3\), a group of physicists, philosophers, and scientists debated the likelihood of the notion that the reality in which we are living is a huge simulation. At the end of the panel discussion, the American astronomist, cosmologist, and the director of Hayden planetarium, Neil DeGrasse Tyson mentioned that the “likelihood may be very

\(^{2}\)https://aeon.co/videos/new-realities-are-imminent-how-vr-reframes-big-questions-in-philosophy

\(^{3}\)https://www.outerplaces.com/science/item/11919-neil-degrasse-tyson-thinks-there-s-a-very-high-chance-we-re-living-in-the-matrix
high” (DeGrasse Tyson, panel discussion, 2016, at 1:38:55). He justified his opinion with a thought experiment based on the assumption that someday we will find intelligent life forms that may be way beyond the human level of intelligence. He added, “It is easy for me to imagine that everything in our lives is just a creation of some other entity for their entertainment” (DeGrasse Tyson, panel discussion, 2016, at 1:41:37). Descartes’, Chalmers’, and DeGrasse Tyson’s discussions brought forward a definition of the reality. Reality can be defined as just a matter of perception and cognition. In this definition, reality is a dynamic concept that constantly evolves as our perception and cognition does.

According to Shields (2002), “the virtual is ideal but not abstract, real but not actual. It is ideally real, like a memory” (p. 43). This resonates with the definition of reality and introduces virtual as an alternative reality where perception and cognition of a person are idealized. As Shields (2002) delineated, dreams, memories, and the past are famously defined by Marcel Proust as virtual. In this sense, virtuality can be a broad and constantly evolving notion. Over the past few decades, virtuality reintroduced itself in new forms such as computer-mediated communication (e.g., Skype) facilitating the presence of distant but significant others as well as digital simulations for play (Shields, 2002). He calls these new forms “digital virtualities.”

From the painted circular panoramas of the 1800s to immersive virtual reality and digital renderings of environments in role-playing and other online games, there is a long history of virtual environments. Central to the recent history is the rise of sophisticated graphic display hardware and software, complex geographical information systems (GIS) and the popularity of video- and computer-games (Shields, 2002, p. 46).

Virtual as an alternative reality can drastically change perception and cognition of people in different and new ways. Some of these new ways were formerly impossible without the technology
that we have today. The current rise of technologies dedicated to alternative realities (AR, AV, and VR) is giving new hopes and desires to researchers and experts in various fields such as design, architecture, museology, and education.

2.6.1.1. Virtual Reality

Virtual reality is a term usually used for an interactive environment occupied by information rather than by physical objects (Grosz & Eisenman, 2001). In this context, various contents can be generated, manipulated, and controlled to some extent (Whyte, 2002). Conceptually, VR is an alternative reality where an actual environment or event can be reproduced using a computer. The use of computers provides opportunities to make slight changes in the time and space inside the VR. Technically, VR stands for a system of digital three-dimensional (3D) simulation environments in which one can interact with the spatial data in real time (Whyte, 2002). This is reminiscent of the notion of “digital virtualities” presented by Shields (2002).

Today, VR can provide people with a new perception and cognition of the reality. Some new VR devices, such as HTC Vive and Oculus Rift, go beyond high-quality screens and mere immersion in the virtual environment (VE). They offer a level of awareness of the actual environment through motion-tracking sensors. VR can also provide opportunities to experience a historical event or a building in another era in an immersive and interactive fashion (i.e., granting access to distant time and places). It can be used “not only for the sake of preserving the cultural heritage, but also to make the information content accessible to the wider public in a manner that is attractive” (Styliani, Fotis, Kostas, & Petros, 2009, p. 520). However, there are still some aspects that affect the capabilities and practical use of VR. For instance, the VR goggles are still heavy and bulky. Most of them are still dependent on long video-cables that can interfere with movement and are subject to physical damage. The awareness of the actual environment is still limited and needs more
improvement. Moreover, some audiences still experience dizziness and motion sickness in VR. Regarding these limitations, extended use of VR is still problematic—people cannot put on VR goggles and roam around easily in a crowded place. Thus, VR can be used for short and limited applications in public spaces where there are no obstacles. Moreover, VR can serve very immersive individual and home-based experiences well.

Styliani et al. (2009) mentioned that “in a VR environment, participants get immersed into a completely artificial world but there are various types of VR systems, which provide different levels of immersion and interaction” (p. 523). Heim (1994) mentioned that the appearance of a 3D environment on a 2D screen is one of the weak levels of VR. Styliani et al. (2009) suggested that “strong VR is the total sensory immersion, which includes immersion displays, tracking and sensing technologies” (p. 523). With respect to the hardware dedicated to this technology, it needs to be mentioned that common head-mount displays and 3D polarizing stereoscopic glasses along with inertial and magnetic trackers are the most popular devices in use. Moreover, a 3D mouse and pair of gloves can be utilized to create a feeling of a control over the actual space. With respect to the required software, the development of commercial VR applications and libraries can help experts to generate fast and effective VEs.

VR has found its way to museums over the past few years (Carrozzino & Bergamasco, 2010). For example, Salvador Dali’s surrealist painting “Archeological Reminiscence of Millet’s ‘Angelus’” has found its way to the Dali Museum in St. Petersburg, Florida. This VR experience that facilitates exploration of the space inside Dali’s painting can be inspiring and motivating for the visitors of the museums.
2.6.1.2. Augmented Reality

AR is a subcategory of the MR technology (Milgram et al., 1995). MR is among the specific technologies capable of merging actual and virtual spaces to produce new environments where physical and digital realms coexist and interact in real time. As Reitmayr and Schmalstieg (2003) mentioned, AR technology superimposes computer-generated entities on top of a user’s perception of the real world in real time. Technically, AR systems supplement the real world with virtual objects appearing to coexist in the same space as the real world (Azuma et al., 2001). Conceptually, AR can be considered as an alternative reality superimposing additional objects and information on top of the actual space. Thus, AR can be used to elevate and change our perception of reality.

Today, the rapid development of necessary software and hardware made AR and mobile-AR accessible to a broader community of researchers and consumers. For instance, MARTA, an application for smartphones developed by Volkswagen, brought reliable technical assistance to the consumers. Another example is the Vuforia software that brought high-quality graphics and visualizations to the users of HoloLens in a fashion that digital content cannot be distinguished easily from the background physical environment.

AR goggles, such as HoloLens, and mobile-AR have some advantages over VR, but they have limitations as well. For example, they are lighter and less bulky than the VR goggles, less dependent on long video-cables, and provide a level of see-through (transparency) capability that not only lets the user see but also move in the surrounding environment. Consequently, awareness of the actual environment and roaming around crowded places are possible. Unlike VR goggles, they do not isolate the audience and individualize the experience. However, the screen size and quality as well as immersion in AR are not comparable with VR. Therefore, AR and mobile-AR may be good fits for application in public spaces such as museums for superimposing a layer of
information onto the actual environment, and experiences do not drastically alter perception and
cognition through immersive experiences.

AR has been experimentally applied to visualize incomplete buildings or broken real objects as
they were in their original state by superimposing the missing parts (Liarokapis & White, 2005).
Recently, mobile-AR technology has found its way to many places such as museums and
educational facilities. For example, as previously mentioned, “Ultimate Dinosaurs: Giants From
Gondwana” could offer ROM’s visitors an opportunity to experience the exhibit in more creative
ways through mobile-AR (Evans & Vavrek, 2013).

1.6.1.3. Augmented Virtuality

AV is another subcategory of MR technology. According to Mohammad-Amin (2015), “the degree
of dominance of the surrounding actual environment is a key aspect that distinguishes AR from
AV” (p. 24). In AV, a VE is augmented with data from the actual world (Tamura, Yamamoto, &
Katayama, 2001). AV technology is mostly under research and development. Technically,
advanced AV systems (e.g., RoomAlive and MagicLeap) are based on 3D projection mapping and
real-time scalable depth sensing. One pioneer AV set of tools (i.e., RoomAlive by Microsoft)
projects a scalable VE in 3D onto an actual space based on the properties of a room (e.g.,
dimensions, obstacles, furniture’s position).

Unlike VR and AR, AV is not dependent on wearables (e.g., goggles), handheld devices (e.g.,
mobile), or long video-cables. Compared with VR, the lack of awareness of the environment does
not exist in AV. Moreover, the level of immersion for the audience is high when compared with
AR. Unlike VR, AV does not isolate the audience. However, it is not portable when compared
with most AR devices. More specific issues for AV are linked to the distortion of images and
shadows of audiences in front of the lens during the projection. However, the major barrier to widespread use of advanced AV technology is cost. For instance, for a full coverage of a medium room by RoomAlive, several ProCam units are necessary (Jones et al., 2014). Each ProCam unit is made up of a projector and a depth camera (Jones et al., 2014). It is necessary to connect the ProCam units to a PC (personal computer) with considerable computational and graphical capabilities. The PC must also be equipped with RoomAlive, which is a dedicated platform. Though an expensive installation, AV can be used to create immersive and interactive experiences capable of altering the perception and cognition of museum audiences.

In contrast with AR, AV relies on a virtual space more than an actual one, but it is different from a VR. A fundamental difference between VR and AV is that VR is merely virtual and users are completely immersed in a simulated environment where they cannot see the actual world around them (Azuma, 1997). In VR, users navigate through the computer-simulated environments while all their senses are controlled by a computer and immersed in the VE (Bimber & Raskar, 2005; Milgram & Kishino, 1994). In contrast, AV users remain in contact with their surroundings, and therefore their senses are not isolated from the real environment (Bimber & Raskar, 2005). This enables AV users to interact with the virtual and real environments simultaneously. Similar to AR, AV equipment provides a level of see-through capabilities that not only let the user see but also move around the holographic objects shown in the actual space.

AV offers state-of-art opportunities to designers and artists to create new exhibits and experiences for audiences. For instance, “A Panorama of the Skies” art installation by Maja Petrić (an artist) and Hrvoje Benko (a human–computer interaction researcher) at Microsoft Research was an interesting use of AV for art exhibition purposes. However, widespread use of AV in museums is undeveloped and still needs more research and implementation.
2.6.2. Authenticity, Veracity, and Access to the Museum Content

Authenticity is a complex concept with strong cultural layers that can be understood or applied differently from one perspective to another and across the cultural settings. According to Van Balen (2008), “When different perspectives (or ways to understand) can be applied to judge the values of an object, a certain value can be assigned within each of those perspectives, or layers” (p. 39). Thus, authenticity is not an absolute notion and cannot be conceptualized in a single piece of literature. However, there may be ways to integrate part of the pre-existing discussions into the interpretations. Such an attempt can open the doors for further studies and discussions about such highly complex notions.

According to Huhtamo (2010), “as prophesied by Walter Benjamin in 1936, the original was seen to be disappearing, replaced by an infinite number of copies” (p. 122). Huhtamo noted that “the ever-present photographic reproductions of artworks made art accessible to audiences who would never have entered a museum” (p. 123). Authentic and inauthentic experiences are no longer placed in contradiction to each other. Indeed, the search for the authentic has, in the late 20th century, become increasingly irrelevant if not abandoned (Jonson, 1998).

In 2003, Burton and Scott conducted a sting study on the challenges of museums in the 21st century. They mentioned that “virtual experiences were not yet perceived to be an acceptable substitute for the authentic experience that museums offer” (Burton & Scott, 2003, p. 67). Yet Clifford Lynch (2010) delineated that “authenticity can be viewed as an assessment that we make about something in the present—something that we have in hand—relative to claims about the past (predecessor copies)” (p. 321). Authenticity and veracity are almost matters of trust or lack of trust (Lynch, 2010). As per current improvements in technology and regarding the fact that Burton and Scott conducted their research in 2003 and most of their data dated back to the late 1990s,
their inferences about virtual experience seems questionable today. Besides, it looks as if Burton and Scott assumed that a virtual experience is to “substitute” a real experience. Yet that is not the case. Instead, both experiences should work in tandem in a space accepting both reality and virtuality to enrich the museum experience. It is similar to what Sikiaridi and Vogelaar (2000) delineated regarding the retailers: “The traditional shop will not disappear. It will transform and merge with its electronic competitor (‘hybrid retailing’)” (p. 10). However, hybrid space in museums can go beyond this to provide improve education and informal learning as well as entertainment and sociocultural development (Baradaran Rahimi, 2014). Such a space (i.e., hybrid space) can help local museums to make the “unfamiliar and inaccessible into the familiar and accessible” using alternative reality technologies (Silverstone, 1994, p. 162). For instance, a curious museumgoer in a small town in Canada who is interested in the sociocultural atmosphere of Paris during the French Revolution cannot easily go to Paris. Even if that is possible, he or she cannot experience the era in an immersive and interactive fashion (i.e., reliving of historic events). However, a museum can provide such an opportunity and solve the problem of access to historic content using a hybrid space.

Attempts to evaluate the authenticity of cultural materials led to The Nara Document on Authenticity:

Depending on the nature of the cultural heritage, its cultural context, and its evolution through time, authenticity judgments may be linked to the worth of a great variety of sources of information. Aspects of the sources may include form and design, materials and substance, use and function, traditions and techniques, location and setting, and spirit and feeling, and other internal and external factors. The use of these sources permits elaboration of the specific artistic, historic, social, and scientific dimensions of the cultural heritage being examined. (Van Balen, 2008, p. 40)
To help cultural heritage experts better grasp and apply the complex and layered concept of authenticity, Van Balen (2008) developed an instrument (i.e., Nara Grid) based on The Nara Document on Authenticity. Van Balen (2008) described a grid in which aspects and dimensions each represent an axis facilitating the process of making authenticity judgments on the objects or contents across different cultural settings. Nara Grid can be modified and used for evaluating the authenticity of digital contents in those hybrid spaces that serve museums. It can be used as “a tool to promote discussion and wider understanding of heritage values by filling it out like a checklist” (Van Balen, 2008, p. 40).

It seems that there is an emerging attention toward the authenticity and veracity of the digital content that partially addresses the matter of trust of digital content. Currently, cultural institutes as well as digital content producers, such as entertainment incorporations and game companies, are paying attention to authenticity and veracity. For example, on October 6, 2014, Ubisoft Montreal, a commercial game developer company, announced that they had enlisted the help of academic historians such as Laurent Turcot at Université du Québec à Trois-Rivières for the daily life of 18th-century Paris. Ubisoft Montreal also mentioned that Jean Clement Martin at the Sorbonne revised the script of one of their famous games⁴. Experts from museums and universities working with game developers can ensure the authenticity and veracity of the digital content. Nara Grid can enrich the examinations of the digital contents while the collaboration between content producers and experts can be the key in creating an authentic environment.

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⁴ [https://en.wikipedia.org/wiki/Assassin%27s_Creed_Unity](https://en.wikipedia.org/wiki/Assassin%27s_Creed_Unity)
2.6.3. Discussing and Developing the Concepts of Hybrid Space and Space Continuum

A matter of perception and cognition, reality can unfold in actual, virtual, or hybrid spaces. According to Herman Hertzberger (2000, p. 14), “space is more an idea than a delineated concept.” He explained that “space” is what contains objects in a structured relationship and “gives you a freedom of view and a view of freedom” (p. 14). This explication of space by Hertzberger, in tandem with the capabilities that alternative reality technologies offer, conveys the idea that space goes beyond the material surroundings. An actual space is the space that people experience in the material world around them, which is tangible and physical. Reality and virtuality are not in a contradiction of each other. According to Shields (2002), “the solution is not to debate the reality of the virtual, but to develop a more sophisticated theory of the real and the ways in which the virtual and the concrete are different really existing forms” (p. 21). Actual space is recognized by the human from the very beginning, and there exists a vast amount of information and studies on it (e.g., Bachelard, 1994; Ching, 2014; Grosz & Eisenman, 2001; Hertzberger, 2000; Hillier, 2007).

A virtual space is the intangible and dematerialized world of virtuality, from the cyber space of information to the mental space of mind. As per Shields (2002), “The virtual captures the nature of activities and objects which exist but are not tangible, not ‘concrete’. The virtual is real but not concrete” (p. 2). One of the best ways to experience virtual space might be through VR equipment offering immersive and interactive capabilities to users. Virtual space has been explored and conceptualized over the past decades by many authors (e.g., Benedikt, 1994; Grosz & Eisenman, 2001; Levy, 2012; Mitchell, 1995, 1999, 2003; Negroponte, 1995; Shields, 2002; Whyte, 2002).

A hybrid space is the tangible world of reality integrated with the intangible world of virtuality (Silva, 2006). Sikiaridi and Vogelaar (2000) delineated that “these ‘hybrid’ environments, these products of the alliances of ‘real’ space and media networks are ambivalent spaces that are at the
same time analog and digital, virtual and material, local and global, tactile and abstract” (p. 7). Hybrid space borrows the power of information to empower the physical space around (Manovich, 2006; Sikiaridi & Vogelaar, 2000). One interesting way to experience hybrid space is through advanced AV equipment that uses 3D projection mapping. A hybrid space can be considered as a third type of space that although being explored less than the other two types of space, has been recognized and conceptualized by authors and architects such as Manovich (2006), Silva (2006), Sikiaridi and Vogelaar (2000), and Zellner (1999).

An early version of hybrid spaces is the trading floor of the stock exchange (Sikiaridi & Vogelaar, 2000) as well as particular urban spaces such as some shopping and entertainment areas of Tokyo, Hong Kong, and Seoul, where the walls of the buildings are completely covered with electronic screens and interactive projections (Manovich, 2006). A hybrid space is not merely digital or physical. Therefore, avatars or digital IDs do not necessarily represent people in a hybrid space. Instead, the individuals themselves represent their own characters in a hybrid space. The multimedia interface of such space is more like face-to-face, human-to-human interactions (Negroponte, 1995). Even a variety of objects in such a space are physical. Thus, they are not only audio-visual (as it currently is in VR) but also tactile and kinesthetic. This is one of the mention-worthy benefits of the hybrid space over virtual space.

The hybrid space has another important advantage over actual space as well, that is elevating the perception of spatial reality. This is possible in the hybrid space since it borrows the key features of the virtual space in several stages such as 3D modeling and real-time rendering. For example, visual cues such as real-time change of relative size, depth, brightness, and perspective for offering a digitally enhanced stereovision is totally possible in a hybrid space. In actual spaces, taking advantage of these visual cues means designing and building a new environment over time or
remodeling the existing ones. Thus, a hybrid space seems to be more flexible in terms of changing and modifying, as well as the fact that it is more affordable in terms of time and resources.

To exemplify, consider a war museum where visual cues can be mapped on physical objects and actual museum spaces (Figure 2-2). For this purpose, it is possible to use a 3D projection mapping or any equipment (e.g., HTC Vive goggles or HoloLens) that can provide immersion in the virtual space while supporting a level of awareness over the actual space along with interactions with both the virtual and actual spaces. The 3D projections are to transform the actual museum space into a historic battlefield. Visitors can be involved in a digital replication of the historic battle while communicating with digital characters or other visitors (Figure 2-2). A hybrid space may help visitors engage with each other, become involved in the storyline, and learn while enjoying a game-like experience. Presumably, to produce more immersive experiences—especially with regard to a more organic reliving of historic events—the interaction between the visitors (or their avatars) that experience such a hybrid space can play a significant role.

![Figure 2-2. Actual space of a museum (left) transformed to a battlefield in a hybrid space (right).](image)

All the three types of space give structured relationships to objects and events as well as the freedom of view to people (Hertzberger, 2000) in presence of different spatial logics (Kluitenberg, 2015). As Figure 2-3 shows, a continuum of space can be considered from an actual space to a
virtual one or vice versa regarding the characteristics of each space type. The overlapping area in Figure 2-3 represents hybrid space. It also shows that one can experience different types of space in this continuum (i.e., actual, hybrid, virtual) using an array of technology from AR to VR.

![Figure 2-3](image)

**Figure 2-3.** Space continuum, hybrid space, and existing alternative reality technology to experience it.

One can experience the hybrid space not only through AV but also by means of AR and VR. An item that can effectively reveal which technology better serves the purpose of a hybrid space in a museum is dependency on either the virtual or actual space. If a certain museum has more physical evidence or artifacts related to a historic event per se, AV or AR can be a better solution to approach a hybrid space. In contrast, if the museum has fewer artifacts or less physical evidence, AV or VR seems to be a better solution. AV in both cases can be considered as a main solution though. Yet AV is not an economical solution for many museums, especially local ones, to provide visitors with a hybrid space. Thus, AR and VR can be still used in creative ways to approach a hybrid space in many cases.

The hybrid space found in museums may become a part of everyone’s living room in the future. Home museums may become as familiar as home theaters in a not very distant future allowing individuals, families, and friends to experience a museum together from anywhere and at anytime in an immersive and interactive fashion. A network of such home museums connected to the
Internet can provide further opportunities for exploring a hybrid museum and experiencing the history similar to a massively multiplayer online game (MMO). Hybrid spaces may be the key to a new generation of museums.

2.7. Conclusion

This article investigated hybrid space as an emerging opportunity that alternative realities offer to the museums. Moreover, hybrid space was positioned in a suggested continuum of space. The existing alternative reality technology to experience the hybrid space was categorized and described. This study conceptualized the hybrid space using a qualitative method. The approach of this study to hybrid space through its technological components may be limiting, as technology develops fast, making categorizations obsolete. However, it seems that VR, AR, and AV will remain in the mainstream of technological development at least for the next few decades. An evidence for this might be several mentions in MIT Technology Review⁵ (e.g., 2015, 2014, and 2010) admitting that many businesses and industries will take advantage of the advances in the alternative reality technologies in the future. This study should serve to frame future research on the development of hybrid spaces in the museums. For instance, large gallery spaces and plenty of surfaces (e.g., walls, ceilings, and floors) in the museums can be used as a canvas for 3D projection mapping and superimposing digital content. This may be the next step to provide hybrid spaces in practice beyond museums as “these digital information/communication spaces should be combined with public urban/architectural spaces” (Sikiaridi & Vogelaar, 2000, p. 14).

As Burton and Scott (2003) delineated, “If museums are to increase attendance, they need to position themselves as attractions with many of the attributes associated with the ‘ideal’ leisure

⁵ https://www.technologyreview.com/
activity” (p. 66). The museum needs to reinvent itself—as cinemas did over the past few decades—to keep or increase attendance (Burton & Scott, 2003). Such a reinvention can go beyond increasing attendance and changing the visitors’ experience on-site. Museums may become more accessible, allowing people to experience the collections and historical treasures even from their living rooms. Hybrid spaces can be a part of the solution. Museums provide a variety of opportunities for hosting hybrid spaces. However, the capabilities of hybrid space and the prospects it brings to museums is still undeveloped. One reason may be that the necessary technology for creating a hybrid space is relatively new and calls for more progress. Another reason for that may be the novelty of hybrid spaces to architects and designers, which makes it less explicable and thus less applied.

Hybrid spaces may eventually become an effective medium, affecting museums’ relationships with their publics in fundamental ways. Offering an immersive, interactive, and game-like experience, hybrid space can revolutionize the field of museums, change the worldview about the museums, and provide audiences with a deeper perspective on the sociocultural aspects of the world’s diverse culture. Hybrid spaces along with alternative reality technologies have the potential to make our museums smarter. This echoes William Mitchell’s (1999) idea that “as the technology of smart places matures, the metaphors are biting back” (p. 43).
Chapter 3

Human behaviour and cognition of spatial experience; a model for enhancing the quality of spatial experiences in the built environment
3.1. Abstract

This paper takes an interdisciplinary approach to find out what makes the experience of spaces different and how can it be enhanced? Based on a literature review this paper draws on cognitive theory to provide a model for enhancing the quality of spatial experiences. The model has three stages: encouraging, enabling, and enclosing. The model asserts that in every enhanced spatial experience the audience gets encouraged at the outset by a variety of strategies such as persuasion, designing for meanings, and including concepts in design. The audience must be then enabled by special means, such as immersive and interactive capabilities of the environment along with its security and safety attributes, to get involved with the spatial experience. Consequently, the experience shifts towards a cognitive level at the enclosing stage, focusing on emotion and engagement. To compose this model, at the very beginning, essential components, dimensions, and elements of experience were identified and defined. Seven selected experts were then informed and asked to decide on the priority of the experience’s elements. Finally, selected elements were employed to propose the model for enhancing quality of spatial experiences in the built environment. The proposed model is then followed by an example that clarifies how the film industry could apply the model to enhance the quality of spatial experience in the built environment of a movie theatre.

3.2. Keywords

spatial experience, experience design, human behaviour, conceptual model

3.3. Introduction

Given that a large majority of an individual’s time is spent in built environments, the need for a greater understanding of human response to environmental stimuli inextricably links design to scientific research. The promise is that architects and
scientists will collaborate more to determine what we build and why it will enhance the human experience (Chong, 2009, p.x).

There exist architectural spaces where one instantly feels comfortable, welcomed, and safe. There also exist architectural spaces where one immediately feels uncomfortable, hostile, and threatened, although architects try to make better spaces and experiences for people (Franz, Heyde, & Bülthoff, 2005; Suri, 2003; Evans, 2003; Canter & Lee, 1974). What makes these spaces different? Is it the space or the experience of space that makes these differences? If an experience relating to space that involves people in a certain activity within a context be called a spatial experience, is it possible to suggest a model for enhancing the quality of such experience?

To answer these questions, architects take an integrative approach and view a design from several perspectives, such as behavioural, social, cultural, and technical. For instance, in architecture, Vitruvius' (1999) architectural discourse on Impact (venustas) and the Environmental Design Research Association research into the nature of people's experiences of spaces and places as well as more technical research on circulation and workflow explored several aspects of spatial experiences. Yet, experience design (XD) as a newly recognized approach has never been integrated into design as a part of the solution to architectural problems (Shedroff, 2009). Perhaps, a part of the problem is that architects are not aware enough of the research in experience design (Shedroff, 2009, 2001; and Diller, Shedroff, & Rhea, 2005) interaction design (Nodder, 2013; and Anderson, 2011) and user-centred design (Weinschenk, 2011; Lidwell, Holden, & Butler, 2010; Norman, 2005; Stanton & Baber, 1998). This problem leads to a knowledge gap between experience design and architecture. While some literature dispersedly suggest sets of clues for an experience, these clues have not been subjected to empirical research in a built environment with an architectural perspective (Kuntson, Beck, Kim, & Cha, 2007). This gap may cause architects to
apply a merely theoretical and intradisciplinary approach to an interdisciplinary problem that needs to be studied empirically. The result of such an improper approach most often is inelegant problem-solving strategies and design solutions (Franz et al., 2005).

This paper takes an interdisciplinary approach to identify and define essential components, dimensions, and elements of experience based on a literature review. This will be followed by analytic hierarchy process (AHP) that relies on theory and practice. Moreover, brain-writing will be applied by the authors to generate ideas and suggest a model for enhancing the quality of spatial experiences in the built environment based on the findings.

3.4. Theory

To reveal the underlying mechanism of human experience several researchers viewed human experience and made theories about it (Baradaran Rahimi, 2014; Fogg, 2009; and Knutson et al., 2007). Even though research exists (e.g., Mitchell, 2003; Bitner, 1992; Zeisel, 1984), experience design, as an emerging field of knowledge, has not been sufficiently engaged with spatial aspects of the experiences in the built environment. For the goal of suggesting a new model to enhance the quality of spatial experiences similarities and overlaps of existing models must be studied. However, to make such a new model pertinent to architecture, deeper understanding of experience and its essential components, dimensions, and elements still seems necessary.

3.4.1. Related works

In a model developed by Fogg (2009, p. 40), it is explained that ‘for a person to perform a target behaviour, he or she must (1) be sufficiently motivated, (2) have the ability to perform the behaviour, and (3) be triggered to perform the behaviour’. In his model, Fogg approaches experience design from a behavioural perspective. Yet, Fogg’s model does not define or discuss
application in a specific architectural context. This makes his model general in context. Moreover, the model seems to be more about encouraging people to perform a certain behaviour. One question that needs to be asked, however, is what happens in coercive situations? Should coercion be considered as a kind of motivation? This makes Fogg’s model very specific in application. Fogg’s model lacks the architectural perspective and suffers from being too general in context and too specific in application.

A second model by Baradaran Rahimi (2014) with an insight into architecture and experience design asserts that for a person to get a target socio-cultural experience, ‘he or she must become sufficiently motivated and be situated in the right context as effective actuation begins the interaction’ (p. 174). His model is fundamentally about enabling people to go through an experience in certain architectural contexts and more specifically focuses on its socio-cultural aspects. It touches upon spatial experiences in the built environments such as museums. However, it does not explain the whole spatial experience, and only targets its socio-cultural aspects.

A third model by Knutson et al. (2007) presents a holistic model for user experience including seven factors, orderly, benefit, accessibility, convenience, utility, incentive, trust, and environment. According to this model, these factors perform in a hierarchical manner with four major components: (1) expectations and perceptions, (2) the consumer’s experience, (3) value, and (4) satisfaction. This model is mainly about enclosing what seems important to people in an experience while doing a common activity. Using a large sample of users, this study made a valid empirical contribution to the field. However, it views the experience at a very end level, more from a customer’s perspective with less attention to earlier levels and designer’s perspective.

A closer look at these three models, conveyed an interesting idea to the authors of this paper. Fogg’s model concentrates on encouraging people; Baradaran Rahimi’s model focuses on enabling
people in the context; Kuntson, Beck, Kim, and Cha’s model looks at enclosing important aspects for people while doing an activity or going through an experience. What if encouraging, enabling, and enclosing be viewed as stages of a new model to enhance the quality of spatial experiences? To reach this goal, a deeper understanding of experience and experience design was necessary.

3.4.2. Spatial experience and essential components of experience

As Volo (200910) cites from the Oxford English Dictionary, an experience is “[t]he fact of being consciously the subject of a state or condition, or of being consciously affected by an event” (p.1). As reported by Hoch (2002), an experience is “the act of living through an observation of events and also refers to training and the subsequent knowledge and skill acquired” (p.448). An experience is created, when an institution, organization, or a company “intentionally uses services as the stage and goods as props, to engage individual customers in a way that creates a memorable event” (Pine & Gilmore, 1999, p. 11). The concept of event seems to be in tight relationship with experience in all these definitions of experience. But what is an event?

The theorist, architect, and well-known educator Bernard Tschumi has an interesting view about architecture and spatial experiences. He believes “there is no architecture without event” (Tschumi, 2012, p.176). Adapted from Eisenstein's diagrammatic methodology, Tschumi discusses the components of which a spatial experience is made space, event, and activity. Tschumi explains that spatial experience is not simply about space, form, and function, but also event and activity. David Leatherbarrow (2005) describes that when we acknowledge the unexpected quality of an experience, we call it an event. He explains (Leatherbarrow, 2005, p.11) that “[w]e give such an experience the name event precisely because of the unforeseen character of what happened – real events are always more than what we expected of them”. Therefore, one can consider event in Tschumi’s work equal to an experience with an unexpected quality as discussed by
Leatherbarrow. Unexpected quality of an experience is closely related to three essential components: people, context, and activity (Anderson, 2011). Based on Anderson’s discussions, the stronger the link between people, context, and activity that can be made, the more unexpectedly higher the quality of experience that can be made. Comparing Anderson’s discussions and Tschumi’s arguments in line with Leatherbarrow’s discussions on spatial experiences, notion of event, and its relationship with unexpected quality of experience conveys the idea that there are similar and interesting references in these works.

The essential components in Anderson’s work recall the components of which a spatial experience is made of in Tschumi’s work. Both authors refer to activity as an essential component. Similarly, Tschumi considers space as the setting where activity takes place and Anderson considers context not only as the setting that activity takes place but also as the circumstances that form the setting for an event. Thus, context in Anderson’s discussion includes the space in Tschumi’s argument in a broader view. Each author approaches the third component in a different way. Tschumi considers event the third component of his framework that refers to the acknowledgement of the unexpected quality of an experience by audience. Anderson considers people the third component of his framework and believes without people there will be no unexpected quality of an experience or event. The notion of event in Tschumi’s argument can be considered as the acknowledgment of unexpectedly high quality of an activity performed by people in a certain context. Uninhibited spaces and abandoned contexts have no audience to offer an experience.

Thus, in the present paper, people, context, and activity are considered as the essential components of spatial experiences in the built environment. A spatial experience will be then defined as an experience relating to space that involves people in a certain activity within a context. Enhancing
the quality of spatial experience to an unexpected level associates with stronger links between people, context, and activity in this paper.

3.4.3. Dimensions of experience and their elements

A growing body of research by Nathan Shedroff (2009, 2005, and 2001) has investigated experience design. The first serious discussions and analysis of superior experience elements emerged in his book:

> While everything, technically is an experience of some sort, there is something important and special to many experiences that make them worth discussing. In particular, the elements that contribute to superior experiences are knowable and reproducible, which make them designable (Shedroff, 2009, p.5).

Shedroff built on his previous work (2001) in addition to that of Diller et al. (2005) and studied the differential impact of superior and non-superior experiences in everyday life (Shedroff, 2009). He reported six subsets of elements that contribute to superior experiences and labelled them ‘dimensions of experience’. These dimensions are, duration, trigger, breadth, significance, intensity, and interactivity (Shedroff, 2009). Although his theory does not fully explain enhancing spatial experiences, most of the elements defined by Shedroff may be applied to architecture and spatial experiences. However, to make the theory pertinent to architecture some reordering and modifications need to be applied as it has been done in the present paper to Shedroff’s dimensions and elements of experience.

3.4.3.1. Duration

The first dimension of an experience, duration, has four phases: orderly initiation, immersion, conclusion, and continuation (Shedroff, 2009). Initiation can be considered the phase of encountering with a spatial experience for the first time, such as stepping into a building for the
first time. Immersion is the phase of evolving and interacting with the experience, like walking around the building under the natural light, touching the surfaces, feeling the textures, and getting the sense of the place after a while. In some cases, the conclusion is the final phase of ending the interaction with the experience (Diller et al., 2005). In other cases, the continuation is the phase of repeating some experiences over time (Diller et al., 2005). For example, one can visit a place once in a lifetime or visit it several times for certain reasons such as personal, occupational, or even strong sense of place.

3.4.3.2. Trigger

The second dimension of an experience, trigger, refers to (potential) stimulus-response mechanisms such as sense, concept, emotion, and promotion. Sense is related to sight, sound, smell, taste, and touch that are primary mechanisms to respond to environmental stimuli. Concept deals with any intellectual mechanism, such as memories, mental maps, or mental models of a built environment, which may trigger certain responses. For instance, a mental model for a Gothic Cathedral is that the scale, color, lights, ornaments, reverberation time, etc. reinforce the concept of majesty (von Simson, 1959). This triggers a certain response in people: getting more impressed. Emotion is a complex stimulus-response mechanism. According to Ekman (2007), there are seven fundamental and universal emotions in a human being that can trigger actions and responses. The universal emotions are joy, sadness, contempt, fear, disgust, surprise, and anger (Ekman, 2007). A built environment can trigger emotions in people (Tschumi, 2012). For instance, a Holocaust museum mostly triggers sadness or a haunted house triggers fear. Promotion entails any communication of information about the experience or its related components (Diller et al., 2005). Communication of information about a spatial experience can convince a large number of people
to accept or reject the experience. Advertisement, comments, discussions, etc. are some ways that can promote a spatial experience.

3.4.3.3. Breadth

The third dimension, breadth, stands for different ways the experience can be delivered. It is in close relation with service, channel, security/safety, and accessibility. Service deals with identifying social tendencies, understanding the need, and responding to them by the designer with deliberate intention to support a certain spatial experience (Diller et al., 2005). For example, to support the experience that people (including customers, staff, etc.) usually have in a high-rise office building, architects gradually found that secondary spaces such as atriums, coffeeshops, food courts, and recreational spaces are very helpful (Proulx & Pineau, 1996). The use of such secondary spaces to partly address the identified social tendencies are rooted in understanding the needs that people have during a prolong stay in a built environment (Gifford, 2007). They can add to the quality of experience and empower the service that the environment offers to people (Mehrabian & Russell, 1974). Channel is the environment of delivering an experience to its consumers (Diller et al., 2005). Thus, the built environment is the main channel to deliver the spatial experience most of the times. For instance, the main channel for a museum to offer the museum experience to people is through the actual museum space (Baradaran Rahimi, 2014). However, emergence of high-quality virtual spaces will eventually bring up other channels, such as virtual museums, to offer a similar museum experience to audience. Security and safety are tied with the freedom from worry about loss and prevention of threatening stimuli (Weinschenk, 2011). Security and safety appear to have considerable importance in most spatial experiences. Often, people share a built environment with others including strangers. Thus, security and safety play pivotal roles particularly in those built environments that are shared. Accessibility refers to the
quality of being available when needed. It can be accessibility to location, to a piece of technology, or to necessary equipment (Weinschenk, 2011). Even a very high price can limit people’s accessibility. A great spatial experience without accessibility will be doomed to failure.

3.4.3.4. Significance

Significance is the fourth dimension of an experience (Shedroff, 2009) that refers to identity, archetype, function, and meaning in a built environment. Identity is the qualities, beliefs, values, cultures, etc., that distinguish or identify a person, or places (i.e., place identity) within a built environment (Norman, 2005). Such qualities remind place making that is tied to place identity and capitalizes on a community's assets, inspiration, and potential, with the intention of creating public spaces that promote people's health, happiness, and wellbeing (Schneekloth & Shibley, 1995). ‘Places offer an individual the opportunity to both express and affirm his or her identity’ (Ramkissoon, Weiler, & Smith, 2012, 263). For example, a mosque not only gives identity to people inside but also gets identity from them (Avcioglu, 2007). Archetypes are iconic universal patterns of theme and master form in the built environments with symbolic values resulting from innate biases or dispositions (Lidwell et al., 2010). For instance, geometrical and mathematical ratios (e.g. Golden Ratio, Phi, and Fibonacci sequence) along with harmonics and proportions (e.g. Divine Proportion) that are commonly used in architecture can be considered among archetypes (Thiis-Evensen, Waaler, & Campbell, 1987; and Jung, 2009). Regarding the nature of archetypes, they can support significance in a built environment. Function deals with the purpose and performance of a spatial experience (Shedroff, 2009). It means that a built environment typically starts off as a functional response to an architectural question. However, the spatial experience in such a built environment goes beyond this and should not be uncomfortable and inconvenient either. In a higher level, such an experience can go above functionality to a cognitive level carrying
emotions and meanings (Anderson, 2011). Meaning is a subjective definition which deals with connotation, worth, or importance for people (Diller et al., 2005). It is impossible to make a built environment meaningful (i.e. a single and universal meaning) for someone since meaning is personal and subjective. Yet, it is possible to design for meaning, e.g., by creating new mental models and memories as well as shepherding beliefs. To exemplify, Daniel Libeskind designed for particular meanings of World War II in the Jewish Museum of Berlin, focusing on memories of exile, memories of Holocaust, and continuity (Libeskind, 1997).

3.4.3.5. Interaction

The fifth dimension of the experience, interaction, comes in different types, namely, passive, active, and interactive (Shedroff, 2009). Passive experiences have static structures and most often the user is merely subjected to the experience (Nodder, 2013). An extreme example of a passive spatial experience can be solitary confinement. Active experiences have a dynamic or animated structure, but the user still does not take part in action (Shedroff, 2009). An example of active spatial experiences can be watching a movie in a traditional movie theatre. Interactive spatial experiences take place when people are in mutual engagement with context and activity throughout the experience (Shedroff, 2009). A common example of the interactive spatial experience can be playing interactive video games such as Rock Band using an interactive controller like drum interface at home. Being passive, active, or interactive in a same built environment can deliver totally different spatial experiences to people. An experiment in Odenplan Metro station in Stockholm (Lucero, Karapanos, Arrasvùori, & Korhonen, 2014), confirmed that if a spatial experience as simple as getting out of the metro station is interactive, it can even change people’s behaviour (Anderson, 2011). In this experiment, a set of stairs next to an escalator, both leading up into the daylight, was transformed into piano keys using sensors attached to speakers. Soon, the
stairs became considerably more popular than the escalator and people delightfully chose to take the stairs instead of escalator for getting out of the metro station.

3.4.3.6. Intensity

The last dimension of an experience, according to the literature, is intensity. ‘In design, the intensity is a measure of the connection a consumer has with the experience’ (Diller at al., 2005, 102). Reflex, habit, engagement, persuasion, and coercion are considered as the means of intensity in the present paper. Reflex is a nearly unconscious response to stimulus (Shedroff, 2009; and Norman, 2005). Spatial experiences can provoke reflexes in people. For instance, walking in a haunted house can rapidly provoke startle reflex and make the person extra jumpy (Asli & Flaten, 2012). Habit is a represented pattern, behaviour, or thought which develops from a need for convenience or efficiency, or just from early training (Diller at al., 2005). Built environments and their experiences can make habits for people. For example, the habits of being quiet in a movie theatre as well as being rowdy in a stadium are very linked to the space and the experience each offers. Engagement is a state where the user’s conscious attention is occupied throughout the entire experience (Csikszentmihalyi, 2014). Built environments can support people’s engagement in a certain activity. For instance, an IMAX 3D movie theatre takes advantage of and integrates audiovisual technology in design of the theatre in a manner that often occupies the conscious attention of the audience through the movie. Persuasion evolves with prompts and motivators to convince people to get involved with the experience (Weinschenk, 2011; and Nodder, 2013). For instance, giving audiences a level of control over the environment or providing them with a relative autonomy through all or a part of the environment can persuade them to get involved in certain spatial experiences (Lidwell et al., 2010). Rewarding programs are another way of persuading people to perform a certain activity and have a particular experience in a built environment
Coercion is the external power and outer control by which the actions of the audience get mediated (Nodder, 2013). Two common examples of coercion in the built environment of the cities are red traffic lights and speed bumps, which coerce a person to act in a certain way.

3.5. Methods

Based on the literature essential components, dimensions, and elements of experience were identified and defined. For the goal of suggesting a model to enhance the quality of spatial experiences, one remaining issue was the relationships between essential components, dimensions, and elements. Making ideas about such relationships based on literature review and the authors expertise needed idea-generating methods such as brain-writing (Van Gundy, 1984). This method is helpful for making expert-group discussions based on prior studies and expertise while preventing common biases linked to other idea-generating methods such as one-sided decision making and neglecting the views of some expert-team members.

Another remaining issue was the setup of the model based on the underlying mechanism presenting three interrelated stages (i.e. encouraging, enabling, and enclosing) for human experience defined from the related works. Having many elements in a model does not necessarily mean that a model can return a fine result. More elements can add to the complexity of the model and reduce the veracity and chances of its practical use. Thus, the priority of elements was necessary to be revealed and those elements with the highest priority be included in the suggested model of this study. For such a purpose, a heuristic approach such as analytic hierarchy process (AHP) that is based on expert-group decision appeared useful (Shah, Kulkarni, & Vargas-Hernandez, 2000). Regarding the complexity of human experience which cannot be easily explored using more
traditional approaches, heuristics can return a sufficient result to the immediate goal (Saaty & Penivati, 2008).

3.5.1. Generating ideas on the relationships

Brain-writing method was applied to generate ideas on the relationships of essential components, dimensions, and elements of experience. To do the brain-writing, authors of this paper wrote down a few ideas for such relationships on a piece of paper. The paper of each author was then passed on to the next authors, who reviewed it silently and added their own ideas to the page. This process was repeated until everyone could add to each original piece of paper. The advantage of brain-writing is that it makes sure everybody is given the opportunity to have their thoughts and ideas thoroughly considered by the group (Shah et al., 2000). This avoids one or more persons intentionally or unintentionally dominating the sessions (Van Gundy, 1984). The notes were then gathered for discussion and generating diagram (Figure 3-1). As Figure 3-1 represents, regarding the relevance of the elements and mechanisms that each dimension contributes to the experience, a pair of dimensions is assigned to an essential component.

Figure 3-1. Essential components, dimensions, and elements of an experience. Figure is created by authors from data in Anderson (2011), Shedroff (2009), and Diller et al. (2005).
Sense, emotion, concept, and promotion can trigger an activity as mentioned earlier. Initiation, immersion, conclusion, or continuation play an important role during an activity. Thus, trigger and duration are both considered more relevant to activity in the present paper. However, it does not mean that there is no relevance at all between these two dimensions and the other essential components. As discussed earlier, identity, meaning, function, and archetype can reinforce the significance of the context that a designer provides. Service, channel, security and safety, and accessibility are substantial to broaden a spatial experience beyond the physical barriers. Therefore, breadth and significance are considered more relevant to context in the present paper.

People have a key role in being passive, active, or interactive in a spatial experience. Without people in one end of the experience interaction loses its value. Reflex, habit, engagement, persuasion, and coercion can change the intensity of an experience for people. Each of these elements can change and empower the intensity of the experience for people to a certain level. So, interaction and intensity are considered more relevant to people in this paper.

As a hypothesis, the elements of Figure 3-1 are not all at the same level of priority in all spatial experiences. Some elements may seem more important than the others regarding the type of space (i.e. actual, hybrid, or virtual). For example, it seems that security/safety is more important in an actual space than a virtual space since the threats in actual spaces are more serious and severe. Immersion, on the other hand, appears to be more important in a virtual space than an actual one.

3.5.2. Deciding on priority of elements

Another remaining issue to address was deciding on priority of elements that enhance the spatial experience in an actual space. This is a complex task to do, especially when a single person makes the decision. Even if a decision is made by a group based on discussion and literature review, the probability of one-dimensional decision-making increases when the group is made up of principal
researchers. Analytic hierarchy process (AHP) is a heuristic method that has particular application in group decision-making. It is based on pair-wise comparison and ranking of multiple elements and considered to be a structured method for organizing and analysing complex decisions (Saaty & Penivati, 2008).

Thus, the authors decided to take advantage of an expert panel selected from relevant fields of architecture and interior design with antecedent studies about spatial experiences and experience design competencies with a minimum of five years professional experience in architecture and design. This helped not only to have the theoretical but also practical views of panel in decision makings.

To run AHP for the present study, the syntax and the semantics of the AHP were clarified for seven selected experts (4 males and 3 females). As suggested by Eberts (1994), a usual minimum sample size for this type of research is six experts in a group. Then, findings from the literature were shared with these experts and they were asked to compare the elements pair-wise and rank them (Appendix E) regarding the following areas of concern:

1. Priority of elements to enhance the quality of spatial experiences in general.
2. The level of priority of a chosen element compared to the alternative in a scale from 1 (the same emphasis) to 9 (extreme importance).
Experts compared pairwise and ranked the priority of elements related to each essential component (criterion) separately using a hierarchic structure (Figure 3-2). All the pairwise comparisons of the elements related to three essential components of experience (criterion I to III) were organized into three square matrices (Appendix F). The normalized right eigenvector of the comparison matrices gives the relative priority of the various elements being compared.

According to the results (Appendix F), ‘Emotion’ has a normalized principal eigenvector equal to 28.8%, which makes it the most important element for enhancing the quality of spatial experience based on the decisions made by the experts. The second and third important elements are ‘Engagement’ with 25.4% and ‘Security and Safety’ with 22.9% normalized principal eigenvectors. The least important element is ‘Passive’ with a 3.3% normalized principal eigenvector. The results show that an enhanced spatial experience tends to shift towards a cognitive level by being emotional, engaging, safe, and secure. Moreover, such an experience is not passive at all, which is a reasonable result.

For each essential component (criterion) of this research, namely, people, context, and activity, the sum of the values in the criterion is 100% and is divided by the number of elements (8). Thus, the mean average of the normalized principal eigenvectors (Appendix F) is 12.5% for each criterion. Elements with higher global ratings and normalized principal eigenvectors over the mean average (i.e., 12.5%), namely, interactivity, engagement, persuasion, meaning, security/safety, immersion, emotion, and concept, were selected for inclusion in the conceptual model.

3.6. Result

Reviewing prior studies (Baradaran Rahimi, 2014; Fogg 2009; and Knutson et al., 2007) have suggested to the authors of this paper that, instead of taking place abruptly, experiences probably take place sequentially in a built environment. As mentioned previously in related works, this
The paper’s authors entitled stages of such a sequence: encouraging, enabling, and enclosing. Brainwriting and following panel discussions suggested to authors that these three stages can be effectively organized in a behavioural model (Figure 3-3). Each stage consists of a set of elements that can be considered helpful for improving a stage.

The model asserts that, to create a superior spatial experience, a person should primarily get encouraged to engage the experience via three elements: the meaning that architect designs for, the concept that are incorporated in the design, and the persuasion styles that are applied to get the audience involved with a spatial experience. At the enabling stage, the audience gets enabled to become involved in the spatial experience. Making a user enabled is possible by taking advantage of immersion, interactivity, and the security/safety attributes of the space. Consequently, at the enclosing stage, the experience shifts towards a cognitive level through emotion and engagement.

When the experience moves to a cognitive level, it can be called an enhanced experience, since most experiences never go to a cognitive level at all (Anderson, 2011). As Figure 3-3 represents, at this stage (i.e., enclosing), the audience experience either ends or reiterates.

Figure 3-3. Conceptual model and stages of designing a superior experience.
Hypothetically, there is no need for the elements of these three stages to perform equally in all situations. Thus, the model does not rank the power of elements. Instead, architects and designers should consider and apply each of the elements according to their design considerations and objectives. Moreover, the environment of use (e.g. actual, hybrid, or virtual space) can imply different combinations for elements of the model. As exemplified before, it seems that security/safety is more important for an actual space than a virtual one since the threats in actual space are more severe than the threats in a virtual one. This may be a subconscious result of rising terrorist attacks such as 9.11 and Bataclan Concert Hall massacres.

Watching a movie in IMAX 3D theatre can provide a clarifying example of the enhanced spatial experiences and the model in practice. The IMAX 3D theatre presents a strong encouraging stage. It borrows from the traditional concept of a movie theatre and offers an improved experience. Moreover, both the experience and the theatre space are designed well-enough to persuade many audiences to consider it as a serious choice compared to traditional public entertainment alternatives. Since the experience is designed to represent more realistic contents by means of the screen size, audio facilities, 3D glasses, and the space dimensions, it is easier to make sense of the meaning imbedded in the experience. For instance, falling down a deep canyon in IMAX 3D and hearing the screams of others in the audience, one can experience more intensely the meaning of fear when compared to watching the same scene at home on an ordinary TV.

The enabling stage is relatively strong in IMAX 3D movie theatres. Except for the element ‘interactivity’, which is not very available in IMAX 3D, the level of immersion and security/safety are high enough to enable the audience to get involved with greater interest. The experience takes advantage of sensory channels of a human being, especially audio-visual channels, to immerse audience in the story. Moreover, the experience does not offer that much of
threat when compared to other public entertainment alternatives such as theme parks’ rides. Therefore, it still can be considered among the most secure and safe public experiences.

Finally, the IMAX 3D boosts emotion and engagement at the enclosing stage. High-quality audiovisual systems can affect the emotions strongly. For instance, while watching a horror movie in an IMAX 3D theatre, the quality of sound and video helps to provoke the emotions to a greater degree. Plus, the entertaining nature of movie watching, optimal design specification, architectural, ambiental, and technical considerations of the environment considerably help to engage the audience more in depth with the content. At this stage, this experience shifts towards an emotional and engaging cognitive level and it is possible to enclose massages or what can be important to people in the experience.

As Bernard Tschumi (2012) mentioned, “[t]he task of architect is to modulate, orchestrate, or simplify the potential reciprocity, indifferences, or conflict that spaces can generate” (p.177). An IMAX 3D theatre may seem explicitly designed to be so immersive that there is no experience of the physical space. However, architect thoughtfully designed such theater in a way that the physical environment serves the purpose of immersing people into the movie. Therefore, this is exactly one of those places where architects orchestrate potential indifferences of space to provide an experience that cannot be unfolded in any other type of movie theaters. Referring to the introduction of this paper, this is an experience relating to space that involves people in a certain activity within a context; a kind of experience that can be called a spatial experience.

3.7. Conclusion

The statistical results given here have demonstrated that there is a significant difference between the elements of an experience with respect to their priority for enhancing spatial experiences. The difference was statistically measured, and the most and the least important ones were defined based
on pairwise comparisons of the elements by a selected group of experts. The model might need modifications for better application in other space types such as actual, virtual, or hybrid spaces. This is not a negative point, since the authors believe that every dynamic and evolving structure in our world is subject to change and development.

Undoubtedly, a single model cannot address all the areas of concern including cultural and historical specificity. However, it can cover some areas of concern and open the room for other researchers to build on and develop the model. This is neither methodological unrigorous nor politically irresponsible approach since science and knowledge come together piece by piece by different groups and individuals over time. The model presented in this paper focuses on an area of knowledge (i.e., experience design) which is less integrated into architecture. The model humbly provides a shared frame of reference for a team working on a project. When everyone on a team is thinking about the creation of an enhanced experience with a common aim and reference points, the project may proceed more efficiently and efficiently. Moreover, the model provides architects and designers with a foundation to better understand the relations between people, context, and activity with the experience design elements. The behavioural stages that are suggested in the model, namely, encouraging, enabling, and enclosing can be helpful especially in the design process to see the experience of people in a built environment in earlier stages of design. This can be useful not only to architects but also to whose practice is related to the experience of people in the built environments, such as interior designers and industrial designers.
Chapter 4

A game design plot: exploring the educational potentials of history-based video games
4.1. Abstract

The number of video games that are developed based on real historical events and evidence is increasing. Players may learn about history from these history-based video games, but the games have not been carefully examined for educational purposes. There is a need for systematic approaches to assessing games as learning environments. In this paper, we discuss the method of comparing authenticity of popular history-based video games. We applied open coding as well as qualitative data analysis to study players’ comments on the web-based communication services, such as game forums, digital distribution platforms, and discussion websites. Casual players’ conversations on these websites showed that there are several potential learning outcomes for players including but not limited to building and developing their knowledge about specific topics related to history.

4.2. Keywords

communications technology, education, e-learning, history-based video games, web-based communications

4.3. Introduction

With the growing interest in video games over the past few decades, there has been a growing concern about the impact of gameplay on users. Some found negative impacts such as the increase in aggression and arousal (Anderson, 2004), difficulties in regulating the amount of time spent on playing games (Ogletree & Drake, 2007), and addiction (Griffiths & Davies, 2002). Yet, others reported on optimistic visions of video games, such as raising awareness of important social issues (Schreiner, 2008), developing gaming literacy in real life situations (Zimmerman, 2009), and learning through designing games in participatory culture (Baradaran Rahimi & Kim, 2018).
Despite the skepticism, many scholars believe that video games provide useful and novel ways of learning. Modern theories of learning suggest that learning is most effective when it is active, experiential, situated, problem-based, and provides immediate feedback. Games offer activities that have these features and often involve players’ emotions that help them make meaningful links to their prior knowledge and experience (Connolly et al., 2012; and Schreiner, 2008).

The video games of historical contexts might provide a useful and motivating method of learning about history and social history (Connolly et al., 2012). Social history, according to Merriam-Webster online dictionary\(^6\) (2017), “concentrates upon the social, economic, and cultural institutions of a people”. Metzger and Paxton (2016) argued, “[h]istory has much to offer video game developers, including ready-made settings that can activate players’ prior mental schemas to provide a sensation of verisimilitude within a context that is nevertheless alternate and malleable” (p.533). With current advances in computer graphics and graphics processing unit technology, video games recreate realistic architecture (e.g., Assassin’s Creed Unity and Grand Theft Auto V), the life of people (e.g., Total War: Rome II and Civilization V), and historical events (e.g., LA Noire, Call of Duty: World at War). While historical events such as revolutions and wars form a considerable part of the history, architecture and urban life of people are significant parts of the social history. Yet, the educational value can get lost in the entertainment aspects of such games. Consequently, many historical details and values of these games remain as a background for the players, if noticed at all.

We recognize the richness of these commercial games regardless of their success. We also acknowledge the relative shortage of adopting their learning potentials. There exist methods of user-testing to understand how players interact with new games (Desurvire & El-Nasr, 2013).

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6 https://www.merriam-webster.com/
However, there are not enough systematic ways to maximize different learning values of commercial history-based video games for casual players. Conversations of casual players on web-based communication services such as game forums, digital distribution platforms, and discussion websites reveal the learning potential in commercial video games. Yet, the need for a systematic way to provide an overview of the values conveyed by such games remains undeveloped. How can the learning potential for the players – to inquire into history in relation to the historical authenticity of different video games – be studied and compared? The goal of this paper is to investigate the learning opportunities that players may have with history-based video games (i.e., historically oriented, situated, or themed video games). As an objective, we explore learning potentials of popular commercial games on web-based communication services to find what kinds of conversations can happen around the historical contexts of video games. Moreover, we investigate how these conversations are already taking place online. Based on our findings we provide a game design plot for visualizing, listing, and comparing the learning outcomes of history-based video games. The plot and the systematic approach that we propose can help developers, designers, researchers, and educators make informed decisions about application of video games in different situations.

4.4. Literature review

To explore the educational potential of video games, we looked at the most relevant literature in game studies to identify three groups of the history-based video games. Using the literature in media and architecture leads to five factors that describe the historical context in such games. A plot was then created based on these factors for those three groups of video games (Figure 4-1).

4.4.1. Learning through history-based video games
The ways in which players learn and think about history and social history can be influenced by popular culture and media technologies (Wineburg, 2001; and Schreiner, 2008). Video games, that are historically oriented, situated, or themed (Metzger & Paxton, 2016), offer players an opportunity to alter historical events, such as winning a battle based on their choices. Experiencing these alternatives can also help understanding how a single decision has the potential to change history or result in better solutions in the context of history:

> Video games can provide a unique mode of engagement for thinking about the world and its past—allowing the young learner not just to observe historical accounts but to actively engage in simulations of history, easily repeating events or sequences, or even controlling and modifying alternate visions of what could have happened in the past (Metzger & Paxton, 2016, p.533).

As Walsh (2013) noted, some game developers tend to move their games from the realm of pure fantasy to the realm of reality in the minds of players. Gee (2008), recognized such games as “action- and goal-directed simulations of embodied experience” (p.254). Video games offer an opportunity for learning history in such an immersive, interactive, and engaging way that is almost impossible using traditional media like movies and books.

Metzger and Paxton (2016) suggested a framework that can help identifying the video games that facilitate learning history. Their framework offers “deployments”\(^7\) of historical understanding while considering authenticity versus fantasy in video games. Metzger and Paxton (2016) suggested that disciplinary practices, elements, and perceptions of validity are important factors to make a video game a legitimate historical representation. Behind the group of legitimate games lays considerable archival or scholarly research by historians and professionals. This archival and scholarly research can range from a deep investigation of a historical event, atmosphere, fashion, 

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\(^7\) Deployment is the term that Metzger and Paxton (2016, 533) used for “a designed representation of the past utilized by game creators to reflect a perspective, interest, or purpose.”
and manner of socialization to a detailed recreation of historic buildings, landscapes, sites, and cities (Metzger & Paxton, 2016). The second group of video games valorizes historic momentums and important events, but not necessarily based on extensive research (Metzger & Paxton, 2016). A third group focuses on reconstructing objects, artifacts, or communications with authentic details, such as historical buildings, furniture, battlefields, and weaponry in a certain period (Metzger & Paxton, 2016). There exist many deployments of history in video games, but the history often collides with fantasy. The more a game goes into fantasy, the more it may depart from authenticity.

### 4.4.2. Factors of historical context in games

In conceptualizing varying adoptions of historical contexts in video games, we considered how architecture and cinema have coexisted in games from the early days of the game industry. DOOM, one of the most significant and influential titles in video game history, pioneered the use of architecture and cinema in a first-person shooter game (Arsenault, 2009). The cinematic exploration of video games was pursued by players on Machinima. As creating game movies became “an outlet for creative expression” (Lowood, 2006, p.326). Such movies can be considered as a “part of the player culture to engage with more challenging stories and themes” (Lowood, 2006, p.380). The architectural and cinematic representations engage players as protagonists of video games:

> A central concept for the architecture of video games is that they are part of the action. They live together with the characters. They are often theatrical architecture, with traps, moving walls, pitfalls, etc. They respond to every move of the player:

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8 A global multimedia network focusing on animations made from games.
in that way, they are living, organic creatures. But they also live because they are visited, admired and interacted with by people (Gerosa, 2008, p.53).

Bernard Tschumi (2012) argued that “there is no architecture without event, no architecture without action, without activities” (p.176). Citing Foucault, Tschumi (2012) said that an event is “the moment of erosion, collapse, questioning, or problematizing the very assumption of the setting within which a drama may take place – occasioning the chance or possibility of another, different setting” (p.176). History-based games unfold in a spatial context, such as an ancient city in the Roman Empire (e.g., Ryse: Son of Rome), Paris during the French Revolution (e.g., Assassin’s Creed Unity), or Los Angeles in the 1940s (e.g., La Noire). Players engage in activities to complete a mission (e.g., investigating a crime scene, destroying the enemies’ structures, or helping a certain group). Events in a game can occur through unexpected encounters in the games (e.g., a player meeting a street hawker selling something from that period) within the social-historical contexts by roaming the open-world of the game. This can resonate with Foucault’s explanation; players may begin questioning or problematizing the very assumption of the game (i.e., gaming as accomplishing pre-determined missions) and find their own missions (e.g., free roaming in the game world to explore its architecture).

Jean Nouvel, a French architect, similarly said that “[a]rchitecture exists, like cinema, in the dimension of time and movement. One conceives and reads a building in terms of sequences.” As Nouvel explained, movement (activity) of people help them conceive building (space) through time in sequences. Players experience time in different scales within history-based games. In addition to the real-time that players spend with the video games, players engage with the time that unfolds in the virtual world of the game. In this time scale, a couple of days or weeks or months

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9 http://www.pritzkerprize.com/2008/bio
in the virtual world of the game may pass just in half an hour. The players also engage with the historical time that the game narrative belongs to. It is indicative of its culture and customs. People, as historical societies or individuals are inseparable parts of video games considering their roles in historical events.

We consider people, time, space, event, and activity as five factors that represent life in games. These factors can guide game creators to provide players with educational experiences within the historical contexts of the games. These factors are critical in identifying or designing structural attributes of the history-based video games. Thus, these factors can play an important role in transforming a history-based video game into an educational medium. Based on Squire’s study (2011), considerable historical content of such games helps players make decisions leading to alternative ideas of the historical consequences.

4.4.3. History-based video games plot

To visualize the information from the literature, we created a plot in which a continuum of historical authenticity and five factors of historical context represent two axes. The plot can be used as a basis for defining different factors in relation to the historical authenticity. The horizontal axis does not represent fixed ends of the authenticity continuum (independent variable). Instead, it represents both the subjective and relative positions of more authentic and less authentic factors of a video game. For each game, the higher the frequency of appearing a factor in players’ comments (subjective) the further the factor goes towards right side of the authenticity continuum (relative) in Figure 4-2. The vertical axis with the factors can play a critical role in identifying or designing structural attributes of the history-based video games. Depending on the nature of a game, specific variables can be used to describe the response to specific occasions in the game. A plot of authenticity against these five factors can be used to compare
multiple video games to understand the educational values they offer. This plot will be used in this paper for comparing sample video games and their educational values.

4.5. Method

According to Desurvire and El-Nasr (2013), “[g]ame user research is still in its inception” (p. 87). Researchers developed several methods (Desurvire & El-Nasr, 2013). However, these methods focus less on players’ intellectual engagement with the game but more on the playability and usability of the games (Desurvire & El-Nasr, 2013). To understand the learning potentials of video games and provide a tool for others to examine similar games, authors selected five history-based video games for discussion in this paper. Our search for the games with “historical” tag on Steam returned 327 game titles. We selected games for this paper based on the historical authenticity and popularity of the video games. To investigate how game players engage in online conversations about historical aspects of the games, we analyzed the comments and discussions of players

<table>
<thead>
<tr>
<th>TABLE 4-1</th>
<th>SAMPLES OF COMMERCIAL HISTORY-BASED VIDEO GAMES</th>
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<tbody>
<tr>
<td><strong>TITILE (RELEASE YEAR)</strong></td>
<td><strong>DESCRIPTION</strong></td>
</tr>
<tr>
<td><strong>ASSASSIN’S CREED UNITY (2014)</strong></td>
<td>Action-adventure game set in Paris during the French Revolution. The player must fight for peace and free will, against the enemies to expose the true powers behind the Revolution. (Ubisoft Montreal)</td>
</tr>
<tr>
<td><strong>LA NOIRE (2011)</strong></td>
<td>Neo-noir detective action-adventure video game set in Los Angeles during the 1940s. The player assumes the role of a detective investigating several real LAPD cases based on a specific type of crime. (Rockstar Games)</td>
</tr>
<tr>
<td><strong>THE SABOTEUR (2009)</strong></td>
<td>Neo-noir open-world third-person action-adventure game set during World War II (WWII) in German-occupied France. The player is a rival who joins the French Resistance to take revenge of his best friend killed by a Nazi commander. (Electronic Arts)</td>
</tr>
<tr>
<td><strong>CALL OF DUTY: WORLD AT WAR (2008)</strong></td>
<td>First-person shooter game set in the period of WWII. It is open-ended, giving the player multiple ways to complete several missions and objectives. (Activision)</td>
</tr>
<tr>
<td><strong>BROTHERS IN ARMS: ROAD TO HILL 30 (2005)</strong></td>
<td>First-person shooter game set around the true story of the 502nd Parachute Infantry Regiment of the famed 101st Airborne Division who were dropped behind German lines on D-Day. It is based on the historical Mission Albany, in which the player must complete tasks based on real actions of the 101st in Normandy. (Ubisoft)</td>
</tr>
</tbody>
</table>

10Steam is an online distribution platform developed by Valve Corporation that provides digital rights management, multiplayer gaming, video streaming and social networking services.
retrieved from online communities and venues including NeoGAF, YouTube, and GameFAQs. Table 4-1 summarizes the themes, publishers, and genres of the selected games for this study.

We studied 952 players’ comments and public discussions made by the players of these five games to identify themes and keywords based on the historical authenticity and factors of each game. We applied open-coding and qualitative data analysis to these textual materials using NVivo 11 software (Watson, Mong, & Harris, 2011). The list of themes and keywords, as well as the players’ comments, were then enlisted for the later discussions by the authors. Based on the objective of this research, authors discussed and refined the themes and keywords until reaching an agreement to consider selected ones for inclusion in the study. In the findings, we included the comments and discussions relevant to the players’ inquiries into history. Later, we used these findings to compare the learning potentials and values of each selected game for players using the plot in Figure 4-2.

Players had commented on several aspects of the games, such as narrative, the backstory of characters, historical values and veracity, game environment, atmosphere, etc. Using NVivo 11

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11 NVivo is a computer software package designed for researchers working with very rich text-based and/or multimedia information, where deep levels of analysis on small or large volumes of data are required.
to analyze every sentence of the online discourses, we could organize the codes and themes based on their similarity (Figure 4-1).

The frequency of the codes and themes were then extracted from NVivo 11. To exemplify, the frequency of direct and aggregated references to “authenticity” was 239. This number was 170 for “space”, 150 for “people”, 100 for “activity”, 95 for “time, and 78 for “event’. These themes represent most of the keywords repeated in the online discourses that we studied.

4.6. Findings

The findings are categorized and discussed below with a variety of textual materials cited from the players in relation to each game. We used pseudonyms (derived from mythology and written in italics) to cite players.

4.6.1. “A huge labour of love” – Learning the history and social history through the game

Players noticed the effort to include accurate representations in the games. Ubisoft (2015) claimed that professors and historians from France helped to develop the world of the Assassin’s Creed Unity (ACU) and the everyday life of Parisians during the French Revolution12. Players seemed to know about such effort when Hera delineated “[w]hen the French re-create France you can assume you'll have a fairly accurate depiction.” Many players such as Thetis and Aphrodite acknowledged the “real-life events you’ll see in Assassin's Creed Unity”. They might be pointing at the people’s lives on the streets during the French Revolution. The information about people’s real-life events shapes a considerable part of the social history. Players also found the architecture in the game realistic and accurate. For Scamander, “[t]he depth in details to architecture was outstanding”

12 https://www.ubisoft.com/fr-ca/
whereas for *Athena*, “[t]he story was just there to keep me going but I really played just for the architecture and visuals.”

Rockstar Games\(^\text{13}\) confirmed that the events in LA Noire were recreated based on real evidence, documents, and film recordings. The players also acknowledged this in their comments. *Merlin* mentioned that “[l]ast I heard, 90% of the cases were based on genuine crimes.” *Iseult* stated that “[a]parently the main dude behind LA Noire read through about 1500 newspapers to get his facts accurate, so I would say a lot of them are very close to being accurate.” The players appreciated authenticity and accuracy of LA Noire’s representation of Los Angeles beyond the story. Poseidon who lives in LA mentioned that “[l]iving in Hollywood makes it pretty cool to just drive the LA Noire neighborhoods, there was A LOT of work put into the city.” His comment reveals the possibility of learning about the urban development of this city over time. *Dido* expressed that “[o]ver time, L.A. Noire has proven to be a masterpiece of recreation, as one thing that the game certainly did well was honoring its source material.”

The Saboteur represents Paris during the World War II (WWII) occupation and recreates the atmosphere of the time. Although the story of the game is not fully accurate, the activities of the French Resistance, everyday life of Parisians at the time, and the look of the city during the occupation are true to history. *Polydorus* mentioned that the game is “based on many of the real events” and shared knowledge about the main character: “Sean Devlin is based off an S.O.E.\(^\text{14}\) operative named William Grover-Williams, a race car driver who help organize the resistance movements and plot sabotage cells.”

As a first-person shooter game, Call of Duty: World at War (COD), pays attention to a variety of real events and important battles of the WWII such as the battles of Stalingrad and Okinawa. The

\(^{13}\) https://www.rockstargames.com/

\(^{14}\) The Special Operations Executive (SOE) was a British World War II organization.
game allows playing alongside historical groups involved in the WWII such as Russian and American troops. Gaheris acknowledged that “[t]he campaign is really cool, and it proves the struggle that the Russians had during the Germans’ rise to power.” Several players, such as Epaphus and Galeshin, explained that this game taught them more about WWII than their history class at school. 

The players of Brothers in Arms: Road to Hill 30 (BIA) compared the game character with an actual historical figure and acknowledged its legitimacy. Diomedes claimed that the main characters of the game represent, “a paratrooper part of the 101st Airborne, 502 Regiment, 2nd Battalion.” Sharing his inquiries about the game, Calchas explained that “[m]any man-hours were spent pouring over old aerial reconnaissance photographs, in order to recreate the landscape as accurately as possible.” According to Nestor, “they replicated major battlefields down to the closest details of its time”, whereas Teucer pointed out that “[t]he producers of this game put a huge labour of love into producing this way back in 2004/05 with numerous trips to Normandy, researching, visiting battle sites, testing weaponry etc. and all this adds to the realism.” In response to Teucer, Agenor wrote that “[e]ach battle scene in the game was actually a carbon copy of the real battle site. So, the producers did definitely put a lot of effort into it.”

Players put their energy into exploration as well as evaluation of the game events against the historical events, which may involve various learning outcomes, such as content understanding and problem-solving. Their evaluations about the historical events behind these games often resulted in acknowledging the effort by the game developers to create accurate representations.

4.6.2. “This game made me care about its citizens” – Sympathy for soldiers and citizens

BIA seemed to engage players emotionally and intellectually in the life story of the soldiers. For example, Belus mentioned that “[t]he game is remarkable not just for the authenticity, but the true
to life story of the soldiers.” Other players, such as Theano, responded in agreement: “it is probably due to the recreated locations and the stellar voice acting.” It seems that some players engage deeply with space and the people depicted in the game. Some players, such as Sarpedon, delineated that “when you realize that you care more about your men than yourself is a signal that you got the spirit of the game.” Similarly, a player of The Saboteur, Caradoc, expressed that “the best part of this game and why I keep playing it is that this game made me care about its citizens.” According to Kim & Kim (2010), “having emotions would mean having certain evaluative appraisals of, for example, a person, which indicate having knowledge about the person’s characteristics” (p.14). The feeling and understanding that Sarpedon pointed to as well as the sympathy that Sarpedon and Caradoc described can be considered as the effective learning outcomes of such video games.

4.6.3. “It's like time travel” – Visiting the historical time and space

Some players took their freedom to explore the open world of the games rather than doing the mission. In discussing ACU, Iris mentioned, “as a Parisian, this game gives me the possibility to see some missing places in Paris, such as the Tuileries castle or the court of miracles.” Another player, Pandarus, explained that “[t]his is why I play Assassin's Creed. To visit places in the past that don't exist anymore. Just walking around Paris during the French Revolution is incredible. Reading the newspaper, listening to people talking in a café, listening to someone making a speech about the politics of the day. It's like time travel.” The activity and space (i.e., free roaming in Paris), as well as the time and event (i.e., during the French Revolution), provide the ground for an immersive play.

The case for BIA was different. As the game narrates stories about historical battles, revisiting the history was limited to the atmosphere of the battlefield. Lycaon said, “after being in the military for a few years, I found myself coming back to BIA.”
Similar impressions were also reported about LA Noire. Lancelot played this game with his father who was born in the 1940s in Los Angeles (LA). Lancelot explained that he got to learn about his grandfather while playing and having conversations with his father. His grandfather was a police officer in the 1940s and shot a person in LA. He mentioned, “[i]t was the only time my grandfather ever used his gun - and that's just one of the things I learned playing L.A. Noire with my dad a few weeks back.” Lancelot continued, “[l]ike any son with a father in his late 60s, I assumed his sudden silence meant he was having a minor cardiac event. He wasn't, however: he was simply back in the presence of a building he hadn't seen in half a century.” Two players even went further and played the game alongside their grandmothers who lived in LA in the 1940s. Abas explained that “one of many reasons I very much enjoyed L.A. Noire, despite its occasional faults, is that I was able to do this too with my grandmother who was a teenager when the game is set.” Another player, Ocalea, delineated, “I played and drove around, for my grandmother who grew up in LA in the 1940s, and she said it was spot on and loved seeing so much of her world recreated like that.” Such activities by players (i.e., playing a game with a person belonging to an earlier generation) echo the affective aspect of learning, which becomes personally more meaningful both during museum visit event and before/after the visit (Schreiner, 2008).

4.6.4. “Getting back to the feel of problem-solving” – Finding new ways of doing

Some games provide players with an open-world to explore (e.g., LA Noire and ACU) and others offer players multiple ways to accomplish a mission (e.g., The Saboteur and BIA). Regarding The Saboteur, Gareth explained that “[t]he sandbox quality of this game gives you lots of ‘play’ time, thinking of different ways you can take out an installation.” Other players, such as Pelleas and Zeus, shared a very similar view. For Pellinore, finding different ways of accomplishing The Saboteur missions was an attempt to solve a problem: “I'm finally getting back to the feel of the
problem-solving.”

Similarly, LA Noire’s game mission is for the players to solve criminal cases. As Apollo explained, “[e]verything revolves around your own willingness to get to the truth: your ability to find every clue, check every nook and cranny, and get answers from your witnesses and suspects.” Players could also develop their own method to solve the cases. According to Ares, “[a]fter investigating the scene I would always take a few minutes to put together what I thought happened so if any of the witnesses said something contrary to my version of events, I would know to grill them. It usually worked out well.” Seemingly, players are in a position to make (good or bad) decisions and deal with the consequences of their decisions in LA Noire.

COD has a potential for players to come up with different ways of playing the game. The players may twist historical content available in the game by creating modifications (mods). This could provide players with an opportunity to reflect on historical events or groups involved in WWII. One of the most popular mods is to make the invaders in COD as zombies. For example, Brastius mentioned that “[t]his is all where it started. Zombie mode!” Such a representation may show how those who created this mod twisted the dark impression of the invaders into non-player characters.

4.6.5. “It's like being back at school!” – Learning history by discussion and decision-making

Sometimes, the online discussions by the players went into details about the history and consequent sharing of information. In discussing ACU, Diomedes delineated that “[t]he layout of Paris was a pretty big mess before Haussmann’s renovation.”¹⁵ In exchanging historical information, players talked about the similarities of a character in Assassin’s Creed Unity (ACU) to Napoleon Bonaparte and referred to history. Ornytus clarified in the ongoing discussion that “the rise of

¹⁵ Haussmann’s renovation of Paris was a vast public program directed by Baron Haussmann, between 1853 and 1870.
Napoleon was from 1802. I believe when he becomes consul then an emperor in 1804 till 1815 where he loses the Waterloo battle.” Cydon, another player participating in this ongoing discussion acknowledged Ornytus’s sharing of information by writing “[g]ood history recap.” Another player, Pallene, expressed his amazement about the ongoing discussion by saying “[m]an, it's like being back at school!” Such ongoing discussions raised in a game forum is promising and shows that players not only play the game but also pay attention to the historical content, collect information from sources, and examine the information through the discussions. Similarly, the historical context of BIA was also a source of learning for some players. Laodice commented, “I learned more about D-Day from the extras menu than I have ever learned from high school history class.” Iphis explained, “honestly, this game is a sublime gem for a history nut like me.”

Discussions about LA Noire were mostly on the LA Police Department cases incorporated in the game, often verifying their authenticity. Deneter mentioned, “Mickey Cohen and the Black Dahlia killer are real people.” Dionysus responded, “[f]rom what I've read, most of the cases were based on real cases but not all were taken from 1947.” Hades joined this conversation and delineated, “[t]hink of this game like a huge connected series of Dragnet episodes, the cases are real, the names have been changed to protect the innocent.” Later, players talked about other cases in a follow up to the ongoing discussion by creating new threads, such as “Red Lipstick Murder” (by Hestia) and “Silk Stocking Murder” (by Eros). Eros went into factual details of the Silk-Stocking Murder: “[i]n 1947, Rosenda Mondragon was found dead after being strangled by a stocking near the City Hall in Los Angeles.” Moreover, online discussions revealed that several players found ways to play the game together, although LA Noire is a single player game. Juno explained, “I played until dawn with the family and that was great. I'd pause at key moments and let everyone discuss what we
should do.” Artemis responded, “I agree and have had similar experiences with friends and family who aren't gamers. The discussions that come out of it are great.”

4.7. Discussions

The historical references of each game have different potentials for learning. We compare and summarize the findings on how the players might inquire into history through these video games (Table 4-2). Based on the comments and the discussions raised by the players, it seems that players pay attention to and learn from the representations of the historical contexts in the video games. Comments indicate that the authenticity of representations in the historical contexts of the games

<table>
<thead>
<tr>
<th>TITLE</th>
<th>LEARNING POTENTIALS</th>
<th>HISTORICAL REFERENCE</th>
</tr>
</thead>
</table>
| ASSASSIN'S CREED UNITY | - Learning about the history and social history during the French Revolution  
- Experiencing Paris scenes from this historical period  
- Learning the historical details through online discussions | Objects (e.g., outfits), atmosphere (e.g., life during the French Revolution), buildings (e.g., Notre-Dame Cathedral), and communications (e.g., trade) |
| LA NOIRE | - Learning the history and social history during the 1940s in LA,  
- Experiencing LA from the 1940s  
- Finding ways to solve problems and accomplish the missions  
- Making in-room group decisions  
- Learning criminological information through the game and online discussions | Events (e.g., famous crimes), atmosphere (e.g., life in the 1940s), lifestyle (e.g., sociocultural interactions), buildings (e.g., City Hall), and police activities (e.g., investigation methods). |
| THE SABOTEUR | - Learning the history and social history during the German occupation of France  
- Sympathising with situation and people through immersion  
- Understanding the ways of being French Resistance and doing stealth missions | Landscapes (e.g., Eiffel Tower), buildings (Sacré-Cœur Basilica), events (e.g., the occupation of France during WWII), and people (e.g., French Resistance). |
| CALL OF DUTY: WORLD AT WAR | - Learning about certain World War II battles  
- Sympathising with soldiers through immersion  
- Finding ways of being and doing the missions of the game | Battlefields (e.g., Stalingrad), groups and troops (e.g., USSR troops), battle style (e.g., Urban warfare), and weaponry (e.g., SV1-40 rifle). |
| BROTHERS IN ARMS: ROAD TO HILL 30 | - Learning about World War II, Mission Alabany  
- Experiencing the battlefield and events  
- Sympathising with the soldiers at war  
- Learning about the historic battle through the game and online discussions | Battlefields (e.g., Normandy), events (e.g., Mission Alabany), groups and troops (e.g., the 502nd Parachute Infantry Regiment (PIR) of the 101st Airborne Division), weaponry (e.g., M1911 pistol), and atmosphere (e.g., representing E-Day). |
could be used for specific educational purposes.

We plot the data (Figure 4-2) to visualize the historical reference and authenticity of each game. In Figure 4-2, each game is represented on the plot with a certain shape (i.e. indicators).

![Completed plot for history-based video games.](image)

Concentrating on two games (ACU and LA Noire), we show the specific use of the plot for investigating the potentials of these games.

For each factor, namely, people, time, space, event, and activity, an assigned shape is located on the plot that can move on the continuum (i.e., the horizontal axis of Figure 4-2) towards more, or less, authentic. This continuum is based on the discussions by Metzger and Paxton (2016). Those video games that focus on fantasy shift towards the less authentic end of the continuum on the plot. For example, some versions of the COD like the Zombie modification, take place in a dystopian representation of spaces and events in the past. So, the indicators related to time, space, and event are
close to the left side of the continuum.

Points enlisted in the callouts may be different from game to game. However, based on the findings of this research and the comments from the players, they play a significant role in making a video game pertinent for particular use as an educational medium. For instance, a video game like The Saboteur may authentically represent the historical occurrences – i.e., event in Tschumi’s work (2012) – or buildings, and landscapes – i.e., space in Tschumi’s work (2012) – but include fictional characters – i.e., people in Tschumi’s work (2012). If the purpose of learning revolves around the historical event or space and buildings, then the game may be a good choice as Pallasmaa (2001) stated that “buildings and cities create and preserve images of culture and a particular way of life”. However, if the purpose is to learn about historical figures the game may not be a good choice.

As Figure 4-2 shows, ACU integrates fictional protagonist/antagonist into the game although the outfitting style of ordinary people and their social interactions remain loyal to the historical evidence as Ubisoft and players mentioned. The number of players’ references to the authenticity of game characters was two. Therefore, on the plot, game characters (first factor: people) appear less authentic on the continuum (Metzger & Paxton, 2016). However, the historical time and space (i.e., Paris during the French Revolution) are considerably based on extensive research according to the findings. Moreover, for each player, the game could represent the atmosphere of the time, buildings and environment (space) of the game authentically. This recalls Pallasma’s (2001) idea of creating and preserving the images of history. Players of the ACU referred to the authenticity of “time” 15 times and to the authenticity of “space” 29 times. The event of the revolution is again fictionalized to some extents and involves fictional characters (protagonist and antagonist groups). The number of references by players to the authenticity of the “event” was three. Therefore, the “event” is located in the mid-low part of the authenticity continuum on the plot. The rebellious activity of the main
character in the game has some real and fictional sides as well. Although the character belongs to a fictional society, the nature of rebellious activities of this character, such as guerrilla-warfare and fire/ambush strategy, in the game has similarities in many aspects with the activities that took place during the French Revolution\textsuperscript{16}. Moreover, players referred to the authenticity of such “activities” 12 times. This means that ACU could be appropriate for the learning purposes of social history, existing architecture of the time, and the general atmosphere of French Revolution.

According to the findings, LA Noire represents a game with almost every factor close to the right end of authenticity continuum. The number of players’ reference to the authenticity of “time” was 23, “space” was 39, “people” was 38, “event” was 23, and “activity” was 31. As the findings pointed out, the atmosphere of the 1940s (time), the city of Los Angeles (space), and the criminal events that happened in that era are authentically recreated in the game based on the evidence and documents. The activity of investigating the crimes are also representative of the methods used by LAPD in the 1940s such as joint questioning and the Reid technique. The outfits of people and their social interactions, as well as the vehicles that people used in the 1940s, are also a good representation of the period (time). However, the main character of the game may not be an exact member of LAPD in the 1940s. This does not dramatically change the authenticity of the game and therefore “people” is placed to the left of – but still close to the right end – of the authenticity continuum on the horizontal axis of the plot. Resonating with Pallasma’s (2001) idea about creating and preserving the images of history, LA Noire can be used for learning about the modern history of Los Angeles having depicted with a high degree of accuracy, the atmosphere, architecture, and criminology as well as clothing and vehicles of the 1940s.

Based on the findings from the analysis of the online comments, the Saboteur represents the

atmosphere (space and time) of the occupation of France during the World War II (WWII) representative of the reality. The players acknowledged the authenticity of the atmosphere frequently (i.e., “time” 20 and “space” 36 times) in their comments. Moreover, space in this game is quite close to Paris during WWII. Everyday life of people in occupied Paris, as well as the activities of French Résistance at the time of occupation, are also partially representative of the reality in that era. Players of this game referred to the authenticity of “people” 32, “event” 18, and “activity” 20 times in their comments. Therefore, all factors of this game are located from the middle to the more authentic side of the continuum on the plot (Figure 4-2). The Saboteur seems to be useful for learning about general atmosphere and urban landscape as well as the history of France and related events during the German occupation, regarding Pallasma’s (2001) idea about the images of history.

Given the findings about the COD, the time and events of the selected battles during WWII are relatively authentic regarding Metzger and Paxton’s (2016) deployments. The number of references to each of these two factors was 13. The ruined buildings and cities in the game (space) are also considerable as they help a lot to reinforce the authentic atmosphere and events of the time. However, disciplinary practices are mixed with fictionalized facts. For example, the activity of fighting with the enemy and the soldiers in the game are partly fictionalized. Players acknowledged the authenticity of “space” 25 times in their discussions. Since the characters change from time to time in the game and there are few links between the narrative of the game and the characters (people), these two factors, people and activity, represent the lower level of authenticity. Yet, the uniforms of the soldiers and their weaponry are authentically represented in the game. The number of players’ references to “people” was 24 and to “activity” was nine. Therefore, Call of Duty: World at War (COD) can serve some educational purposes that are focused on selected battles of the WWII, such as the battle of Stalingrad, as well as the general atmosphere of WWII in the battlefields, including
weaponry, related events, and characteristics of regiments belonging to different countries, such as Germany, Russia, Japan, and the United States.

Based on the findings, Brothers in Arms: Road to Hill 30 (BIA), paid considerable, attention to authenticity. The number of players references to the authenticity of “time” was 24. This number was 41 for “space”, 37 for “people”, 21 for “event”, and 28 for “activity”. This resonates with Metzger and Paxton’s (2016) deployments. The players acknowledged lots of research and assessment of historical evidence and documents to support the game development. People represented in the game are the 502nd Parachute Infantry Regiment of the famed 101st Airborne Division who were dropped behind German lines (place) on D-Day (time). The game is based on the historical Mission Albany (event) and the player must accomplish the mission (activity). The people, place, event, activity, and time are all historically accurate. Although the game revolves around a limited chunk of the WWII events, spaces, people, and time, it delivers certain values, such as sympathy and caring about soldiers, to the players. Many details, such as the uniforms of the soldiers and their weaponry are authentically represented in the game. Resonating with Pallasma’s (2001) idea, the factors of BIA are located towards the more authentic side of the continuum on the plot. This game can be used for educational purposes that concentrate on the study of a particular mission during the WWII. It can serve as a medium to learn about the general atmosphere of the D-Day in the battlefield, weaponry, and characteristics of the 502nd Parachute Infantry Regiment of the 101st Airborne Division.

The outcomes for players included learning about history and social history and consequentially building or developing their knowledge about specific topics. Revisiting history and learning historical details through their post-play discussions shape another part of the outcomes. Through their discussions, the exchange of information and knowledge took place. Teamwork to go through
a historical event, mission, or mystery was another considerable part of the outcome. Sometimes teamwork was focused on multiplayer mode and sometimes it was focused on playing a single player game with a friend, parent, or a grandparent who was familiar with the specific part of the history represented in the game. Such a teamwork could help them to learn about the history by doing it along with a person familiar with certain historical events. Sympathizing through their immersive game experiences were also part of the outcomes for some players. These outcomes involved caring about others and feeling better about one-self. Moreover, finding new ways of being, such as being a game modifier, could help some players to develop new identities. More explicitly, this process let players see themselves as co-designers implementing a modification of a game to share with others and get feedback from them. In addition, finding new ways of doing the game mission was obvious in the creative ways that players could implement to play a game beyond its intended purposes. It also helps to find their own ways to engage in deeper learning, drawing on their desire. For example, several players refused to play the mission of a game and instead explore the open world of the game to visit the architectural structures and historic monuments.

4.8. Conclusion

A considerable amount of online conversations in game forums can be helpful in evaluating players’ responses to specific occurrences in the game. These conversations contain valuable points that can help educators, game developers, and designers understand how casual players play and learn from a commercial game.

This paper explored five history-based video games to understand the learning potentials for the casual players in relation to the historical authenticity and factors of the historical context in such games (i.e., people, time, space, event, activity). Players revealed they inquire into history using different resources such as online archives, documentaries, history books, and verifications from
those who lived a certain era. A sample of five commercial games was considered for this study (Table 4-1). A plot was then created to visualize the learning potentials of each game and to compare them together. Using NVivo 11 data linked to each game was analyzed (Figure 4-1) and the relative position of factors towards the ends of the authenticity continuum (i.e., the horizontal axis of the plot) was determined (Figure 4-2). As a tool, the suggested plot can provide an overview of learning potentials to facilitate comparison and selection between the history-based video games for the use as an educational platform (Table 4-2). Future studies may add to the factors or go beyond the authenticity of the games.

Undoubtedly, there are other aspects of learning through video games that are not depicted in this paper. These aspects include a range of skills such as problem-solving and strategic decision making. For future studies, researchers may want to investigate the role of historical authenticity and factors of historical context in developing such skills. Sociocultural differences and preferences in the learning outcomes, which was informally witnessed during the investigations of this study, may have impacts on how players look at learning values of the games. For instance, when players made modifications to the COD, the number of zombie modifications surpassed the other modifications, which could have been influenced by popular media and gender.

In terms of using video games for learning purposes, the outcomes of this research suggest that they have the potential for particular proposes such as learning about certain people, spaces, events, details in the history, social history, and alternative histories. Moreover, this paper may be considered as an attempt to motivate game developers to more deeply look at how their games may influence players and learners beyond the entertainment purposes. Developers and game designers may want to provide educational versions or special editions of their games to be used in educational or cultural institutes such as universities and museums. Commercial games have a great potential for in-depth
learning, as they incorporate the vast knowledge of experts, such as historians and librarians, as well as university professors in the fields of history, social history, and digital media. Maximizing this vast knowledge of experts may help players learn about history. We hope that our work contributes to the scholarly discussion on design and application of games among multiple disciplines and stimulates further exploration on the synergistic work between industry and academia.
Chapter 5

Learning and enjoyment through museum hybrid spaces: an empirical study
5.1. Abstract

A museum hybrid space combines physical artifacts co-located with virtual and augmented reality displays. Although the technology exists to provide museums with hybrid space, there are few empirical studies on human behavior and the application of hybrid space. Museums, as agents of social change, must consider human behavior in potential hybrid spaces as a part of the whole museum experience. The goal of this research is to provide a way for enhancing the quality of hybrid space experience in museums for audiences using virtual reality (VR) technology. To reach this goal, a cognitive model for improving the quality of spatial experiences in the built environment is applied to provide the setup for experimentation. A sample hybrid space, namely, a VR-enhanced exhibition is then setup and compared with two traditional exhibits, one relying on the combination of labels and photos and the other relying on the combination of videos and photos. Results show that the audience experience is improved within the VR-enhanced exhibition in terms of learning and enjoyment when compared with the traditional exhibitions.

5.2. Keywords

hybrid space, virtual reality, museum experience, experimental study, human behavior, edutainment

5.3. Introduction

In 1947, Andre Malraux presented his famous idea of an imaginary museum without walls and explained that photographic reproductions of artworks make art accessible to those who never visit museums (Huhtamo, 2010). Taking this idea further, imagine a museum space where anyone could experience in virtual reality (VR) the background to an artifact, a historic era, or a work of art in an immersive, interactive, and game-like environment. While Johan Huizinga mentioned that play is fundamental in cultural development, harnessing playful activities for museums is not well developed (Walker & Fróes, 2011). Burton and Scott’s (2003) data shows that museum visits have
increasingly diminished over the past decades in many parts of the world (e.g., 15.6% in Scotland, 12% in Australia, 9% in Germany, and 7% in Denmark). Yet, learning through digital media and engaging in playful activities including video games is increasing (Burton & Scott, 2003). One way for museums to deal with this problem is taking the ideas of Malraux and Huizinga further. The ideas of Malraux and Huizinga combined with alternative reality technology\(^{17}\) advances can take us to the gates of the hybrid museum. A hybrid museum can be defined as a museum that takes advantage of hybrid space to improve the museum experience for audience. According to Baradaran Rahimi, Levy, and Boyd (2018a), hybrid space takes the power of the digital world to empower the physical world using virtual reality (VR), augmented reality (AR), and augmented virtuality (AV). A museum experience can be viewed as a spatial experience in general as it unfolds in the museum space. However, a museum experience is a special spatial experience with the purpose to entertain and educate (Silverstone, 1994). Improvement in the museum experience can be considered on two levels: a general level of museum experience that focuses on the setting and the quality of the spatial experience and a special level of museum experience that aims to entertain and educate the audience by facilitating their enjoyment and learning.

Although the technology (e.g., AR, VR, and AV) exists to provide museums with hybrid space, there are few empirical studies on the application of hybrid space as a part of the greater solution for improving the quality of the museum experience. The goal of this research is to enhance the quality of spatial experience within the hybrid space of the museum in terms of learning and enjoyment. Baradaran Rahimi, Levy, Boyd, and Dadkhahfard (2018b) offered a specific model to provide the setup for experimentation and empirical study of audiences’ experience. Their model is applied in the present research to setup a hybrid space, namely, the VR-enhanced exhibition of Los Angeles

\(^{17}\) Alternative reality technology refers to virtual reality (VR), augmented reality (AR), and augmented virtuality (AV). It is sometimes called extended reality (XR).
(LA) in the 1940s. As it follows, comparing this VR-enhanced exhibit with traditional exhibits (i.e. actual space) showed the VR-enhanced exhibition was able to improve the museum experience for audiences in terms of learning and enjoyment.

5.3.1. General level of museum experience: Hybrid space of museum and the spatial experience

A VR-enhanced environment can be categorized as a Hybrid Space (Baradaran Rahimi et al., 2018a). In such an environment within a museum, visitors can “interact with people of an ancient era and sensually immerse themselves in the history using digital interfaces” (Baradaran Rahimi et al., 2018a, p. 2). Since play is fundamental to cultural development (Walker & Fróes, 2011), hybrid spaces in cultural institutions like museums might take advantage of game-like platforms to create the possibility for visitors to engage in playful activities that could enhance their experience and learning. The experience of such a hybrid space is still a spatial experience in a general sense as it takes place in the physical space. Baradaran Rahimi et al. (2018b) identify and define basic components of a spatial experience, namely, people, context, and activity. Baradaran Rahimi et al. (2018b) then introduced a three-stage model – encouraging, enabling, and enclosing – for enhancing the quality of the spatial experience (Figure 5-1). Their model is applied in the present study to setup the hybrid space of a VR-enhanced museum experience.

![Figure 5-1. Model for enhancing the quality of spatial experiences (Baradaran Rahimi et al. 2018b).](image-url)
Silverstone (1994) stated that pleasing and educating the audience are important goals for museums. Education in museums is generally not formal, although there are several learning outcomes for museums (Hooper-Greenhill et al., 2003). Increase in knowledge along with enjoyment shape a considerable part of the learning outcomes of informal education in museums (Hooper-Greenhill, 2004). Undoubtedly, there exist other possible learning outcomes for museums, such as change in attitudes or values (Hooper-Greenhill et al., 2003) or making personal meanings (Falk, Moussouri, & Coulson, 1998). Yet, the present research focuses on increase in knowledge and enjoyment through providing a VR-enhanced environment.

5.3.1.1. Encouraging stage in the VR-enhanced museum

In every enhanced spatial experience the audience gets encouraged at the outset by a variety of strategies such as persuasion, designing for meanings, and including concepts in design (Baradaran Rahimi et al., 2018b, p.245).

Providing the audiences with a level of control over the environment as well as providing them with a relative autonomy through all or a part of the environment can persuade them to get involved in certain spatial experiences (Lidwell et al., 2010). As a VR-enhanced museum experience unfolds in a game-like environment, with support for free roaming, it offers control and autonomy to the audience. Audiences can follow the story of the game or choose to roam around the open world of the game on their own. For the present study, a game (i.e., LA Noire) is used as a platform for the VR-enhanced museum experience to encourage audiences to choose, of their own will, between pursuing the game story or exploring and roaming the game world. The VR replication of Los Angeles in this game benefits from precise modeling and exceptional renderings of the Los Angeles in the 1940s based on the real evidence and footage (Baradaran Rahimi, Kim, Levy, & Boyd, 2019). This platform was selected in order to create a sense of presence for Los Angeles during the 1940s (i.e., designing for meanings). Los Angeles is a well-known city around the world. However, there
are few individuals who had the chance to visit this city in the 1940s. Having the opportunity to be present in Los Angeles of the 1940s today, in the 21st century, can be educational and encouraging in Baradaran Rahimi et al.’s sense. The concept that the present study focused on was the museum experience. Combining the physical museum environment with a game-like environment has the potential to encourage both museumgoers and gamers to reconsider the concept of museum experience in the 21st century.

5.3.1.2. Enabling stage in the VR-enhanced museum

The audience must be then enabled by special means, such as immersive and interactive capabilities of the environment along with its security and safety attributes, to get involved with the spatial experience (Baradaran Rahimi et al., 2018b, p.245).

Immersion in a VR-enhanced museum can be considered as the sense of “presence”, a perception of being physically present in a non-physical world (Whyte, 2002). According to Mikropoulos (2006), “philosophers, sociologists, psychologists and computer scientists clearly state or imply the sense of presence as the key feature of virtual environments (VEs)” (p. 197). Immersion enables the audience to get into the flow state of mind (Csikszentmihalyi, 1990; Carliner, 2001) where they lose complete sense of time because of the enjoyment and full engagement in the VR-enhanced environment. For the hybrid space of this study, the immersive capability of VR-enhanced environment, as well as the game platform (i.e., LA Noire), can considerably facilitate the process of getting museum visitors into the flow state of mind.

Interaction can be described as the mutual action of two or more individuals and/or objects that influence one another. The idea of a two-way effect is essential in the concept of interaction, as opposed to a one-way causal effect. The multitude of interactions such as social, cultural, and spatial in an actual space can take new shapes in a VR-enhanced space. Today people socialize,
make shared spaces, replicate the real life, and interact with each other using platforms such as Decentraland, Second Life, and Minecraft. In addition to traditional interactions in a museum, a VR-enhanced museum experience supports interactions with virtual objects and artificial intelligence (AI) characters within the game platform (Roussou, 2001). For instance, a museum audience may talk to a curator asking about an interesting artifact in the museum belonging to an ancient civilization (i.e. social interaction). Following this social interaction, a VR-enhanced museum curator can offer the audience a pair of VR goggles to immerse in a game-like environment and engage with the story behind the artifact. According to DuFour and DuFour (2013), such engaging and interactive environments have the potential to help audiences learn more about an artifact or a historic event.

In a VR-enhanced museum environment, several considerations exist that are related to security and safety. An important consideration is physical boundaries and obstacles. When a visitor puts on the VR goggles, the field of view is limited, transparency is lacking, and awareness over the physical space decreases. However, recent developments in VR equipment, such as HTC Vive and Oculus Rift, provide a basic sense of awareness over the physical environment through their tracking devices. Awareness over the physical environment and the obstacles around a person is important in the hybrid space of the museums to reduce injuries for the person or damage to the artifacts around the visitor wearing the VR goggles. The area around a person who is experiencing the VR-enhanced museum must be clear of obstacles and passers-by. Security and safety considerations expand to providing reliable and accurate information. To facilitate the examination of the history-based video games in terms of authenticity, veracity and educational values, Baradaran Rahimi at al. (2019), provided a game design plot. This plot is useful in determining suitable game platforms for the VR-enhanced museum experience when several options are
available. Moreover, it can be used for designing a dedicated platform when need be. Commercial games are still more affordable, already available, and far less obtrusive than sophisticated platforms specifically developed for VR-enhanced museum experiences.

5.3.1.3. Enclosing stage in the VR-enhanced museum

Enclosing is a cognitive stage at which the experience deals with the audience’s emotion and engagement (Baradaran Rahimi et al., 2018b). According to Paul Ekman (2007), there are seven fundamental and universal human emotions: joy, disgust, surprise, anger, contempt, sadness, fear. Depending on the content, a museum may trigger one or more of these emotions. For instance, a holocaust museum, a war museum, or a science museum may trigger different emotions. However, joy can be considered as the main emotion that museum experience promotes (Hooper-Greenhill, 2004; Silverstone, 1994). This means that even if a museum experience promotes sadness or fear it can be presented as entertainment. This is common in cinema but not museums. Viewers experience joy when they intentionally watch Alien (promoting horror) directed by Ridley Scott in 1979 (IMDb rate: 8.5). They enjoy Kill Bill (promoting anger) directed by Quentin Tarantino in 2003 (IMDb rate: 8.1). Viewers enjoy Titanic (promoting sadness) directed by James Cameron in 1997 (IMDb rate 7.8).

Engagement can be approached from several perspectives. One perspective that is pertinent to the VR-enhanced museum experience is providing audiences with a game-like environment to harness playful activities in museums (Walker & Fröes, 2011). However, as Walker and Fröes (2011) delineated, “harnessing playful activities for museum learning is mostly undeveloped” (p. 1). Facilitating the flow state of mind through the sense of presence and the use of history-based commercial video games, such as LA Noire, can facilitate the full engagement of audiences with the experience. Such history-based video games offer an opportunity for learning history in such
an immersive, interactive, and engaging way that goes beyond learning through the traditional media like movies and books (Baradaran Rahimi et al., 2019).

5.3.2. Special level of museum experience: Edutainment in the hybrid space of museum

Edutainment is media designed to educate through entertainment. Such media includes content for learning but has incidental entertainment value or vice versa. According to Silverstone (1994), museums “aim to please and to educate; they define, consciously or unconsciously; effectively or ineffectively, an agenda; they translate the otherwise unfamiliar and inaccessible into the familiar and accessible” (p. 162). As museums aim to please and educate, edutainment seems to be a relevant area for museums. In the present research, pleasing and educating shape a special level in the museum experience.

5.3.2.1. Enjoyment

According to the Stanford Encyclopedia of Philosophy (Katz, 2016), pleasure, in the inclusive usages includes the affective positivity of all joy, gladness, liking, and enjoyment. At the root of enjoyment is joy, which is one of the fundamental emotions shown by facial expressions and physical gestures of a person (Ekman, 2007). There is often little thinking or anticipating involved with joy as people respond to what is happening now (Weinschenk, 2011). Hooper-Greenhill et al. (2003) mentioned that enjoyment adds to the quality of museum experience and its learning outcomes. She further explained (Hooper-Greehill, 2004) that enjoyment “includes having fun, or pleasure while using a library, archive or museum” (p.165). Enjoyment as she delineated (Hooper-Greehill, 2004) “can clearly be recognized as one of the outcomes of learning” (p.166). Given the remarkable role that enjoyment can play, it is considered in the present paper as a factor on which to focus to improve the quality of the hybrid museum experience. However, this does not mean that the content of the VR-enhanced museum experience should not promote any other emotions.
In fact, it means that a VR-enhanced museum experience can promote any emotion in a fashion that helps people to engage with and make joy out of their experience.

To measure enjoyment, three variables, namely, approach, avoidance, and time perception (Figure 5-2) are useful (Brengman, 2002; Donovan & Rossiter, 1982). Brengman explains (2002) that affiliation, affect, and spending, are three elements to measure approach and avoidance. Approach in this context is the tendency of individuals to socialize with others (i.e. affiliation), to spend time or money (i.e. spending), and to feel joy because of being in a certain place (i.e. affect). On the contrary, avoidance as Brengman mentions (2002) is the dislike or unwillingness of individuals to socialize with others (i.e. affiliation), to spend time or money (i.e. spending), and to feel joy because of being in a certain place (i.e. affect). Time perception is a defined indicator showing the transformation of stimulus time to judgmental time (Graham, 1981). According to Chinchanachokchai, Duff, and Sar (2015), when a task is not enjoyable or there are fewer stimuli to pay attention to, more attentional resources are available to process temporal cues, which then leads people to perceive time as passing slowly (overestimation). However, when the task is more enjoyable, fewer attentional resources are available for time processing (Chinchanachokchai et al., 2015). Thus, people will perceive time as passing quickly (underestimation).
Based on studies by Brengman (2002) and Donovan and Rossiter (1982), a scale for measuring approach and avoidance has been developed for the present study to investigate enjoyment in the VR-enhanced museums (Appendix B, Questions 17 to 21). Participants respond through a scale from 1 (strongly disagree) to 7 (strongly agree) to a variety of questions concentrated on time, affiliation, affect, and spending. The higher the score in response to a question, the greater the approach is towards the environment. Conversely, the lower the score in response to a question, the greater the avoidance. Moreover, recording time for the museumgoers during their museum experience and comparing it against their time perception is necessary for investigating enjoyment in the present study. As per Brengman (2002) and Donovan and Rossiter (1982), when there is no obligation to be in an environment, tendency to stay implies that a person is enjoying the environment, tends to stay longer, and perceives time as passing quickly.

5.3.2.2. Learning

According to the Contextual Model of Learning, Falk and Dierking (2003) suggest that learning in the museum is influenced by different aspects of the context. Thus, the arrangement of the exhibition seems to mediate the cognitive structure of the experience for the museum audience (Falk & Dierking, 2018; Kwon, Kim, & Woo, 2016; Falk & Storksdieck, 2005). This echoes the links between the general and special levels of the museum experience where the spatial experience supports learning in museums. Although education in museums is not often defined formally, museum curators must “pay attention to specific measures of learning: knowledge gain and thinking” (Donald, 1991, p. 371). According to Kwon et al. (2016), “[m]any educational technologists and learning scientists have shown that learning is a process of creating new understanding based on prior knowledge and experiences” (p.398). As per Vygotsky (1978) learning and doing are inseparable and “learning complies and assimilates with culture by
absorbing the latter’s values” (Kwon, Kim, & Woo, 2016, p.398). Doing tasks in the game-like environment of a hybrid space can provide a better ground for learning by doing.

Based on Generic Learning Outcomes (GLOs) for museums, Hooper-Greenhill (2004) delineates that increase in knowledge along with enjoyment are shaping a considerable part of learning outcomes in museums. Explicit knowledge that we can report, and of which we are consciously aware, is defined by Yildirim, Ozden, and Aksu (2001), Schunk (1996), Anderson (1995), and Smith and Ragan (1993), as declarative knowledge. Smith and Ragan (1993) stated that even though declarative knowledge acquisition is often mentioned as “lower level learning”, it is the substance of much human thinking and is generally acquired within meaningful structures. As per Yildirim et al. (2001, p.208) declarative knowledge is “an essential prerequisite for effective and higher-level learning.” Increase in declarative knowledge in a museum might be subject-specific or might result in making connections between or across subject areas (Falk & Dierking, 2003). Therefore, increase in declarative knowledge is considered as a factor at the special level to improve the quality of the hybrid museum experience.

Retention and recognition play significant roles in measuring increase in declarative knowledge (Yildirim et al., 2001; Smith & Ragan, 1993; and Gagne & Briggs, 1979). Retention is the fact of keeping something in one's memory. Retention in particular is the preservation of the aftereffects of experience and learning that makes recall or recognition possible. For instance, recalling the answer to a multiple-choice question in a test relies heavily on retention. Recognition is the action of recognizing something or someone as well as the state of being recognized. Recognition can be considered in particular as the knowledge or feeling that someone or something present has been encountered before. To exemplify, recognizing the picture of someone among a group of similar pictures in a test is a situation that relies on recognition. Therefore, retention and recognition are
considered in the present study as the variables for measuring the increase in declarative knowledge in the VR-enhanced museum experience. Using a standard questionnaire with multiple-choice, true/false, and open-ended questions (Appendix D), learning can be measured in a VR-enhanced museum.

5.4.Method
This research took an experimental approach to measure the enjoyment and learning (dependent variables) of participants in response to selected environments (independent variables). To control the environments, three scenarios were designed:

1. Traditional museum environment (an exhibition based on labels and pictures)
2. Traditional museum environment (an exhibition based on video clips and pictures)
3. Hybrid museum environment (an exhibition based on VR-enhanced experience and pictures)

Each scenario – to be called “a condition” in the remainder of this paper – was a thematic exhibition about Los Angeles in the 1940s. Scenarios were designed with regards to the model for enhancing the quality of spatial experiences in the built environment. In each scenario, enjoyment and learning were studied. Enjoyment was measured with following variables (sections 1.2.1):

- Approach
- Avoidance
- Time perception

Learning was measured with following variables (section 1.2.2.):

- Retention
- Recognition
To measure variables a questionnaire was designed (Appendices B and D). To measure approach/avoidance, questions 17 to 21 (Appendix B) are used. Time perception was measured by questions 22 and 23 (Appendix B). Moreover, time was recorded for each participant by the researcher to be compared with the time participants estimated spending at the exhibition. Retention was measured by questions 1 to 4 (Appendix D) where recognition was measured by questions 5 to 8 (Appendix D).

5.4.1. Participants

The target population of this study was adults over 18 years old who have interest in museums and/or video games. We used the following formula from Daniel (1999) to calculate our sample size, \( n \):

\[
n = Z^2 \frac{P(1-P)}{d^2},
\]

where \( Z \) is the confidence level, \( P \) is the estimated portion of the population that presents the characteristic, and \( d \) is the precision. For the level of confidence of 95%, which is conventional, \( Z \) value is 1.96 (Naing, Winn, & Rusli, 2006). Based on a prior study by Janes (2009), 80% of the population of museum audiences believe that museums need change (i.e. \( P=0.8 \)). Regarding the resource limitation of this research, a larger precision (\( d=15\% \)) is selected for calculation the sample size (Naing, Winn, & Rusli, 2006). For \( Z = 1.96 \), \( P = 0.8 \), and \( d = 0.15 \) (15%) we get the sample size, \( n = 27.3 \).

Participants were then recruited through volunteer sampling (Teddlie & Yu, 2007) and snowball sampling (Sadler, Lee, Lim, & Fullerton, 2010) approaches. Participants were randomly assigned to a condition out of the three. Each participant was first assigned to a group non-randomly. Then
the assignment of each participant was swapped with the group assignment of a randomly chosen participant (Table 5-1).

Table 5-1. Participants assigned to their groups.

| Participant | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 |
|-------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|

5.4.2. Conditions

A VR studio was equipped and arranged like a small thematic gallery (Figure 5-6). The gallery was sound proof and the room dimensions were 4.75 meters in width and 7.25 meters in length. One side of the gallery had a projection screen and the other three sides were used to hang photos. The study had the three following conditions: three thematic exhibits, representing the same information about Los Angeles in the 1940s but through a different medium. In all conditions, a researcher was present in the gallery all the time to help the individuals with general questions and instructions. The frequency of interactions between a participant and the researcher, such as a question asked by the participant, or a comment about the exhibit, were recorded for further analysis. The following hardware was used to equip the exhibit for different conditions:

A. VR headset: HTC VIVE goggles, VIVE controllers, and VIVE tracking stations
B. Computer: CPU Core i7- 6700K (40 GHz), RAM 32 GB (4x8 DDR IV 3200 MHz), GPU (NVIDIA GTX 1080, HDD 10TB SSD)
C. Sound: Logitech Speaker System Z623
D. Projector: DIGITAL PROJECTION M-vision Cine 260-HB
E. Camera: Two Panasonic HDC-SDT750, and one Canon PowerShot SX30 IS
5.4.2.1. Condition 1: Traditional museum scenario (actual space based on labels and photos)

Under condition 1, a traditional exhibition was organized with 16 photos (16”x24”\textsuperscript{18}) of Los Angeles in the 1940s along with descriptive labels. Photos and labels were prepared in consultation with the curators to represent the city scale, vehicles’ style, urban life, and outfitting style as well as the architecture of Los Angeles in the 1940s. There was not a chronological order for visiting the exhibit. However, photos with similar content were placed near each other to be better recognized by the participants (Carliner, 2001).

There were two aerial photos that represented Los Angeles to help participants better locate the landmarks in the city (Figure 5-3). Moreover, there was a frame representing a Los Angeles Police Department (LAPD) case that took place in 1947 (i.e. Silk-Stocking Murder). Participants were

\textsuperscript{18} This is a medium size for the posters which can provide audience with relatively good visibility of details. Regarding the budget limitation and number of the photos, this size was selected as the optimal choice for this research.
asked to pay attention to the surroundings in the photographs, including but not limited to the buildings, streets, vehicles, and outfits of people presented in the photos and descriptive labels.

5.4.2.2. Condition 2: Video-enhanced museum scenario (actual space based on videos and photos)

Under condition 2, the photos on the walls remained in the same position. However, instead of descriptive labels, two video clips were used in the gallery to represent Los Angeles in the 1940s. The content of both video clips was selected in a fashion to be similar to the content exhibited in the other two conditions of this experiment. The first video clip (length 8:57 minutes) was a short documentary retrieved from an online archive of historic videos\(^\text{19}\). This video clip provided participants with general information about 1940s Los Angeles including but not limited to the city scale, vehicle styles, urban life, fashion, and architecture. The second video clip (length 10:18 minutes) was a documentary about the Silk-Stocking Murder. This video clip was made by the first author in Adobe Premier Pro CC adopting Ken Burns’ style\(^\text{20}\) and using historic resources such as photos, footages, newspaper, and podcasts related to the topic.

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\(^{19}\) https://archive.org

\(^{20}\) Kenneth Burns is an American filmmaker, known for his style of using archival footage and photographs in documentary films.
We projected the video clips onto a screen placed in the gallery. Participants had the choice to either sit and watch the second video clip about the Silk-Stocking Murder or skip it (Figure 5-4). Participants were also able to look at the photos on the wall if they wanted to. There was a 30 second gap between the two video clips to give the participant a short break. Subjects were asked to pay attention to surroundings presented in the video clips, including but not limited to the buildings, streets, vehicles, and outfits of people.

5.4.2.3. Condition 3: VR-enhanced museum scenario (hybrid space based on VR game and photos)

Under condition 3, the photos on the wall remained in the same position as the other conditions. However, instead of descriptive labels and videos, a VR environment was used in the gallery to represent Los Angeles in the 1940s. The content of the VR environment was selected in a fashion to be similar to the content exhibited in the other two conditions of this experiment. For this purpose, LA Noire: The VR Case Files was used (Figure 5). This game provides audiences with a potential to roam around the city (e.g., walking and driving). Moreover, it includes the Silk-Stocking Murder that was used in the present study as an optional case for the participants to investigate. To model Los Angeles as well as the LAPD cases, the game developers used aerial photographs taken by photographer Robert Spence (Stoudt, 2011; Citizen, 2010). The game developers also used the photographs to create traffic patterns and public transport routes, as well as the location and condition of buildings (Stoudt, 2011; Citizen, 2010). All these facts as well as the study by Baradaran Rahimi et al. (2019) on the educational values of this game suggested that L.A. Noire: The VR Case Files is a game with considerable historical precision and can be used as a platform for a VR-enhanced experience in the present research.
The participants could have encounters and interactions, such as talking with the AI characters, investigating crime scenes, and interrogating suspects within the VR game. Participants individually experienced this case and were asked to pay attention to surroundings, including but not limited to the buildings, streets, vehicles, and outfits of people presented in VR. Participants could also look at the photos on the walls. The participants assigned to the third condition of this study (VR-enhanced exhibition) were first trained for 10 minutes before the exposure. The training included, driving, walking, running, investigating, grabbing and holding objects, and orienting within the VR environment. The training took place in a pre-set location in the VR environment of the game similar but unrelated to the specific content being tested.

### 5.4.3. Experimental Design

As this study seeks to inquire whether a VR-enhanced exhibition (i.e. hybrid space) can improve learning and enjoyment for audiences compared to traditional exhibits (i.e. actual space), a three-phase experiment was designed. The experiment took place in February and March 2018 and had the following structure (Campbell & Stanley, 1963):

\[
\begin{align*}
\text{Traditional (labels and photo):} & \quad R \quad X_C \quad O_1 \\
\text{Traditional (video and photo):} & \quad R \quad X_B \quad O_2 \\
\text{VR-enhanced (VR game and photo):} & \quad R \quad X_A \quad O_3
\end{align*}
\]
Where R means random assignment, X means the exposed group, and O means observation. The first and second conditions (i.e., traditional and video-enhanced scenarios) hosted the control groups and the third condition (i.e., VR-enhanced scenario) hosted the experimental group of participants. The exposures to an assigned condition took place individually and the sessions were video recorded. We recorded time of exposure for each participant to compare it against his or her perception of time. After introducing and clarifying the purpose of the research, we provided participants with consent forms and the pre-exposure questionnaire (Appendix A) focusing on demographic information as well as the participant’s attitudes towards museum visiting and video-game playing.

Participants assigned to each condition (Figure 5-6) were then asked to begin their visit to the thematic exhibition. As soon as the experiment ended, participants responded to a post-exposure questionnaire (Appendix B) followed by a short interview (Appendix C) focused on the details of the exposure and participants’ experience as well as their perspectives about their visit. This was followed a month later by a special questionnaire concentrating on the learning aspects of the
participants’ visit (Appendix D). One month was considered as the time for the participants to forget part of the information that is subject to forgetting (Murre & Dros, 2015).

5.5. Analysis

Statistical methods, including Fisher Exact test and Kruskal-Wallis test, were used to analyze the data in the Statistical Package for the Social Sciences (SPSS 24). The Fisher Exact test is a powerful statistical test of significance appropriate for categorical data. Kruskal-Wallis one-way analysis of variance has particular use for ranked data across groups. These tests are robust, operating well even with considerable heterogeneity of variances, as long as all the conditions have the same number of participants (Zar, 2010). Moreover, they are also robust with respect to the assumption of the underlying populations’ normality (Zar, 2010). The validity of the analysis is affected only slightly by even considerable deviations from normality (Zar, 2010).

In addition to the statistical tests, a part of the data, which included textual material from open-ended questions and interview transcriptions, were analyzed in NVivo 11 using the open-coding method as suggested by Watson et al. (2011). To do this, a list of themes and keywords, as well as the participants’ comments were enlisted for the discussions by the authors of this paper. Authors discussed and refined the themes and keywords until reaching an agreement to consider selected ones for inclusion in the study.

5.6. Results

A majority of participants were female (55.6%), the average age was 37 years old ranging from 22 to 65. The majority of participants had advanced academic degrees (65.4%). More than half of the participants (58.3%) had visited a museum within the last six months. A large portion of the participants (70.4%) had “much” to “extremely much” motivation to visit a museum (Table 5-2).
Moreover, about the half of participants (13/27 or 48.1%) found learning about the appearance of the cities from the past “much” to “extremely much” important (Table 5-3). Regarding learning about the vehicles from the past, 40.7% of participants found it “much” to “extremely much” important (Table 5-4).

Table 5-2. Participants’ motivation for visiting museums

<table>
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<th>Frequency</th>
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<th>Valid Percent</th>
<th>Cumulative Percent</th>
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<tr>
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</tr>
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</tr>
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</tbody>
</table>

Moreover, about the half of participants (13/27 or 48.1%) found learning about the appearance of the cities from the past “much” to “extremely much” important (Table 5-3). Regarding learning about the vehicles from the past, 40.7% of participants found it “much” to “extremely much” important (Table 5-4).

Table 5-3. The importance of learning about cities from the past

<table>
<thead>
<tr>
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<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
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Table 5-4. The importance of learning about vehicles from the past

<table>
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<th>Percent</th>
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<td>33.3</td>
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<tr>
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<td>85.2</td>
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<tr>
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5.6.1. Museum visit patterns

Based on the pre-exposure questionnaire, among a variety of reasons for visiting museums, half of the participants (50%) claimed that individual entertainment, as well as learning about people, cultures, places, and events are the first two reasons to visit museums. Moreover, watching documentary movies during the museum visit was among the favorite activities of participants (39.1%). A majority of participants (63%) usually started with the exhibit near the museum entrance and moved in order. A large portion of the participants (74.1) mentioned local museums, such as Glenbow Museum (Canada), Royal Tyrrell Museum (Canada), and Vancouver Museum of Anthropology (Canada), as the targets of their casual visits. The average time spent visiting the last museum was one to two hours for 53.8% of the participants, two to four hours for 26.9%, less than an hour for 11.5%, and four hours or more for 7.7%.

5.6.2. Familiarity with Los Angeles of the 1940s

Based on the pre-exposure questionnaire, 81.5% of the participants had “little” to “extremely little” familiarity with the appearance of Los Angeles in the 1940s. Based on the data, 70.4% of the participants had “little” to “extremely little” familiarity with the vehicles. Similarly, 70.4% of the participants had “little” to “extremely little” familiarity with the fashion. Moreover, 63% of the participants had “little” to “extremely little” familiarity with the architecture of Los Angeles in the 1940s. Finally, 77.8% of the participants had “little” to “extremely little” familiarity with major landmarks of Los Angeles in the 1940s.

5.6.3. Game playing patterns

Based on the pre-exposure questionnaire, 40.7% of the participants were “much” to “extremely much” familiar with video or mobile games (Table 5-5) and 63% of them played video or mobile
games at least once a month. The majority (82.4%) of valid cases (n=17) played games from one to four hours per playing (Table 5-6).

Table 5-5. Familiarity of participants with video and mobile games

<table>
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<th>Percent</th>
<th>Valid Percent</th>
<th>Cumulative Percent</th>
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Table 5-6. Hours of playing video or mobile games per playing

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As a first choice, playing mobile games was slightly more popular among the participants (56%) compared to video games (44%). The main reasons participants played video or mobile games was entertainment (69.5%). Based on the data, 81.5% of the participants found the gameplay “much” to “extremely much” important in evaluating and considering a game (Table 5-7). When asked about graphics of the game, 81.5% of the participants found it “much” to “extremely much” important (Table 5-8).
Moreover, 70.4% of the participants found character animation “much” to “extremely much” important (Table 5-9). In evaluating and considering a game, 59.3% of the participants found the audio (sound and voice track) “much” to “extremely much” important (Table 5-10). Finally, 55.6% of the participants found the storyline “much” to “extremely much” important in evaluating and considering a game (Table 11). The majority of participants (n=26) had experience of 3D movies. Of those who experienced 3D movies, 69.2% participants had experienced them from one to five times, 23.1% from five to ten times and 7.7% ten to twenty times. About half of the participants (n=14) had experience with 3D VR goggles. Of those who experienced 3D VR goggles, 71.4% had experienced them one to five times and 23.6% from five to ten times.
Table 5-9. The importance of character animation in evaluating video games

<table>
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Table 5-10. The importance of audio (sound and voice tracks) in evaluating a video game

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Table 5-11. The importance of storyline in evaluating a video game

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<th>Percent</th>
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</table>

5.6.4. Enjoyment

Based on the data, the majority of the 27 participants (92.6%) “agree” to “strongly agree” that an immersive, interactive game environment that replicates history can be used in museums. Where asked about activities like playing a virtual reality (VR) game related to an exhibition, 81.5% of the participants found them “frequently” to “always” useful for museums. As a reason, a
participant delineated that “[i]t is immersive. You learn in a sub-conscious way”. Another participant wrote “Looking at my kids, I believe that using VR may be a good idea to persuade them to go to a museum”. A participant mentioned:

The VR experience engages you completely. There is no sense of distance. Not only your eyes but your sense of touch and balance are engaged. I personally would not need the narrative. I would simply like to explore on my own. Kids, however, would be inspired by the narrative. I like to explore aspects of history they normally wouldn't be interested in. The challenge I think would be avoiding narrative clichés.

On the other hand, some participants (18.5%) did not find activities like playing a virtual reality (VR) game related to an exhibition useful to museums. A participant stated that “[i]t can only be a short session and has space limitations. Also, only one person can experience VR at a time. The choice of VR game should not be puzzle solving - too time consuming”.

<table>
<thead>
<tr>
<th>Table 5-12. One-way ANOVA on approach/avoidance</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
</tr>
<tr>
<td>----</td>
</tr>
<tr>
<td>(1) Photo+Text</td>
</tr>
<tr>
<td>(2) Video+Photo</td>
</tr>
<tr>
<td>(3) VR+Photo</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Analysis of variance (ANOVA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sum of Squares</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Between Groups</td>
</tr>
<tr>
<td>Within Groups</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

To study the enjoyment, part of the post-exposure data was collected on approach/avoidance (Table 5-12) and time perception (Table 5-14). Table 5-12 is a sum of scores from a number of questions (Appendix B, Questions 17 to 21) that are a modified version of the standard questionnaire used by Brengman (2002) for measuring approach and avoidance. One-way analysis
of variance was used to determine whether there were any statistically significant differences between the means of three independent groups (i.e., Photo+Text, Video+Photo, VR+Photo) in terms of approach/avoidance. Results showed that there was a statistically significant difference between the three conditions in terms of approach/avoidance with F (2,24)=16.121, p<.001).

Table 5-13. Post Hoc Test. Tamhane pairwise comparison of approach/avoidance in different conditions

<table>
<thead>
<tr>
<th>(l) group</th>
<th>(j) group</th>
<th>Mean Difference (l-j)</th>
<th>Std. Error</th>
<th>Sig.</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Photo+Text</td>
<td>(2) Video+Photo</td>
<td>-3.55556</td>
<td>2.08241</td>
<td>.292</td>
<td>-9.1559</td>
</tr>
<tr>
<td>(1) Photo+Text</td>
<td>(3) VR+Photo</td>
<td>-11.66667*</td>
<td>2.25804</td>
<td>.000</td>
<td>-17.6894</td>
</tr>
<tr>
<td>(2) Video+Photo</td>
<td>(1) Photo+Text</td>
<td>3.55556</td>
<td>2.08241</td>
<td>.292</td>
<td>-2.0448</td>
</tr>
<tr>
<td>(2) Video+Photo</td>
<td>(3) VR+Photo</td>
<td>-8.11111*</td>
<td>1.96811</td>
<td>.003</td>
<td>-13.3790</td>
</tr>
<tr>
<td>(3) VR+Photo</td>
<td>(1) Photo+Text</td>
<td>11.66667*</td>
<td>2.25804</td>
<td>.000</td>
<td>5.6439</td>
</tr>
<tr>
<td>(3) VR+Photo</td>
<td>(2) Video+Photo</td>
<td>8.11111*</td>
<td>1.96811</td>
<td>.003</td>
<td>2.8432</td>
</tr>
</tbody>
</table>

*The mean difference is significant at the 0.05 level.

Tamhane pairwise comparisons indicated that there was a statistically significant difference with group 3 versus group 1 (p<.001), group 3 versus group 2 (p=.003) but there was no statistically significant difference between groups 1 and 2 with p=.292 on approach/avoidance. This shows that the difference between the groups comes from the group 3 where the participants did better in terms of approach/avoidance.

Table 5-14. Time perception group cross tabulation and results of the Pearson Chi-Square and Fisher’s exact tests

<table>
<thead>
<tr>
<th>Time perception</th>
<th>Under estimation</th>
<th>Count</th>
<th>Photo+Text</th>
<th>Video+Photo</th>
<th>VR+Photo</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% within group</td>
<td>0.0%</td>
<td>0.0%</td>
<td>88.9%</td>
<td>29.6%</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Count</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Identical estimation</td>
<td>Count</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>% within group</td>
<td>55.6%</td>
<td>33.3%</td>
<td>11.1%</td>
<td>33.3%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Over estimation</td>
<td>Count</td>
<td>4</td>
<td>6</td>
<td>0</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>% within group</td>
<td>44.4%</td>
<td>66.7%</td>
<td>0.0%</td>
<td>37.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>Count</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>% within group</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td>100.0%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The researcher recorded time for each participant during the exposure to the condition. The recorded time was then compared with the time participants estimated spending at the exhibit to classify the estimate as overestimation, identical, or underestimation (Table 5-14). Pearson Chi-Square and Fisher’s exact tests were used to look at relationship between time perception and the three conditions. Results showed that they were related with $\chi^2(4)=24.267$, $p<.001$.

### 5.6.5. Learning

After exposure, participants were asked if the activity they performed improved their knowledge of North-American urban history. A participant assigned to the first condition (Photo+Text) responded “[s]omehow. Learned more about the city itself and the police cases in the 1940’s”. Another participant assigned to the same condition acknowledged that “[t]he murder case was new to me”. A third participant mentioned “such thematic exhibits have very particular audiences”.

A participant assigned to the second condition (i.e. Video+Photo) mentioned “[a] little bit. Especially the first video on architecture, infrastructure, etc. The second video was more of a true crime story from history”. The first video was an informative clip with narration about Los Angeles in the 1940s. Similarly, another participant delineated “[b]ackground narration with film of LA gives context”. A participant commented on the second video and wrote “[v]ideo moves quick, difficult to concentrate”. The second video was about the Silk-Stocking Murder with narration.

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>df</th>
<th>Asymptotic Significance (2-sided)</th>
<th>Exact Sig. (2-sided)</th>
<th>Exact Sig. (1-sided)</th>
<th>Point Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>24.267&lt;sup&gt;a&lt;/sup&gt;</td>
<td>4</td>
<td>.000</td>
<td>.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fisher’s Exact Test</td>
<td>21.838</td>
<td></td>
<td></td>
<td>.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>27</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup>. 9 cells (100.0%) have expected count less than 5. The minimum expected count is 2.67.

<sup>b</sup>. The standardized statistic is -3.413.
Comments for the third condition (VR+Photo) were not only on learning about the content but also the technology. A participant who was assigned to the third condition mentioned in the interview that “I have to admit the biggest thing I learned was that how incredibly engaging virtual reality is”. Another participant assigned to this case wrote:

I was already familiar with the aspects with which I was engaged in the game only. Focus was also on getting familiar with the technology. I would like to try it again and be more of a sightseeing. One of my favorite experiences was being on the bridge and looking out over LA in the 1940s.

Another participant assigned to the third condition (VR+Photo) mentioned the exposure can help improve knowledge of North-American urban history “[m]ostly ‘pop’ culture because of the true-to-life ‘experience’”. Another comment about this condition was:

It makes you feel like you are part of the experience. However, when playing LA Noire - it is hard to control the character. If playing with standard controller was possible it would be better.

<table>
<thead>
<tr>
<th>Table 5-15. One-way ANOVA on retention.</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>(1) Photo+Text</td>
</tr>
<tr>
<td>(2) Video+Photo</td>
</tr>
<tr>
<td>(3) VR+Photo</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Analysis of variance (ANOVA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sum of Squares</td>
</tr>
<tr>
<td>Between Groups</td>
</tr>
<tr>
<td>Within Groups</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>
Evaluation of learning took place a month later than the exposure. Retention and recognition were measured using a survey with multiple-choice, true/false, and graphical questions (Appendix D). Tables 5-15 and 5-17 are sums of scores from a number of questions. A mean score of 2.00 represents 50% correct answers to the questions related to retention and recognition. One-way analysis of variance was used (Table 5-15) to determine whether there were any statistically significant differences between the means of three independent groups (i.e., Photo+Text, Video+Photo, VR+Photo) in terms of retention. Results showed that there was a statistically significant difference between the three conditions in terms of retention with F(2,24)=10.822,p<.001.

<table>
<thead>
<tr>
<th>(I) group</th>
<th>(J) group</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
<th>95% Confidence Interval Lower Bound</th>
<th>Upper Bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photo+Text</td>
<td>Video+Photo</td>
<td>-.33333</td>
<td>.38188</td>
<td>.783</td>
<td>-1.3839</td>
<td>.7173</td>
</tr>
<tr>
<td>Photo+Text</td>
<td>VR+Photo</td>
<td>-1.55556*</td>
<td>.27358</td>
<td>.000</td>
<td>-2.2850</td>
<td>-.8261</td>
</tr>
<tr>
<td>Video+Photo</td>
<td>Photo+Text</td>
<td>.33333</td>
<td>.38188</td>
<td>.783</td>
<td>-.7173</td>
<td>1.3839</td>
</tr>
<tr>
<td>Video+Photo</td>
<td>VR+Photo</td>
<td>-1.22222*</td>
<td>.38889</td>
<td>.023</td>
<td>-2.2853</td>
<td>-.1591</td>
</tr>
<tr>
<td>VR+Photo</td>
<td>Photo+Text</td>
<td>1.55556*</td>
<td>.27358</td>
<td>.000</td>
<td>.8261</td>
<td>2.2850</td>
</tr>
<tr>
<td>VR+Photo</td>
<td>Video+Photo</td>
<td>1.22222*</td>
<td>.38889</td>
<td>.023</td>
<td>.1591</td>
<td>2.2853</td>
</tr>
</tbody>
</table>

*The mean difference is significant at the 0.05 level.

Tamhane pairwise comparisons (Table 5-16) indicated that there was a statistically significant difference with group 3 versus group 1 (p<.001), group 3 versus group 2 (p=.023) but there was no statistically significant difference between groups 1 and 2 with p=.783 on retention. For the 95% confidence interval, lower bound looks at mean-t(.975,n-1)* SE. When the calculated standard error is large, the lower bound has a negative score (Table 5-16).
Table 5-17. One-way ANOVA on recognition

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error</th>
<th>95% Confidence Interval for Mean</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>9</td>
<td>2.0000</td>
<td>1.00000</td>
<td>.33333</td>
<td>1.2313</td>
<td>2.7687</td>
<td>1.00</td>
</tr>
<tr>
<td>(2)</td>
<td>9</td>
<td>2.0000</td>
<td>.50000</td>
<td>.16667</td>
<td>1.6157</td>
<td>2.3843</td>
<td>1.00</td>
</tr>
<tr>
<td>(3)</td>
<td>9</td>
<td>3.3333</td>
<td>.86603</td>
<td>.28868</td>
<td>2.6676</td>
<td>3.9990</td>
<td>2.00</td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>2.4444</td>
<td>1.01274</td>
<td>.19490</td>
<td>2.0438</td>
<td>2.8451</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Analysis of variance (ANOVA)

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>10.667</td>
<td>2</td>
<td>5.333</td>
<td>8.00</td>
<td>.002</td>
</tr>
<tr>
<td>Within Groups</td>
<td>16.000</td>
<td>24</td>
<td>.667</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>26.667</td>
<td>26</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

One-way analysis of variance was used (Table 5-17) to determine whether there were any statistically significant differences between the means of three independent groups (i.e., Photo+Text, Video+Photo, VR+Photo) in terms of recognition. Result showed that there was a statistically significant difference between the three conditions in terms of recognition with F(2,24)=8.000,p=.002.

Table 5-18. Post Hoc Test. Tamhane pairwise comparison of recognition in different conditions

<table>
<thead>
<tr>
<th>(I) group</th>
<th>(J) group</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photo+Text</td>
<td>Video+Photo</td>
<td>.00000</td>
<td>.37268</td>
<td>1.000</td>
<td>-1.0357</td>
</tr>
<tr>
<td></td>
<td>VR+Photo</td>
<td>-1.33333*</td>
<td>.44096</td>
<td>.024</td>
<td>-2.5111</td>
</tr>
<tr>
<td>Video+Photo</td>
<td>Photo+Text</td>
<td>.00000</td>
<td>.37268</td>
<td>1.000</td>
<td>-1.0357</td>
</tr>
<tr>
<td></td>
<td>VR+Photo</td>
<td>-1.33333*</td>
<td>.33333</td>
<td>.005</td>
<td>-2.2477</td>
</tr>
<tr>
<td>VR+Photo</td>
<td>Photo+Text</td>
<td>1.33333*</td>
<td>.44096</td>
<td>.024</td>
<td>.1555</td>
</tr>
<tr>
<td></td>
<td>Video+Photo</td>
<td>1.33333*</td>
<td>.33333</td>
<td>.005</td>
<td>.4189</td>
</tr>
</tbody>
</table>

*The mean difference is significant at the 0.05 level.

Tamhane pairwise comparisons (Table 5-18) indicated that there was a statistically significant difference with group 3 versus group 1 (p=.024), group 3 versus group 2 (p=.005) but there was no statistically significant difference between groups 1 and 2 with p=1.000 on recognition. This
shows a difference between group 3 participants and those of groups 1 and 2 where the participants assigned to the third condition did better in terms of recognition.

5.6.6. Hybrid space

Based on the observations, in the first condition all the participants spent time looking at all the photos and labels. However, when we reviewed the video tapes of participants in condition two, we observed that none of the participants looked at the photos after watching the video clips. Although the third condition was the only condition providing participants with a hybrid space, only three participants of the third condition took time to explore the actual space of the exhibition and looked at the photos. They especially spent more time on the frame of the Silk-Stocking Murder after the exposure with the VR environment. The average time these three participants looked at the photos was 128 seconds. There is no data to confirm, but one may relate this to the fact that in the third condition they were involved in the investigations of this case in LA Noire and they wanted to compare it with the actual report and photos of the case.

In the interviews (Appendix C), four of the participants (50% of the valid interview cases n=8) assigned to the third condition recognized the hybrid nature of the space. However, one of them was not captured on video looking at the photos after the exposure. This might be related to the fact that video recording only started after the participant signed the consent form. Thus, a participant could look at the photos before the exposure without being captured on the video recording. A participant assigned to the third condition (VR+Photo) mentioned on a few occasions during the interview that:

usually the museums we went to are just displays. So, it is static to look at artifacts here and there. You would not try to enter one of these places… Here, virtual reality
enhances my experience more, because I can move around more and see what is going on. I walked up to the gun store.

Another participant mentioned that “I felt I was being a part of action in LA not just some random person in the exhibit”. A third participant who recognized the hybrid nature of the space and found it useful for history museums mentioned that “if you have an artifact in the display case and the context of the artifact, like where they found it, in VR space that will work even better”. The last participant whom we did not captured on the videotapes looking at the photos mentioned:

I think because right now kids even know that with CG you can make anything look real, so I think in our mind we kind of don’t really trust virtual environments as much but if there is something like even a photograph, I know that you’ve got photographs here, but something that you could make it more grounded in reality, I think suddenly there will be that leap.

5.7. Discussions

According to Hill (2010)\textsuperscript{21}, the majority of museumgoers in Canada have some university education or a college degree. This level of education generally suggests that visitors are at least 22 years old. Moreover, a Canadian government report\textsuperscript{22} shows that, 85% of museum goers’ age ranges from 15 to 64. Comparing these two reports reveals that most of the museumgoers in Canada are age of 22 to 64 and have at least some post-secondary education. In addition, the museum visitors are divided fairly equally among men (47%) and women (53%) according to a survey by the Canadian government\textsuperscript{23}. Based on the results, characteristics (i.e., gender, age, and education) of the participants in the present research were close to the characteristics of museumgoers in Canada. This makes the outcomes more realistic as the participants notably

\textsuperscript{21}https://canadacouncil.ca/research/research-library/2012/11/factors-in-canadians-arts-attendance-in-2010
\textsuperscript{22}http://canada.pch.gc.ca/eng/1443530283817/1443530281438#ageGroup
represent the target population. Based on the pre-exposure survey, the majority of participants were motivated to visit museums and learn about the past (Tables 5-2 to 5-4). This suggests that participation was not deeply affected by other motivators such as remuneration, or course grade that could reduce the validity of results.

5.7.1. Museum visit and game playing patterns

The museum visit patterns were similar for the participants (Section 5.6.1.) in terms of reasons for visiting, method of exploring, time spent, and the type of museum preferred (i.e. local museums). This was important because prior studies showed that 80% of the population believe that local museums need to change in the 21st century (Burton & Scott, 2003). Results of this study show that game players represent about half of the participants. The random assignment of participants to the conditions allowed for both gamers and non-gamers to be included in the groups of participants assigned to each of the three conditions. This reduced the risk of having all gamers in a certain condition and non-gamers in another. The game playing patterns were similar for the participants (Tables 5-5 to 5-11) in terms of reasons for playing, ways of evaluating, time spent, and the game preferences (i.e. mobile games). Most of the participants were familiar with 3D environments such as 3D movies. Half of the participants had experience with 3D virtual reality. The random assignment of participants to the conditions allowed for an even distribution of the number of individuals with and without such experience in each condition.

5.7.2. Improvements at the special level (Learning and enjoyment aspects of the experience)

Based on the pre-exposure results, the majority of participants were not familiar with the urban life of Los Angeles in the 1940s, including the fashion, vehicles, architecture, and historic
landmarks (Section 5.6.2.). A better understanding of what participants could learn was possible because they were not relying on past knowledge to answer the post-visit survey. Results of the learning survey showed that both retention and recognition were significantly different in the third (VR+Photo) condition when compared to the other conditions (Tables 5-15 to 5-18). Tables 5-15 and 5-17 show that the participants assigned to the third condition performed better on visual questions that were designed to measure recognition (Appendix D, Questions 5 to 9) and textual questions designed to measure retention (Appendix D, Questions 1 to 5). Enjoyment was measured through approach/avoidance and time perception (Tables 5-12 to 5-14). Enjoyment was also increased in the third condition (VR+Photo) when compared to the other conditions. According to the results, participants increased approach towards the environment (Table 5-13) and perceived time as passing faster (Table 5-14).

Participants stated or implied that they learned about history, Los Angeles infrastructures, and buildings as well as the VR technology in their discourses (Section 5.6.5.). They identified its strengths and weaknesses, they had suggestions about the interface, and directly mentioned learning about the VR technology in the exhibition (Section 5.6.5.). Although these were not specifically explored, the participants show technological literacy as well as an increase in understanding and critical thinking. Such outcomes pave the way for later studies on such learning topics. Participants also stated or implied enjoyment in their responses. Parents found the third condition promising for attracting their children to museums as it incorporated a game-like environment (Section 5.6.4.). This can be related to the playful characteristic of the games and engagement of younger generations with video-games even in a place like museum. Although playful activities in museums are not limited to playing games or exploring game-like environments, such discourses by parents recall Huizinga’s idea of harnessing playful activities
for museums. Participants assigned to the third condition also talked about the possibility of going to places that are normally impossible to explore in a traditional museum setting (Section 5.6.6.). This echoes Malraux’s idea of a museum without walls where the museum experience goes beyond the physical walls of the museum. Moreover, participants noted in their discourses (Section 5.6.4.) the control over the environment and the freedom to follow the narrative (i.e. historical event) or roam around the game-like environment and interacting with the AI objects or characters. This can be interpreted as a personal agency during their museum experience and actively learning about a historical event (Falk & Dierking, 2018). Parents found the third condition promising for children’s learning and enjoyment results, implying that in the third condition the audience’s experience was improved at the special level where it focused on edutainment in the hybrid space of museum.

5.7.3. Improvements at the general level (Spatial aspects of the experience)

As mentioned before, the exhibit was designed to create a sense of presence for Los Angeles during the 1940s (i.e., designing for meanings) and the concept of the museum experience was the focal point of this research. Given that many museums do not allow audiences to closely interact with the artifacts or the environment (e.g. touch a piece or engage in an activity within the historical context) there is a distance between these and the audience (Frampton & Ibelings, 2011). Consequently, such a distance between the artifacts and the contexts in which they are located, and the audience may influence the museum experience. According to the qualitative data (i.e. section 5.6.4.) participants noted, in the third (VR+Photo) condition, no sense of physical or temporal separation. Because this condition engaged the senses of touch, sight, and balance, they can contribute to an improvement in the museum experience. The sense of presence for Los Angeles during the 1940s appeared to be deeper in the third condition as well. For example, a participant assigned to the third condition mentioned his most favorite experience of “being on the bridge and
looking out over LA in the 1940s”. Another participant wrote about pop culture and the “true-to-life” experience of the third condition found new meanings for presence in Los Angeles during the 1940s. Participants also implied or mentioned that the third condition (VR+Photo) was able to persuade audiences, especially children (see section 5.6.4.). This characteristic of the VR-enhanced experience can be helpful to persuade adolescents to visit museums more. As discussed here, strategies such as persuasion, designing for meanings, and including concepts in design can reinforce the VR-enhanced museum experience. This resembles encouraging stage (Figure 5-1) where audiences get involved in the experience.

As the qualitative data shows, some parents who participated in the experiment believed that the third condition (VR+Photo) would be attractive and involving for children. As the data in section 5.6.4. shows that might be related to the use of a game platform for the VR-enhanced experience. According to Granic, Lobel, and Engels (2014), games offer a safe environment to face negative emotions and developing emotional regulation in children. Given that the children need to be in a secure and safe environment, those participants who suggested the third condition helpful to museums for attracting children might have found the third condition relatively secure and safe. As mentioned, the immersion (i.e. sense of presence) in the virtual environment was also a reason for participants to increase enjoyment. The references by a participant to the exploration of the game world suggests that the VR environment can provide the museumgoers with new types of interactions. In the present study, interaction with the virtual world was only available in the third condition. This might be the reason that the participant found it a source for enjoyment. The immersion and interaction within the virtual world as well as the secure and safety attributes of the virtual world might be what enables audiences to become more deeply involved in the experience. This recalls the enabling stage of the Figure 5-1.
The reasons that participants who were assigned to the third condition (VR+Photo) gave for their increase in learning and enjoyment revealed several matters (Section 5.7.2.). Beyond those (and based on the qualitative data and the quoted discourses from section 5.6.5.) the increase in learning was linked by some participants to engagement. Some participants referred to deep engagement as a “true-to-life” experience. Moreover, part of the participants assigned to this condition found their enjoyment relevant to their engagement with the environment they experienced. Such references in section 5.6.5. to enjoyment and engagement recall the enclosing stage of Figure 5-1.

Encouraging, enabling, and enclosing stages were considered for setting up the third condition (VR+Photo) to support the audience experience at the general level where it focused on the spatial experience of a hybrid space.

5.7.4. **Application of combined media**

Text, photo, video, and VR can deliver a similar message through different media. Multiple combinations of these media may help in certain situations to facilitate delivery of the message. Based on the results, the second condition (Video+Photo) is useful in giving information about subject specific areas, such as architecture and infrastructure, through the narrative. In cases that participants are expecting to receive a large amount of information in a short time, the video clips along with the photos can be a good solution. However, the video clips should not be fast-paced as it may cause motion sickness in the audiences. A fast-paced game platform for the VR-enhanced museum experience can cause motion-sickness as well. Based on participants discourses (Section 5.6.5.), the first condition (Text+Photo) could help several participants to learn about a specific event (i.e., The Silk-Stocking Murder). As there was only a single frame with the report of the case along with the photos of the crime scene and the victim (Figure 5-3), such discourses in section 5.6.5. might be related to this combination of text and photos. In terms of retention and recognition,
the first and second conditions performed similarly. However, in situations that retention and recognition are sought, a hybrid space can be a better solution. As a participant assigned to the third condition mentioned (Section 5.6.6.), a combination of VR with items such as photos or artifacts can make the experience more grounded in reality and provide the audience with a sudden leap.

5.7.5. Hybrid space

Half of the valid interview cases (n=8) had indications that the participants assigned to the third condition recognized the hybrid nature of the space and found it helpful for enhancing the museum experience (Section 5.6.6.). A part of this may be related to the fact that in many cases participants assigned to the third condition consumed all their exposure time in VR and even went beyond the schedule. According to the data (Table 5-14) most of the participants (88.9%) assigned to the third condition perceived the time as passing slower. In most cases, they mentioned that they must hurry to reach another appointment or class and left the exhibition in rush not being able to spend more time to look at the photos or explore the exhibition. However, there is no data to confirm, if the design of the exhibition or the theme was different, the number of participants who recognized the hybrid nature of the space in the third condition could increase. Based on the data from the interviews in section 5.6.6., rather than mere photos, using artifacts or a combination of artifacts and photos in the third condition may draw more attention to the hybrid space. Maybe a pair of gloves supported with haptic technology can be a better choice in situations that a hybrid space incorporates actual artifacts and immersive virtual environments. The design of the space and incorporating the hybrid space in visible areas of the museums (Figure 5-7) may also change the mindset about and increase the recognition of hybrid spaces in museums.
Data from the interview in section 5.6.6. shows that those who recognized the hybrid nature of the space in the third condition found it more dynamic than the traditional museum spaces they had previously visited. The potential of the hybrid space for switching between actual and virtual spaces was acknowledged by several participants when they mentioned experiencing the context of an actual artifact in VR and virtually exploring the places that are presented in the historical photographs. Talking about the “leap” moment (Section 5.6.6.), a participant acknowledged the hybrid space of the exhibition and believed that it could provide audiences with the “leap” moment if it were more grounded the reality. This is true specially when the hybrid space is in a museum where many more artifacts are available to be displayed. Moreover, shorter experiences in VR, related to more artifacts or historical photographs, may increase the trust of museumgoers in hybrid spaces and VR-enhanced environments.
5.7.6. Challenges

As the participants stated, there is still room for improving the VR-enhanced museum experience. In addition to motion-sickness, the problem of getting familiar with the interface and the VR technology should be solved. Training the participants still plays an important role as there are many people who are not familiar with VR equipment. Based on the comment of the participant quoted in section 5.6.5., standard controllers for gaming consuls and computers are popular. Using a new kind of controller (e.g. VIVE controllers) might be obtrusive for many audiences. As several participants pointed out, VR-enhanced museums should be able to serve multiple participants simultaneously. The idea of using a commercial video game as a platform for hybrid spaces in museums can be a double-edged sword. While it is engaging, it should not be puzzling, long, and hard to control. The option of free roaming around the virtual environment appeared to be useful and influential.

5.8. Conclusion

In this paper, a cognitive model for enhancing the quality of spatial experiences in the built environment (Baradaran Rahimi et al., 2018b) was applied to provide the basis for experimentation and empirical study of audience experiences. This model can improve museum experiences where it focuses on the spatial experience of a hybrid space in museums. To investigate the improvement of the museum experience in terms of learning and enjoyment, a three-phase experiment was conducted. A hybrid space, a VR-enhanced exhibition about Los Angeles in the 1940s, was setup. Comparing this VR-enhanced exhibition with traditional exhibitions (i.e. actual space), that rely on labels, photos, and videos, showed that a VR-enhanced exhibit can perform better to improve the museum experience for the audience in terms of learning and enjoyment. Results of this experiment demonstrated that the museum experience improved where it focused on edutainment
in the hybrid space of museum. However, the traditional settings relying on labels, photos, and videos can be still very useful for certain purposes as discussed.

The audience experience in the museum is complex. This research focused only on a part of the audience experience in museums related to the spatial experience, learning, and enjoyment. The study concentrated on a particular hybrid space that utilizes VR to enhance the museum experience. Undoubtedly, doing experiments with a larger sample size may result in more detailed outcomes such as more explanations about participants’ reasons for spending more time on certain parts of the game platform or particular exhibited photos. Learning in museum is not only a matter of retention and recognition. Making personal meanings, increase in understanding, and improvement in critical thinking were also observed. However, these learning outcomes were beyond the scope of this research and maybe considered for the future studies. There still exist several areas to develop for the widespread use of hybrid spaces and VR-enhanced environments in museums. For example, developing platforms for supporting multiple-user participation, the controllers for the ease of use, and the equipment for wireless experiences can support more developed experimentation. As the tools advance, our knowledge of using hybrid spaces in museums and other public spaces advances.

This research was to pave the way for future studies. The rapid development of VR, AR, and AV technologies may result in different experiments and more comprehensive studies. One may compare the hybrid spaces that are created using AR or AV technologies with a VR-enhanced environment. Instead of a history theme, one may consider science and natural history for future experiments and investigations. Running the experiment in an actual museum will return additional outcomes. However, it may decrease the control over the experiment. To expand this study, researchers might investigate the use of hybrid spaces and application of the cognitive model for
enhancing the quality of spatial experiences in other public spaces such as libraries, schools, and universities. One may focus more on the design of the hybrid spaces in museums and look into the possibilities for participatory design. Last, but not the least, one may want to investigate the balance and combinations of human interactions within and between new forms of actual, virtual, and hybrid spaces. This echoes William Mitchell’s (1999) idea that “[t]he diverse architectural and urban forms of the future will surely reflect the balances and combinations of interaction modes that turn out to work best for particular people, at particular times and places” (p.144).
Chapter 6

Conclusion
6.1. Introduction

Development of this manuscript-based dissertation was prompted by identification of a knowledge gap between the application of hybrid space, human behavior, and harnessing playful activities for museums. Hybrid space has been explored and conceptualized in the literature, but it has yet to reach its potential as an effective medium in museums. However, it seems to have quite a few advantages for employment in museums. This chapter will discuss the main findings of the four manuscripts contained in chapters two, three, four, and five. The discussion then centers on the original contribution that these works make to the advancement of theory and practice.

6.2. Central findings

As was discussed in chapter one, visits to museums have been steadily decreasing over the past decades in many parts of the world (e.g. 15.6% in Scotland). In contrast, socializing on the World Wide Web, learning through digital media, and engaging in computer-related activities such as video gaming are all on the increase (Burton & Scott, 2003). This was a motivator to find a way to combine such playful activities with museum experience in a certain type of space, entitled hybrid space.

In chapter two, the manuscript entitled Hybrid Space: An Emerging Opportunity That Alternative Reality Technologies Offer to the Museums built on the concept of hybrid space and placed it in a continuum of space to demonstrate the overlaps that hybrid space has with actual and virtual
spaces. Moreover, in chapter two it was defined that a museum hybrid space combines physical artifacts co-located with virtual and augmented reality displays. As the hybrid space borrows the power of information to empower the physical space around us using alternative reality technologies, chapter two defined how AR, AV, and VR can be used in museums to create a hybrid space. The authenticity and veracity of the content in a museum hybrid space was also explored. Generations ago when people compared photos with actual spaces in museums, they had doubts since a photo can be manipulated. Today, the same doubt exists about the digital content of the hybrid space. As suggested in chapter two if a well-respected museum and academic figures check the content of a museum hybrid space, people will increase trust about the digital content of the hybrid space. Moreover, it was suggested that video-games maybe used as a platform for the hybrid space experience in museums. Thus, developing a tool for examination of the digital content in terms of authenticity and veracity can be helpful. As the present dissertation makes use of history-based video games, this suggestion was further explored and a plot for authenticity of history-based video-games was developed in chapter four.

In chapter three, the manuscript entitled Human Behaviour and Cognition of Spatial Experience; A Model for Enhancing the Quality of Spatial Experiences in the Built Environment, defined spatial experience and essential components of experience. Identifying dimensions and elements of experience was the next step. It was demonstrated in chapter three that there is a significant difference between the elements of an experience with respect to their priority for enhancing spatial
experiences. Consequently, a new model was developed in chapter three for enhancing the quality of spatial experiences in the built environment. The model asserts that, to create a superior spatial experience, a person should primarily be encouraged to engage with/in the experience via three elements: the meaning that the architect designs for, the concepts that are incorporated in the design, and the persuasion styles that are applied to get the audience involved with a spatial experience. At the enabling stage, the audience gets enabled to become involved in the spatial experience. Making a user enabled is possible by taking advantage of immersion, interactivity, and the security/safety attributes of the space. Consequently, at the enclosing stage, the experience shifts towards a cognitive level through emotion and engagement. When the experience moves to a cognitive level, it can be called an enhanced experience, since most experiences never go to a cognitive level at all (Anderson, 2011). At this stage (i.e., enclosing), the audience experience either ends or reiterates. This model was later adopted and utilized in chapter five to setup the hybrid space exhibition.

In chapter four, the manuscript entitled A Game Design Plot: Exploring the Educational Potentials of History-based Video Games demonstrated that a considerable amount of online conversations in game forums can be helpful in evaluating players’ responses to specific occurrences in the game. These conversations contain valuable points that can help educators, game developers, and designers understand how casual players play and learn from a commercial game. A plot was then created in chapter four to visualize the learning potentials for the casual players in relation to the
historical authenticity and factors of the historical context in such games (i.e., people, time, space, event, activity). In terms of using video games for learning purposes, the outcomes of this research suggested that video games have the potential for particular proposes such as learning about certain people, spaces, events, details in the history, social history, and alternative histories. Among the five history-based video games that were selected and evaluated using this plot, LA Noire was later used as a platform for the hybrid space exhibition in chapter five. According to the findings, LA Noire represents a game with almost every factor close to the authenticity side of the plot. It was also asserted that LA Noire can be used for learning about the modern history of Los Angeles having depicted with a high degree of accuracy, the atmosphere, architecture, and criminology as well as clothing and vehicles of the 1940s. This assertion was also examined in an experiment in chapter five.

In chapter five, the manuscript entitled Learning and Enjoyment through Museum Hybrid Spaces: An Empirical Study explained that the experience of a museum hybrid space can be viewed in two levels: general and special. The experience of museum hybrid space is still a spatial experience in a general sense as it takes place in the physical space. The behavioral model developed in chapter three was then applied to support the audience experience at the general level where it focused on the spatial experience of a hybrid space. Moreover, based on the literature it was found that the experience of museum hybrid space aims to entertain and educate the audience by facilitating their enjoyment and learning. Therefore, special level in this chapter focused on facilitating learning
and enjoyment. To investigate the improvement of the museum experience in terms of learning and enjoyment, a three-phase experiment was conducted. A hybrid space, a VR-enhanced exhibition about Los Angeles in the 1940s, was setup. LA Noire was used as the hybrid space exhibition platform. Comparing this VR-enhanced exhibition with traditional exhibitions (i.e. actual space), that rely on labels, photos, and videos, showed that a VR-enhanced exhibit can perform better to improve the museum experience for the audience in terms of learning and enjoyment.

6.3. Contributions to practice and theory

In considering the actual benefits that may be derived from research, Miles, Huberman, and Saldana (2014) suggest considering how a study will contribute in a broad way to a domain, and how it is that participants who have devoted time and energy to the project might benefit. This discussion considers the contributions that this work makes to practice and theory relative to those who contributed to the study as well as to the field more generally. The concepts and models presented in the chapters serve to situate, within a broader context of the field, the contributions of this dissertation.

6.3.1. Contributions to the theory of hybrid space

The deep understanding that has emerged through this inquiry suggest that the findings may be of substantial utility for future research on the development of hybrid spaces in the museums. For
instance, large gallery spaces and the abundance of surfaces (e.g., walls, ceilings, and floors) in the museums can be used as a canvas for 3D projection mapping and superimposing digital content. This may be the next step to provide hybrid spaces in practice beyond museums as “these digital information/communication spaces should be combined with public urban/architectural spaces” (Sikiaridi & Vogelaar, 2000, p. 14). Hybrid spaces may eventually become an effective medium, affecting museums’ relationships with their publics in fundamental ways. Offering an immersive, interactive, and game-like experience, hybrid space can revolutionize the field of museums, change the worldview about the museums, and provide audiences with a deeper perspective on the sociocultural aspects of the world’s diverse culture. Hybrid spaces along with alternative reality technologies have the potential to make our museums smarter. This echoes William Mitchell’s (1999, p.43) idea that “as the technology of smart places matures, the metaphors are biting back”.

6.3.2. Contributions to the practice of design

The model for enhancing the quality of spatial experiences in the built environment presented in this dissertation focuses on an area of knowledge (i.e., experience design) which is less integrated into architecture. The model humbly provides a shared frame of reference for a team working on a project. When everyone on a team is thinking about the creation of an enhanced experience with a common aim and reference points, the project may proceed more effectively and efficiently. Moreover, the model provides architects and designers with a foundation to better understand the
relations between people, context, and activity with the experience design elements. The
behavioural stages that are suggested in the model, namely, encouraging, enabling, and enclosing
can be helpful especially in the design process to see the experience of people in a built
environment in earlier stages of design. This can be useful not only to architects but also to whose
practice is related to the experience of people in the built environments, such as interior designers
and industrial designers.

6.3.3. Contributions to game studies and application

As a tool, the suggested plot in the chapter 4 can provide an overview of learning potentials to
facilitate comparison and selection between the history-based video games for the use as an
educational platform. In terms of using video games for learning purposes, the outcomes of this
research suggest that they have the potential for proposes such as learning about certain people,
spaces, events, details in the history, social history, and alternative histories. This research may be
considered as an attempt to motivate game developers to more deeply look at how their games
may influence players and learners beyond the entertainment purposes. Developers and game
designers may want to provide educational versions or special editions of their games to be used
in educational or cultural institutes such as universities and museums. This dissertation promotes
the message that commercial games have a great potential for in-depth learning, as they incorporate
the vast knowledge of experts, such as historians and librarians, as well as university professors in
the fields of history, social history, and digital media. Maximizing this vast knowledge of experts can help players learn about history. This work also contributes to the scholarly discussion on design and application of games among multiple disciplines and stimulates further exploration on the synergistic work between industry and academia.

6.3.4. Contributions to the museums

As Burton and Scott (2003) delineated, “If museums are to increase attendance, they need to position themselves as attractions with many of the attributes associated with the ‘ideal’ leisure activity” (p. 66). The museum needs to reinvent itself—as cinemas did over the past few decades—to keep or increase attendance (Burton & Scott, 2003). Such a reinvention can go beyond increasing attendance and changing the visitors’ experience on-site. Museums may become more accessible and playful, allowing people to experience the collections and historical treasures with more freedom. The audience experience in the museum is complex. This research focused only on a part of the audience experience in museums related to the spatial experience, learning, and enjoyment. Given the results proved that the museum experience improves in terms of learning and enjoyment when a hybrid space is available, museums can consider using hybrid space as “a necessary component in the arsenal of tools to educate, entertain, and dazzle” (Roussou, 2001, p. 2). Demonstrating that the hybrid space exhibition can support visitors’ playful learning through virtually experiencing the events and stories behind an exhibition (chapter 5), this research
proposes a novel paradigm for museums that could draw broader audiences, including youth, to museums. This can reconnect the museums with the public and demonstrate their value and relevance in contemporary life. This research also contributes to the methodological discussions of informal learning in museums and of the digital humanities more generally, especially around the applicability of hybrid spaces in cultural institutions.

6.4. Future research

For the future studies, one may explore the application of hybrid space in public urban and architectural spaces beyond museums. The model for enhancing the quality of spatial experiences can be developed by other researchers and applied by designers to improve the built environment. Future studies may add to the factors of the plot for authenticity of history-based video games or go beyond the authenticity of the games. There still exists several areas to develop for the widespread use of hybrid spaces and VR-enhanced environments in museums. To exemplify, developing platforms for supporting multiple-user participation, the controllers for the ease of use, and the equipment for wireless experiences can support more developed experimentation. Researchers may want to explore museum fatigue within hybrid museum exhibitions and the reasons for staying or leaving the hybrid museum space. This dissertation tried to shed light on the way ahead and pave the way for future studies and advances in science. This echoes John Dewey’s (2008) idea that “[e]very great advance in science has issued from a new audacity of imagination” (p.294).
References


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teach about the past. Theory & Research in Social Education, 44 (4), 532-564.

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Appendix A.

VR-enhanced experience of space: When a museum goes VR to enhance the audience experience.

This questionnaire concerns your museum experiences over the course of your lifetime as well as your preferences about video-games and immersive 3D environments. Feel free to elaborate where you think it would be helpful to the study. All responses are confidential.

Thank you for your participation.

Note that following questions will be answered before the exposure begins.

Name: __________________________________________
Gender: Male ____ Female ____ I identify as ________________ Prefer not to disclose ____
Age: ______________________ Education level__________
Field(s) of Education ____________________________________________________________

1. When was the last time you attended a museum?
   ___ Last week. If you can remember, how many times___________
   ___Last month. If you can remember, how many times___________
   ___Within the last 6 months. If you can remember, how many times___________
   ___ Within the last year. If you can remember, how many times___________
   ___Within the last 2-5 years. If you can remember, how many times___________
   ___ Can’t remember at all

2. Why do you visit museums? (Rank in order of preference)
   ___For individual entertainment or activity
   ___To learn about people, cultures, places, and events
   ___To learn subject-specific artifacts
   ___To access the museum collection
___To access the museum cafés and stores
___To be entertained at museum events
___To enjoy the museum experience
___To meet friends
___Family activity
___Other (please list) ______________________

3. Once you have decided which museum to visit, how do you plan your visit? (Check all that apply)
___I plan where to go before the visit using the museum’s website
___I plan where to go before the visit using social media including Facebook
___I plan where to go by asking others for suggestions
___I use a map given to me at the museum’s information desk to determine what I plan to see.
___I start with the featured exhibits and then explore other areas of the museum.
___I start with the exhibit nearest to the entrance and move in order
___I don’t plan
___Not sure
___Have not been to a museum
___Other (please describe): __________________________

4. What museum did you attend last? _________________________________

On average, how long did you spend there?
___Less than 1 hour
___1-2 hours
___2-4 hours
___4 hours or more
___Have not been to a museum
5. What do you like the most about visiting a museum? (Rank in order of preference)

___The collections and exhibits
___Learning about people, cultures, places, and events
___Entertaining events inside the museum
___Watching documentary movies in the museum
___Other (please describe): _______________________

6. Are you familiar with the way that Los Angeles looked in 1940s? (Rank on the following scale)

<table>
<thead>
<tr>
<th></th>
<th>Extremely little</th>
<th>Extremely much</th>
</tr>
</thead>
<tbody>
<tr>
<td>The city</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The vehicles</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The clothing style</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The architecture</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The major landmarks</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
</tbody>
</table>

7. How would you rate your motivation for visiting museums on the following scale?

<table>
<thead>
<tr>
<th></th>
<th>Extremely little</th>
<th>Extremely much</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
</tbody>
</table>

8. How would you rate the importance of learning about North-American cities on the following topics?

<table>
<thead>
<tr>
<th></th>
<th>Extremely little</th>
<th>Extremely much</th>
</tr>
</thead>
<tbody>
<tr>
<td>The appearance of cities from the past</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The vehicles from the past</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The clothing styles from the past</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The architecture from the past</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The major landmarks from the past</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
</tbody>
</table>

9. How much familiar are you with video games?

<table>
<thead>
<tr>
<th></th>
<th>Extremely little</th>
<th>Extremely much</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
</tbody>
</table>
10. How often do you play video or mobile games?

___ At least once a day ___ hours per week
___ At least once a week ___ hours per week
___ At least Once a Month ___ hours per month
___ More than once in the last year
___ Once In the last year
___ never

11. What are your favorite video or mobile games? Please list them below. (Rank order)

1. ________________________________ (Your most favourite game.)
2. ________________________________
3. ________________________________
4. ________________________________
5. ________________________________

Why do you enjoy these games? (Rank order)

___ Escape from every day stress
___ Entertainment
___ Education
___ Social engagement
___ Other (please describe): ____________________________

12. In evaluating a video game what do you consider important (Circle?)

<table>
<thead>
<tr>
<th></th>
<th>Extremely little</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>Extremely much</th>
</tr>
</thead>
<tbody>
<tr>
<td>Game Play</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NA</td>
</tr>
<tr>
<td>Graphics</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NA</td>
</tr>
<tr>
<td>Audio (Sound and tracks)</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NA</td>
</tr>
<tr>
<td>Story line</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NA</td>
</tr>
<tr>
<td>Character animation</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NA</td>
</tr>
</tbody>
</table>
13. Have you ever experienced a 3D stereo environment? How many times? (Check and circle all that apply)

<table>
<thead>
<tr>
<th>Environment</th>
<th>0</th>
<th>1-5</th>
<th>5-10</th>
<th>10-20</th>
<th>20+</th>
</tr>
</thead>
<tbody>
<tr>
<td>3D Movie</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3D Video</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3D Computer Display</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3D CAVE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3D Virtual Reality goggle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3D Virtual Reality Smart Phone</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

___ Other (please explain): _______________________

14. Do you think that an immersive, interactive game environment that replicates history can be used in museums? (Circle one)

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>

Thank you for your participation.
Appendix B.

Note that following questions will be addressed right after the exposure.

15. Do you think that the activity you just performed improved your knowledge of North-American urban history? (Circle one)  
   Yes  No

Why or why not? _____________________

16. In looking at the exhibit on the LA what do you remember? (Rank on the following scale)

<table>
<thead>
<tr>
<th></th>
<th>not remember at all</th>
<th>remember extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td>The streets and architecture</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The vehicles from the past</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The clothing from the past</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The major landmarks from the past</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
</tbody>
</table>

17. I like to spend much time exploring this exhibit. (Circle one)

Strongly Disagree                      Strongly Agree
                                          1 2 3 4 5 6 7

18. This exhibit is a place where I feel friendly and talkative to people who happens to be near me. (Circle one)

Strongly Disagree                      Strongly Agree
                                          1 2 3 4 5 6 7

19. I was excited by what I experienced in today’s visit to the exhibit. (Circle one)

Strongly Disagree                      Strongly Agree
                                          1 2 3 4 5 6 7

20. I was engaged with some or all parts of the exhibit today. (Circle one)

Strongly Disagree                      Strongly Agree
                                          1 2 3 4 5 6 7
Please define which part: (Rank all that applies)

___Photos
___Labels and texts
___Videos
___Virtual Reality experience
___The mystery case

21. Do you think that activities like playing a virtual reality (VR) game related to an exhibit are useful for museums? (Circle one)

never(always
1 2 3 4 5 6 7

Why or why not? ______________________

22. How did you perceive the time passing while visiting the exhibit today? (Circle one)

Extremely slow (Circle one) Extremely fast

1 2 3 4 5 6 7

23. Please define how much time do you think that you have spent visiting the exhibit today?

___Less than 10 minutes
___10 to 20 minutes
___20 to 30 minutes
___30 to 40 minutes
___40 to 50 minutes
___50 to 60 minutes
___60 to 70 minutes
___70 to 80 minutes
___80 to 90 minutes
___More than 90 minutes (please write your estimation): ______________________

Recorded time: This box will be filled by the researcher.
Appendix C.

Note that following questions will be asked in the interview.

1. If you want to describe the single most impressive thing that helped you enjoy your experience today, what would it be? Why?

2. If you want to describe the single most impressive thing that you learned during your experience today, what would it be? Why?

3. How do you compare this exhibit with the other exhibits that you visited in the past?

4. Do you think that exhibits similar to what you experienced today can change your attitude towards museums?

5. What did you like least about the activity you just performed?

6. What is your recommendation to improve the aspect you enjoyed least about the VR-enhanced exhibit? (Only answer this question if you experienced a VR-enhanced exhibit in your visit today)

Thank you for the interview.

Code. ___________
Appendix D.

This questionnaire concerns the information you learned during your visit to the LA exhibit Last month. To answer these questions please do not look up the answers in external resources and rely on your memory as it is very important to the study. Feel free to elaborate where you think it would be helpful to the study. All responses are confidential.

Thank you for your participation.

Code. _______________

Note that following questions will be responded a month after exposure.

1. What did Los Angeles look like in 1947? (Check all that apply)
   ___ A modern city with several skyscrapers and clean streets
   ___ Under construction with cranes over the sky
   ___ An industrial city with dirty streets
   ___ A large port with blasts of the ships over the city
   ___ A resort full of tourists wearing camera around neck

2. What best describes most buildings of Los Angeles in 1947?
   ___ High-rise buildings and modern skyscrapers
   ___ Modern buildings with a maximum of 6 storeys
   ___ Very old buildings with a maximum of 4 storeys
   ___ None of the above

3. True or False: Despite being a crowded large city in 1947, Los Angeles did not have highways.
   ___ TRUE
   ___ FALSE
4. True or False: Although the Hollywood district existed in 1947, the famous Hollywood sign did not.

___TRUE
___FALSE

5. Which of the following pictures better represents clothing style of Los Angeles ladies in 1947?

A  
B  
C  
D

6. Which of the following pictures better represents clothing style of Los Angeles gentlemen in 1947?

A  
B  
C  
D
7. Which of the following pictures better represents popular vehicles style of Los Angeles in 1947?

[A] [B] [C] [D]

8. Which of the following pictures better represents a place exhibited during your visit today?

[A] [B] [C] [D]
9. Based on your experience today, do you consider Los Angeles in 1947 a crowded city with traffic problem?

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
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<tr>
<td>3</td>
<td></td>
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<td>4</td>
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<td>5</td>
<td></td>
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<tr>
<td>6</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>

10. Open-ended question: What is the single most impressive thing that you learned about urban history in your visit? Why is it impressed you?

Thank you for your participation.
Appendix E.

Analytic Hierarchy Process (AHP) input tables. Each of the core components of the experience, People (top), Context (middle), and Activity (bottom) along with related elements of each were organized in a separate table.

<table>
<thead>
<tr>
<th>Element</th>
<th>A</th>
<th>B</th>
<th>Priority (A∩B)</th>
<th>Intensity (1-9)</th>
<th>Name:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passive</td>
<td>Active</td>
<td>Interactive, Reflex, Habit, Engagement, Coercion, Persuasion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reflex</td>
<td>Habit, Engagement, Coercion, Persuasion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Habit, Engagement, Coercion, Persuasion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Engagement, Coercion, Persuasion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Coercion, Persuasion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Seven experts (4 males and 3 females) were asked to pairwise and rank the variables on a scale from 1 to 9. For example, the first expert goes through the first row of the column A. namely, passive. The expert must compare this element (passive) with each of the elements in the first row of column B, orderly, active, interactive, reflex, habit, engagement, coercion, and persuasion. In
this example, if the expert believes that being active is strongly important than being passive he or she puts the letter B in the column entitled ‘Priority’. It means that the item ‘active’ is more important than item ‘passive’ to enhance the quality of spatial experiences in general.

Then, the expert must put a value from 1 to 9 in the column entitled ‘Intensity’. On the bottom of the table, the definitions of these values exist. Back to our example, if the expert puts the value 5 in the column entitled ‘Intensity’ it means that item active is strongly important than the item passive. The process goes on until the whole tables are complete.
<table>
<thead>
<tr>
<th>Element</th>
<th>A</th>
<th>B</th>
<th>Priority (AorB)</th>
<th>Intensity (1-9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initiation</td>
<td>compared with</td>
<td>Immersion</td>
<td>Conclusion</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Continuation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sense</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Emotion</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Concept</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Promotion</td>
<td></td>
</tr>
<tr>
<td>Immersion</td>
<td>compared with</td>
<td>Conclusion</td>
<td>Continuation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sense</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Emotion</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Concept</td>
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<td></td>
<td></td>
<td></td>
<td>Promotion</td>
<td></td>
</tr>
<tr>
<td>Conclusion</td>
<td>compared with</td>
<td>Continuation</td>
<td>Sense</td>
<td></td>
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<tr>
<td></td>
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<td></td>
<td>Emotion</td>
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<td>Concept</td>
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<td></td>
<td></td>
<td>Promotion</td>
<td></td>
</tr>
<tr>
<td>Continuation</td>
<td>compared with</td>
<td>Sense</td>
<td>Emotion</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Concept</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Promotion</td>
<td></td>
</tr>
<tr>
<td>Sense vs Concept</td>
<td></td>
<td>Emotion</td>
<td>Concept</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Promotion</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intensity of importance</th>
<th>Definition</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Equal importance</td>
<td>Two elements contribute equally to the objective</td>
</tr>
<tr>
<td>3</td>
<td>Moderate importance</td>
<td>Experience and judgment slightly favor one element over another</td>
</tr>
<tr>
<td>5</td>
<td>Strong Importance</td>
<td>Experience and judgment strongly favor one element over another</td>
</tr>
<tr>
<td>7</td>
<td>Very strong importance</td>
<td>One element is favored very strongly over another, its dominance is demonstrated in practice</td>
</tr>
<tr>
<td>9</td>
<td>Extreme importance</td>
<td>The evidence favoring one element over another is of the highest possible order of affirmation</td>
</tr>
</tbody>
</table>

2, 4, 6, 8 can be used to express intermediate values, 1, 1.2, etc. for elements that are very close in importance.
Appendix F.

Intensity radial diagrams and AHP matrices for three basic components of the experience, people (top), context (middle), and activity (bottom).
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</table>

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